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THE

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TRANSACTIONS

OF THE

ACADEMY OF SCIENCE OF ST. LOUIS.

ATMOSPHERIC ELECTRICITY,

BY

A. WISLIZENUS, M. D.

Since Benjamin Franklin, by his celebrated kite-experiment, in June, 1752, proved the identity of lightning with the electricity developed by the electrical machine, natural philosophers of all nations have turned their attention to these interesting researches, and experimenting sometimes with stationary, sometimes with movable apparatus, they have acquired a good deal of information on the subject of atmospheric electricity. Dalibard, Le Monnier, Canton, Read, Richmann, de Romas, Charles, Cavallo, Nollet, Archard, de Saussure and Volta, Becquerel and Breschet, Pfaff, Gay Lussac, Matteuci, Schübler, Calladon, de Luc and others, have labored successively in this new field of discovery and enriched science with many new facts and new methods of observation. These experiments were not always conducted without danger. Thus, Richmann, of Petersburg, from want of proper precaution, was killed by lightning during one of his observations; while, on the other hand, de Romas of Neræ, received and directed, uninjured, during a thunder storm, flashes of fire from nine to ten feet long and an inch in diameter. The patient and zealous researches of such men have proved conclusively the existence of a constant flow of electricity through our atmosphere, increasing with its height and being generally of a positive nature, and changed only exceptionally, (for instance, during thunder-storms,) into negative electricity. But while their various apparatus for attracting atmospheric electricity were very ingenious, their instruments for determining and measuring the collected electricity were rather defective, especially when it became necessary to observe electricity of very feeble tension. As measuring instruments for this purpose, there were used, at first, only two single threads, or little balls of the pith of elder, or the attractive power of the electrified wire for sawdust, bran and cotton, or the Leyden phial, or a straw or goldleaf electrometer, simple or graduated, or a dry (zambonic) pile; or, later, since the discovery of electro-magnetism, a needle galvanometer (rheometer). But none of these instruments proved to be sensitive enough for measuring very feeble degrees of atmospheric electricity, and none therefore fully answered the purpose of making regular daily and hourly observations in all kinds of weather. The most delicate instrument of that class was probably Coulomb's electroscope, a torsion balance, in which a needle of shellac, attached to a cocoon thread, is moved by the smallest electrical force and turned round over a graduated circle. This instrument was originally intended merely for examining the electrical properties of various bodies after friction, and proved to be the most sensitive and practical one for that purpose; but the idea of such a torsion balance for electrical measurement has been taken up again in our day by Prof. F. Dellmann, of Germany, and, by his many and ingenious improvements, it has been rendered the most delicate, exact and practical instrument for regular observations of atmospheric electricity that has come to my notice. Prof. Dellman is a scientific man in Kreuznach, on the Rhine, and, for several years past, he has made there regular daily observations of atmospheric electricity for the Prussian State, which publishes them in the annual reports of the Royal Meteorological Institute in Berlin.

Dellmann's electrometer is a torsion balance. A very fine glass thread, about eighteen inches long, running vertically through a glass tube, has, on its lower end, fastened to it by shellac, a very thin and light beam or needle of brass in a horizontal position. This beam, when moved by any force, will be driven around in a circle over a metallic disc with a graduated scale, divided into four times ninety degrees. Directly below the movable beam, but unconnected with it, is another similar thin piece of brass, which is fixed, perfectly isolated from the metallic disc, and ends below in a metallic wire, also isolated, to which the electrical charge is applied from without. The upper beam with the glass thread can, by a micrometer screw, be lowered, or elevated, so as either to touch the lower beam, or hang suspended above it. By another ingenious mechanism, the upper beam, when at rest, is always kept exactly over the lower one; and the three iron feet, upon which the whole instrument rests, can be screwed up and down so as to give it a proper level. Now, if an electrical charge is applied to the outside wire and to the lower beam, and the upper beam, by screwing it down, is for a moment brought in slight contact with the lower one, the upper beam will be charged with the same electricity; and, since equal electricities repel each other, the movable upper beam will be driven off a certain number of degrees, according to the intensity of the charge. If both beams were movable, both would be driven in opposite directions, like the two leaves of a goldleaf electrometer; but, as one beam is fixed, the other movable one can alone give way, and, by its motion, indicates the force of the electrical charge. The box, containing the graduated disc and the beams, is covered with a glass to protect them from dust and dampness, and, with the aid of a *loupe*, the grades can be easily read. To determine the positive or the negative character of the electricity, immediately after reading the degrees, the outside wire is again charged with electricity of a known quality, (for instance, with the negative electricity from a resinous cork, rubbed over woollen cloth.) If the first electricity is of the same character as the second, the movable beam will be still more repelled, because like electricities repel each other; if of opposite character, the movable beam will, at once, return to the fixed one, because unlike electricities attract each other.

Since glass threads, however fine they may be, are never quite equal, and a slight difference in the glass threads may cause slight variations in the instrument, it is needed, for comparative observations on different instruments, to determine the sensitiveness of each instrument by the tension of a zinc-copper column of a certain size, the tension of one element to be used as unity for the table of calculation.

For collecting atmospheric electricity, Prof. Dellmann uses also a peculiar apparatus. He believes, with many others, that a fixed apparatus does not answer the purpose, because it can never be sufficiently isolated, is charged but slowly and gradually, and does not indicate the actual electricity of the surrounding atmosphere. He therefore makes use of a movable apparatus, that is, a hollow ball of copper or brass, six inches in diameter, with a metallic stem; the latter resting in a metallic tube, from which it is perfectly isolated by shellac. This collecting apparatus is fixed to a pole about thirty feet long, which is, by a windlass, drawn up along the wall of the house to the height of the roof, where the air circulates freely; the observer then touches, by means of a thin wire, the stem of the ball with a half-moon-shaped piece of brass; the ball is thus charged with electricity, the pole let down again quickly, and the collecting apparatus is, at once, brought into contact with the measuring instrument.

The electricity, thus collected in the ball, is not directly communicated to it by the surrounding atmosphere (*durch Mittheilung*, permanent electricity of contact,) but developed by induction (*durch Vertheilung*, electricity of induction;) that is, the natural electricity of the ball, being in equilibrium, is separated by the electrical tension of the surrounding atmosphere into positive and negative electricity, one of which is attracted to the upper part of the ball and the other repelled to the lower. Atmospheric electricity, in its normal state, is positive. If we expose, therefore, the collecting apparatus to the positively electrified atmosphere, the natural electricity resting in the ball will, at once, be separated into negative and positive; the negative will be attracted to its upper part and the positive be repelled to the lower. By touching now the stem with the half-moon-shaped piece of brass, the positive electricity is conducted through the wire and the body of the observer to the ground; the negative is left in the ball and measured by the electrometer. It thus becomes apparent, that, when the electrometer exhibits negative electricity in the ball, it indicates positive electricity of the atmosphere, and *vice versa*. Before this relation was well understood, doubts were expressed by some, whether the electricity were not communicated to the ball by means of the observer from the earth, the electricity of which is generally negative. To ascertain the truth, or fallacy, of this supposition, I made the following experiment: After having made an observation of atmospheric electricity in the usual way, I tried the electricity of my own body; finding none therein, I isolated myself perfectly, also the collecting apparatus and its appurtenances, wherever they touched the house, and made thus another observation of atmospheric electricity. The result in quality and quantity of atmospheric electricity was the same in both cases. This experiment proves, that the electricity collected in the apparatus is not obtained directly from the earth, but from the surrounding atmosphere. The fact, also, that within the house no electricity, or at least very little, can be collected by the apparatus, seems to confirm the opinion, that the electricity is obtained directly from the surrounding atmosphere in a free state of circulation. I will mention, also, on this occasion, that I sometimes used the collecting apparatus in a horizontal, instead of the vertical position, and obtained invariably the same result.

The subject of atmospheric electricity attracted my attention, several years ago, as a part of meteorology not sufficiently explored. Looking over the long list of the names of those who, during a century, had distinguished themselves in exploring the laws of electricity, I felt somewhat timid in undertaking, what so many intelligent men of science had but partially accomplished; but, considering, on the other hand, that regular daily observations of atmospheric electricity had been attempted, only within the last twenty years, in but a few places in Europe (in Brussels, in Munich, in Kreuznach and in Kew), and not at all, as yet, in any other part of our globe, I felt encouraged again, and determined to follow the slow but sure course of daily observations continued for years, and thus add my mite to this neglected but important branch of meteorology.

The principal difficulties to be overcome in such observations are, first, the subtle, imponderable, as it were, spiritual essence of electricity. This wonderful creation of nature, having itself no material substance, but filling heaven and earth; inherent in all earthly bodies, but rushing through some with proverbial velocity and clinging to others with partial affection; sometimes invigorating our nerves and giving a delightful tension to our whole system, sometimes depressing our body and mind; or, in its fury, finishing our human existence more speedily than any other natural phenomenon, or mortal power, could do; now at perfect rest, slumbering like an innocent child, and now suddenly aroused, rent into its two polar elements and pouring streams of fire upon an affrighted world—such a mysterious, ubiquitous, all-powerful, and, nevertheless, super-delicate agent, cannot be handled and explored as easily as matters that present themselves to all our senses at once; and still it has been controlled to some degree by human ingenuity. It has been drawn down from heaven; its course has been directed; its fiery fluid has been bottled and its wrath been chained, and more yet may be accomplished in course of time. The day may even appear, when electricity, with its twin brother magnetism, will be chained to the air car, to steer it speedily and safely through higher regions.

A second difficulty in these researches has been, heretofore, the want of proper instruments for collecting quickly and measuring accurately the collected atmospheric electricity. When I began paying attention to the subject, I first tried, as collecting apparatus, movable iron rods, then fixed isolated copper wires, erected along the wall of my house, ending at the top with metallic points or balls; and as measuring instruments, I used, at first, balls of elder pith moving over a graduated scale, then the goldleaf electrometer, then a zambonic column with goldleaf electrometer (Fechner's instrument) alone, or with a condensator; but, finding none of them satisfactory, I thought of constructing a rheometer, when I fortunately heard of Prof. Dellmann's excellent instrument. I tried, at once, to procure one, but as the instrument is little known, and Prof. Dellmann had to attend himself to its construction, it was a couple of years, before I received one. He forwarded, at the same time, two of his instruments to this country, one for the Smithsonian Institution at Washington, the other for myself. I received mine in the summer of 1860, but parts of it were injured by transportation, and a new glass thread had to be inserted (a very delicate operation), so that I could not begin using it before July. The instrument worked very well, but it was several months, before I thoroughly understood all its delicate motions and occasional whims. The management of the collecting apparatus gave me also some trouble, because my house, though a corner house, with a free circulation of air, did not allow of conveniently raising the ball above the roof in the manner described by Prof. Dellmann. But by using an attic of my house, I arranged it so that, with a pole about eight feet long, the collecting apparatus could be easily thrust out of the window to a height, in which the air has free access from all sides; then, after having touched the stem of the ball with the half-moon shaped metal, I let down the pole as fast as possible and approach the charged ball, at once, to the measuring instrument, which stands close by the window. The time from the charging of the ball to its connection with the measuring instrument is, on an average, not more than twelve seconds, which is of some importance, since any delay occasions a trifling loss of electricity.

I found also some difficulty in keeping the collecting apparatus perfectly isolated. Prof. Dellmann has for this purpose surrounded the lower part of the stem of the ball, where it is inserted in the metallic box, with two thick rings of shellac and a piece of leather. But during our summer heat these rings frequently cracked and broke and needed constant mending. I therefore inserted in the bottom of the metallic box a small, well-fitting porcelain pot, filled with melted shellac, and in its midst the metallic stem. To the upper part of the metallic box, I fitted a thick glass, such as is used for lightning rods, filled its centre with shellac, and run the stem through it. The stem was thus doubly isolated (by shellac and glass or porcelain) and rendered also less liable to injury.

After having thus completed my preparations, and while I was gradually gaining more experience, in the use of the instrument, I happened to break the tender glass thread by some mismanagement. This occasioned again some interruption in my observations; but, during the fall and winter of 1860, they were continued without any further accident. During the entire year of 1861, I made the observations as regularly as possible, about six times daily and sometimes oftener. I noted, at the same time, all the other meteorological phenomena, to ascertain their direct or indirect connection with atmospheric electricity. This meterological journal of 1861 is herewith offered to the public. Embracing, as it does, between two and three thousand observations, and presenting, probably for the first time on this continent, such a complete series of observations on atmospheric electricity, it may prove interesting, not only to the meteorologist, physicist, and physician, but to every man who takes pleasure in exploring the laws of nature and in gaining a deeper insight into the mysteries of the physical world. From the several thousand observations made, I drew conclusions, at the end of the year. I summed up the qualitative and quantitative result by the month, by the whole year, and by the different hours of observation throughout the year. I compared them with other meteorological phenomena and prepared therefrom diagrams, which present to the mind, in one view, the law of regularity and periodicity, by which atmospheric electricity is governed.

The following are the principal conclusions in regard to atmospheric electricity, which I have deduced from my observations in 1861 :

1st. Our atmosphere exhibits, almost always, electricity. In some 2,200 observations of atmospheric electricity, the instrument showed, but fifty-nine times, no appreciable action, marked in the journal 0. This occurred generally after thunder storms and rains, when atmospheric electricity had been carried to the earth and exhausted, and was distributed throughout the year in the following ratio :

There	was	0	in April	1
"	"	"	May	1
"	"	"	June	8
"	"	"	July	1
"	"	"	August	6
"	"	"	September	10
"	"	"	October	20
"	"	"	November	6
"	"	"	December	6
				59 times.

2nd. The normal state of atmospheric electricity is positive, and only exceptionally and temporarily is it changed into negative. Thus in 2,124 observations, made at the regular hours, the atmospheric electricity was 2,046 times positive, and only 78 times negative. This negative state of atmospheric electricity occurred

3	times	in	January.
6	"	"	February.
15	"	"	March.
12	"	"	April.
17	"	"	May.
5	"	"	June.
3	"	"	July.
5	"	"	August.
1	"	"	September.
4	"	"	October.
2	"	"	November.
5	"	"	December.
78 times.			

This negative electricity was connected with and apparently conditioned by the following meteorological phenomena:

30	times	by thunder storms or hail storms; sometimes by thunder and lightning, without rain.
23	"	by common rains, without thunder and lightning, but especially fine, drizzling rains.
20	"	by high winds and gales, without rain, and without thunder and lightning.
4	"	by snowing.
1	"	by fog.

Thunder storms, as we perceive from this table, are the most common cause of the change from positive into negative electricity. This change seems to be constant in thunder storms, but the electrometer does not indicate this change many hours beforehand like the barometer. True, the positive electricity seems to diminish always before a storm, but the negative electricity appears suddenly with the storm itself, changes often in quantity during the same, and, after it, is followed by perfect neutralization (0) or very weak positive electricity.

As an illustration of its action in thunder storms, I refer, for instance, to March 29th, in my journal.

Negative electricity appears generally in greater intensity than positive. While the highest degree of positive electricity, that I noticed during the year, was 42°, it often happened that the negative electricity during thunder storms reached 90°, the maximum of the electrometer.

But not thunder storms alone create negative electricity; common rains, without thunder and lightning, often produce the same effect, especially fine, drizzling rains, in which the condensation of vapor into water seems to go on very gradually.

Snowing, too, will sometimes create negative electricity, especially fine snowing or sleeting; but oftener the positive electricity is by snowing increased and made more intense.

Fog is mentioned in one instance as having produced negative electricity. This happened after a drizzling rain. Generally fog alone produces no negative electricity, but increases rather the intensity of the normal positive electricity. Some observers in Europe regard fog as a principal source of negative electricity; but my observations, here made, give quite a different result.

Having considered the meteorological phenomena, which seem to change the positive electricity of the atmosphere into negative by condensation of atmospheric vapor into water, it remains still to mention the *dry storms* as a cause of negative electricity; by which term I designate high winds and gales, without rain and without thunder and lightning; rising suddenly in the south, or west, blowing sometimes only a couple of hours, sometimes a half a day, or even a whole day; changing with their appearance the positive electricity of the atmosphere into intensely negative, and leaving at their disappearance the atmospheric electricity at zero or feebly positive, in the same manner as thunder storms do. What is the particular action of these dry storms in regard to electricity? Is mechanical friction a prime agent in them? or, considering their southern origin, thermo-electricity?

I refer in my journal to the following dry storms:

22d	February,	with	S.	wind.
18th	April,	"	W.	"
3d	May,	"	N.W.	"
5th	May,	"	S.W.	"
6th	May,	"	W.	"
7th	May,	"	W.	"
26th	May,	"	S.W.	"
29th	October,	"	S.W.	"
5th	November,	"	S.W.	"

3d. The quantity or intensity of the positive atmospheric electricity is very unequal throughout the year; highest in winter and lowest in summer. The diagram, No. 1, is intended for illustrating this law of its distribution among the different months. It is shown, there, that the positive electricity is most intense in January, falls then gradually every month to its lowest figure in September; then rises again suddenly in October, November, and December, to a point somewhat lower than in January. It forms, therefore, from January to December, a regularly descending and ascending scale. In the months of June, July, August, and September, in which electricity is the lowest, the descent is more moderate than in the rest of the year. I will mention, in this connection, that these four months constitute our hottest as well as our sickliest season of the year.

4th. The regular distribution of positive electricity through the different months does not correspond to the monthly relative humidity, but corresponds more, though not quite exactly, in inverse ratio to the monthly mean of temperature. This is illustrated by diagram No. 2.

5th. There is a regular daily periodicity in the development of positive atmospheric electricity, manifesting itself by two maxima and two minima in the twenty-four hours; the first, or greater maximum, taking place about nine in the morning; the second, lesser, about six in the evening; and the first minimum occurring about three in the afternoon, the second about nine in the evening, or probably between midnight and morning. For want of sufficient observations during the night, I cannot fix the hour of the second minimum with such precision as the others.

To ascertain this periodicity, I made sometimes in the winter, when the sky was clear and the weather fair and constant through the day, my observations, every hour or two, and always found some periodicity, though the hours of maxima and minima differed somewhat. This periodicity became more distinct by comparing the monthly mean of positive electricity at the regular hours of observation, for which I refer to the tables at the end of my journal. These hours I have stated there as six, nine, twelve, three, six and nine, from morning to night. But the journal shows, that the observations were not always made exactly at these hours. Not being a gentleman of leisure, I was sometimes unable to make my observations at the exact time. The first observations in the morning, for example, show great variation in time. Considering it of some importance that the first observations should be made before sunrise, I made my first observation, on an average, about five in the summer, and about seven in the winter, as the journal shows. As a mean number, I stated, therefore, in the monthly tables, six o'clock as the hour of first observation. On account of this irregularity in my observations, as well as on account of the many disturbing influences in our changeable climate, the hours of periodicity still show some differences in the monthly table. It may be, also, that these hours differ somewhat in different months. But to gain the nearest approach to the law of periodicity, I summed up the monthly mean at the fixed hours of observation for the whole year, hoping thus to balance, as much as possible, all disturbing influences, and diagram No. 3 illustrates these results. In order to ascertain, in what relation this periodicity of positive electricity stood to temperature and relative humidity, I illustrated on the same diagram the temperature and the relative humidity, as observed throughout the year, at these hours. These two correspond very accurately to each other in inverse ratio. either of them forming an elliptic circle with opposite curves; but they exhibit no relation to the outlines, representing the electrical periodicity. The only periodical phenomena, to which the electrical periodicity bears resemblance, are those of the barometer and of the magnetic needle. This leads me to another question — to the cause or causes of atmospheric electricity.

6th. The ultimate cause of atmospheric electricity has been an object of investigation for a century, and seems as yet not to have been solved. Various are the conjectures and the surmises in this respect; but all of them may be classified under three heads, viz: those ascribing it to cosmic, or to atmospheric, or to telluric origin. Those, who ascribe atmospheric electricity to cosmic origin, consider it as emanating from that interplanetary space called the ether, from which light and radiant heat flow to our globe. This somewhat vague theory, not based upon physical experiment, or mathematical calculation, may derive more plausibility from the now established connection in the periodicity of terrestrial magnetism and of the spots in the sun. Taking this ground, atmospheric electricity may be ascribed directly to solar influence. Those, who seek for the source of atmospheric electricity in the atmosphere, itself explain its origin by the many mechanical, chemical, and caloric changes going on around us. Therefore, friction of the clouds and winds, changes in the aggregate condition of matter, combustion, vegetative processes on the surface of our globe, evaporation, especially of sea-water, unequal distribution of temperature, and, in consequence thereof, thermo-electric currents from the equator to the poles, have been successively brought forward and discussed as principal causes of atmospheric electricity. It seems to me, that all these above named processes have some influence on its distribution, modification, and, perhaps, partial reproduction; but I consider it very doubtful, if they are really the instruments for creating atmospheric electricity and filling the immense space of our atmosphere with its inexhaustible supply. But of all these supposed causes the idea of thermo-electricity (adopted by Becquerel and de la Rive) strikes me as the most plausible. The well-known quality of the tourmalin to acquire electric polarity, when its temperature is raised, and the physical experiment, made with a bar of metal, heated on one end and cool at the other, (in which case currents of electricity flow from the heated to the cool end, the former being negative and the latter positive,) prove certainly, that different states of electricity will be produced and maintained by difference of temperature. It has been objected to this theory, that a column of air, a nonconductor, cannot be compared to such a good conductor as a bar of metal. But atmospheric air can only be called a nonconductor when in a perfectly dry state; and as it contains constantly a greater or less proportion of that good conductor, vapor, its relative conducting power cannot be denied.

Lastly, the prime source of atmospheric electricity has been sought for in the globe itself. It is well known, that our earth is not only the best conductor for both kinds of electricity, but also exhibits, on its surface, electricity that appears to be negative. It was, therefore, natural, that some should regard our globe itself as the fountain-head of atmospheric electricity, assuming that the electricity of the earth passes to the atmosphere by induction. This theory has of late been taken up again and ingeniously defended by the learned Secretary of the Smithsonian Institution, Prof. J. Henry. But as we know so very little of terrestrial electricity, and, on the contrary, have acquired important information in regard to the power of terrestrial magnetism, it may not be amiss to trace atmospheric as well as terrestrial electricity to that higher source in the interior of our globe—terrestrial magnetism. The astounding discoveries made during this century, in the exploration of this power, rather favor this theory. Atmospheric electricity, according to my view, is magneto-electricity, emanating from the magnetic force of our globe and manifesting itself either by regular magneto-electric currents from (magnetic) pole to pole, or by constant magneto-electric induction of the atmosphere from the surface of the entire earth.

Terrestrial magnetism, in its three-fold manifestation of intensity, inclination, and declination, has commanded pre-eminent attention in this century, especially since the late Alexander von Humboldt, whose favorite study it was, prevailed upon England and Russia to erect, in the most distant parts of their vast empires, magnetic observatories. By a net-work of observations over the globe, great results have been obtained; two magnetic poles—the magnetic equator and the four points of greatest intensity—have been ascertained; the isogonic, isoclinic, and isodynamic lines have been laid down, and the daily and yearly periodical changes in intensity, declination, and inclination have been determined. But for our purpose it will suffice to point out only some of these results which may have a direct bearing on, and relation to, atmospheric electricity.

First. The magnetic needle exhibits daily four regular motions; as it were, a magnetic ebb and flow, corresponding to the four periodical risings and falls (the two maxima and two minima) of the barometer and the electrometer.

Second. The magnetic force (intensity and inclination of the magnetic needle) is greater in both the northern and southern hemispheres in the months of December, January, and February, when the sun is nearest the earth, than in those of May, June, and July, when it is most distant from it. Greater or less distance from the sun controls therefore the magnetic force. Whereas, if these effects were due to the temperature, the two hemispheres should be oppositely instead of similarly affected at each of the two periods mentioned.

Now atmospheric electricity, as diagram No. 3 shows, has also its greatest intensity in December, January, and February, and is lowest from June to September. As this corresponds merely to the inverse proportion of temperature, the latter is assumed thus to influence the intensity of atmospheric electricity. But, if experiments made in the southern hemisphere should prove, that the greatest intensity of atmospheric electricity appears there in the same months as in the north, it would follow conclusively, that not temperature, but magnetic force controls, in this respect, atmospheric electricity. In the interest of science, I take the liberty of drawing the attention of Gen. Sabine, Superintendent of the Colonial observatories in the British Empire, to this subject. If this distinguished savant, who has enriched science with so many important discoveries, could, by his influence, provide for simultaneous observations of atmospheric electricity in the observatories at Toronto, Canada, and at Hobart Town, Van Diemen's Island, to be continued for one or several years, this problem would be solved at once, and comparative observations, made in the two hemispheres, might develop still greater results.

Third. Besides the daily and yearly periodicity of the magnetic force, one also of about ten years has been discovered, and this magnetic periodicity of ten years coincides wonderfully with the changing frequency of the spots in the sun, as a persevering German astronomer, M. Schwabe, who has made the spots in the sun his special study, ascertained after observations for twenty-five years. This proves, conclusively, the close relation between terrestrial and solar magnetism. Whether such a periodicity controls atmospheric electricity, future observations must show.

Fourth. All bodies on our globe have been ascertained to be either diamagnetic or paramagnetic. The first, when under magnetic influence, will adopt equatorial, the latter axial or polar position. Now, of all the gases, there is but one, as Faraday has discovered, that has paramagnetic power, viz: oxygen. The immense mass of oxygen surrounding our globe seems, therefore, to be capable of being kept by the permanent magnet in the interior of our globe in a constant state of polarity by induction, and may be compared to an armature of soft iron around a globular magnet. To what degree this important discovery of Faraday affects atmospheric electricity, has still to be determined; but it is not unlikely that this magnetic force of oxygen may form the connecting link between terrestrial magnetism and atmospheric electricity.

Fifth. Since the *Aurora Borealis* affects the magnetic needle so sensibly, that it has been designated a magnetic storm, it is to be expected that on such occasions the atmospheric electricity also will be influenced by it to some degree. The fact that during an aurora the telegraphic wires may be worked without a battery by mere connection with the earth, indicates, certainly, the presence of intense magneto-electric currents; but, thus far, I have had no opportunity to make electric observations during an *Aurora Borealis.*

Having now touched all the principal theories concerning the origin of atmospheric electricity, and having ventured the opinion of connecting it directly with the magnetic force of our globe, I am nevertheless well aware, that for the present, it is a mere theory, receiving some plausibility from several facts, but, like all the other theories of atmospheric electricity, not incontrovertible. Further researches and experiments will show its truth, or its fallacy. But if, in addition to known facts, it should be proved that the greatest intensity of atmospheric electricity occurs in both the northern and southern hemisphere in the same months of the year as the greatest intensity of the magnetic force, this *experimentum crucis* would, in my view, give to this theory a basis firm enough to be considered a fundamental truth.

Meteorological Observations, made in 1861, *in St. Louis, Mo., by* A. Wislizenus, M.D.

The observations of *atmospheric electricity* are made in the central part of the city, at my residence, No. 91, South Fifth street, corner of Almond, at the height of forty feet above the pavement, and with *Dellmann's* collecting apparatus and electrometer. The quantity of atmospheric electricity is given in the degrees of that electrometer, from 1 to 90. Its quality, as exhibited by the instrument, is the opposite of atmospheric electricity; but to prevent mistakes I have changed the signs in the following tables, + and – represent therefore the real state of the atmospheric electricity.

The *winds* are recorded in eight points of the compass, and their force is estimated in figures from 1 to 10.

1. Very light breeze.
2. Gentle breeze.
3. Fresh breeze.
4. Strong wind.
5. High wind.
6. Gale.
7. Strong gale.
8. Violent gale.
9. Hurricane.
10. Most violent hurricane.

The *sky*, or the amount of cloudiness, is designated by figures frm 0 to 10—10 being entire cloudiness, 5 half cloudiness, and 0 entire clearness.

The *kind of clouds* are entered, st. (stratus), cu. (cumulus), cir. (cirrus), nim. (nimbus), and cir. st., cu. st., cir. cu. (cirrostratus, cumulostratus, cirrocumulus), etc.

The *relative humidity*, or the per centage of saturation of the air with vapor, is calculated from the difference of the dry and wet bulb thermometer by means of the Smithsonian tables; 100 indicating full saturation; 50 half saturation, etc.

Fog 1 means slight fog.
" 2 common fog.
" 3 thick, dense fog.

JANUARY, 1861.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	Ther. F.	REMARKS.
1	7	+17	s.e.	2	0	22	hazy, moonshine, before sunrise.
	8	17	s.e.	2	0	23	after sunrise.
	9	25	s.e.	2	0	27	
	10½	30	s.	1	0	35	
	12	30	s.	1	0	39	
	2	13	s.e.	1	0	44	
	3	14	s.e.	1	0	45	
	4	11	s.e.	1	0	42	
	5¼	11	s.e.	1	0	42	after sunset.
	7	11	s.e.	1	0	37	
	9	18	s.e.	1	0	34	stars brilliant.
	12	22	s.e.	1	0	31	" "
2	2½	14	s.e.	1	0	29	" "
	6	22	s.	1	5	27	fog 2.
	7¾	32	s.w.	2	10	29	fog 3.
	9	32	s.w.	2	10	32	fog 2.
	12	40	s.w.	1	10	39	hazy.
	2	33	s.w.	1	10	39	"
	4	23	s.w.	1	10	38	" overcast, dark.
	6	32	s.w.	1	10	37	"
	8	20	s.w.	2	10	35	
	10	15	w.	3	0	29	sky starry.
3	8	2	n.w.	3	10	29	overcast.
	12	9	w.	3	10	29	overcast, fog 1.
	2	17	w.	3	10	31	overcast.
	6	5	n.w.	3	10	29	"
	9½	3	n.w.	3	10	27	a few drops of rain, some snowing in [the night.
4	7	27	n.w.	3	9	14	
	9	32	n.w.	3	8	16	some snow flakes falling.
	12	25	s.w.	2	2	23	
	2	10	w.	2	1	25	
	6	17	e.	3	2	22	
	10	27	e.	2	1	20	
5	7	18	s.e.	2	1	20	
	9	26	s.e.	3	0	26	
	12	23	s.e.	2	6	35	
	2	22	s.e.	2	7	37	
	6	5	s.e.	2	10	35	
	9	8	e.	3	10	35	
6	7¼	12	s.e.	2	1	36	
	9	20	s.	2	1	43	
	12	12	s.	2	2	53	
	3¼	9	s.	2	10	52	
	9	1	s.	1	10	47	high wind in the night.
7	7¼	9	n.w.	3	10	36	
	9	12	n.w.	3	10	36	
	12	18	n.w.	3	10	37	
	2½	16	n.w.	3	7	37	
	6	21	n.w.	3	5	34	
	10½	30	n.w.	2	0	30	

JANUARY—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. F.	Remarks.
8	7¾	+23	n.e.	2	10	29	fog 1, white frost.
	12	17	n.w.	3	10	35	
	3	14	n.e.	3	10	34	hazy, overcast.
	6	14	n.e.	2	10	33	
	9½	1	n.e.	3	10	32	
9	7½	17	n.w.	2	10	28	fog 1.
	9	28	n.w.	2	10	28	"
	12	30	n.w.	2	9	31	
	3	27	s.	2	5	35	sunshine.
	6	24	s.w.	2	10	34	
	10	16	s.w.	3	0	30	
10	7¾	9	n.w.	3	9	27	cu.
	9	12	n.w.	4	0	26	
	12	19	w.	4	0	28	
	3	21	w.	3	0	30	
	6	12	s.e.	2	5	26	
	10	8	s.e.	2	10	26	snowfall after midnight.
11	7¾	1	s.e.	2	10	31	
	9	8	s.e.	2	10	33	
	12	20	s.e.	2	4	42	
	3	14	s.w.	2	5	47	
	6½	14	n.e.	2	6	41	
	10	6	n.w.	3	0	37	
12	7¼	23	s.e.	2	10	31	fog 1.
	9	28	s.e.	2	0	33	hazy.
	12	25	s.	2	0	42	
	2	19	s.	2	0	46	
	7	24	s.e.	1	0	40	fog 1.
	10	19	s.e.	1	0	37	
13	7½	15	s.e.	2	5	35	
	9	18	s.e.	2	8	38	fog 1.
	12	6	s.e.	2	10	43	soon afterwards sprinkling rain.
	4	2	s.e.	2	10	40	drizzling rain.
	7	5	s.e.	2	10	35	
	10	1	s.e.	1	10	37	drizzling rain.
14	7½	30	e.	1	10	40	fog 3.
	9	30	e.	1	10	42	fog 3.
	12½	30	e.	1	10	46	fog 2.
	3	7	n.w.	1	10	44	hazy, dark.
	6	9	n.w.	1	10	44	hazy.
	10	10	n.w.	1	10	40	fog 2.
15	6	15	n.e.	1	10	40	fog 2.
	9	20	n.e.	1	10	40	fog 3.
	12	–45	w.	3	10	42	rain beginning a little before 12.
	3	+ 7	n.	3	10	43	drizzling rain.
	6¾	–55	n.	3	10	42	rain.
	10½	–30	n.	2	10	42	drizzling rain, snowfall in the night.
16	7¼	+ 8	w.	3	10	35	some snowing between 8 and 9.
	9	18	w.	3	10	37	" " " 9 " 10.
	12	3	n.w.	3	10	37	

JANUARY—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	Ther. F.	REMARKS.
	3½	+14	w.	3	10	37	
	7	4	n.w.	2	10	36	
	10	5	w.	2	10	33	
17	7½	15	s.	1	10	31	
	9	20	s.	1	10	33	fog 1.
	12	23	s.e.	3	10	34	hazy.
	3	16	s.e.	2	10	35	
	6	13	s.e.	2	10	33	snowfall from 8 to 10.
	10	6	e.	3	10	33	
18	7½	11	s.w.	3	2	37	
	9	17	s.w.	4	0	37	
	12	15	s.w.	4	1	39	
	3	11	s.w.	4	0	41	
	6	13	s.w.	4	0	36	
	10	8	w.	3	0	33	
19	7¼	6	w.	4	0	26	
	9	16	w.	4	0	28	
	12	15	w.	3	0	35	
	3	15	w.	3	0	38	
	6	18	w.	3	0	34	
	10	33	w.	3	0	29	fog 1.
20	7¼	27	s.w.	3	0	24	fog 1.
	9	30	s.w.	2	0	26	fog 2.
	11	35	s.w.	2	0	36	
	5½	23	n.e.	2	0	38	fog 1.
	10	13	n.e.	2	0	33	
21	7½	17	e.	2	0	27	fog 1.
	9	15	n.e.	2	0	27	
	12	23	w.	3	0	31	
	3	20	n.w.	3	0	33	
	6	15	n.w.	3	0	30	
	9½	9	s.w.	3	5	27	
22	7¼	2	n.e.	2	10	23	fog 1.
	9	12	s.e.	2	0	28	
	12	20	s.e.	3	1	40	
	3	17	s.e.	3	0	44	
	6	9	s.e.	2	0	39	
	10	10	s.e.	2	0	38	
23	7½	15	e.	2	10	33	
	9	10	s.e.	3	10	37	
	12	18	s.e.	1	10	39	drizzling rain.
	3	22	s.e.	2	10	40	" "
	6	8	s.	1	10	38	
	10½	24	s.	1	10	35	drizzling rain, in the night high wind [and considerable snow fall.
24	7¼	14	n.w.	3	5	10	
	9	18	n.w.	3	0	16	
	12	11	w.	3	0	22	
	3	17	s.w.	4	0	26	
	7	23	s.w.	4	0	19	
	10	19	w.	3	0	17	

JANUARY—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. F.	REMARKS.
25	7¼	+37	s.e.	3	10	9	hazy, sun just setting.
	9	30	s.e.	3	0	18	
	12	25	s.e.	2	0	29	
	3	17	s.e.	2	0	32	
	6½	19	s.e.	2	0	26	moonshine.
	9	15	s.e.	2	0	24	"
26	7	23	s.e.	2	5	22	hazy.
	9	21	s.e.	2	6	30	cir. cu.
	12	35	s.	2	1	39	st.
	2½	32	s.	2	0	42	
	5	20	s.e.	2	0	41	sun just setting.
	7	17	s.e.	2	8	36	cu.
	10	16	s.e.	2	10	36	high wind in the night.
27	7¼	7	w.	4	0	18	sun just rising.
	9	14	w.	4	0	19	
	12	19	w.	3	0	28	
	3	16	w.	3	0	31	
	6	25	n.e.	2	5	28	fog 1.
	10	20	e.	2	0	25	
28	7	15	s.e.	2	10	30	
	9	14	s.e.	2	5	36	
	12	16	s.	2	8	46	
	3	12	s.	2	10	50	
	6	20	n.w.	3	8	45	fog 2.
	10	12	n.w.	3	0	42	
29	7	25	n.w.	3	1	30	hazy.
	9	19	n.w.	3	0	31	
	12	20	w.	3	2	37	
	3	12	n.w.	3	0	40	
	6	15	n.w.	3	0	37	fog 1.
	9½	15	n.w.	3	0	32	
30	7	15	n.w.	4	0	10	hazy.
	9	17	n.w.	4	0	8	
	12	17	w.	3	0	17	
	3	13	w.	3	0	18	
	6	15	n.w.	3	2	17	
	10	9	n.w.	2	10	19	
31	7	12	e.	3	10	23	
	9	2	s.e.	3	10	24	cu.
	12	11	s.e.	2	10	29	
	3	3	s.e.	3	10	29	overcast, dark.
	6	8	s.e.	2	10	28	
	10	3	s.e.	2	10	28	drizzling rain in the night.

FEBRUARY.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. F.	REMARKS.
1	7¼	− 8	s.e.	2	10	34	drizzling rain.
	9	−32	s.e.	2	10	35	" "
	12	+12	s.w.	1	10	40	fog 1.
	3	18	w.	2	10	45	
	6	23	w.	1	10	41	
	10	7	n.w.	3	10	37	
2	6½	5	w.	2	10	34	
	9	4	n.w.	3	10	30	some snow flakes about 11.
	12	1	w.	4	10	29	
	3	6	w.	3	10	29	
	6	5	w.	3	10	29	
	10	7	n.w.	4	10	26	
3	7	15	n.w.	4	9	15	
	9	17	n.w.	4	10	16	a few snow flakes, about 12 quite clear.
	1½	15	w.	3	2	29	
	4	15	w.	3	0	29	
	6½	18	s.w.	2	0	25	
	10	20	s.w.	2	0	25	
4	6¾	20	s.e.	2	0	22	before sunrise, white frost, fog 1.
	8	13	s.	2	0	25	
	9	15	s.	2	0	28	
	10	29	s.	2	0	33	
	11	18	s.w.	3	0	36	
	12	27	s.w.	3	0	39	
	1	22	s.w.	3	1	42	cir. n.e.
	2	15	s.w.	3	3	44	
	3	15	s.w.	3	3	45	
	4	13	s.w.	2	3	44	
	5¼	14	n.w.	2	2	41	after sunset, hazy.
	6	20	n.w.	2	5	41	fog 1.
	7	16	n.w.	2	5	40	"
	8	17	n.w.	2	5	39	"
	10	15	n.w.	2	8	37	"
5	6¾	24	n.w.	3	0	30	before sunrise, fog 1.
	8½	21	n.w.	3	1	29	
	10½	20	n.w.	3	2	34	
	12	20	w.	3	5	38	
	2	19	w.	3	0	40	
	4	18	w.	3	0	41	
	6	23	w.	3	0	36	after sunset.
	8	22	w.	2	0	33	
	10	17	w.	2	0	32	
6	6¾	14	s.w.	2	2	32	
	9	20	s.	2	2	39	
	12	11	s.w.	4	1	50	
	3	13	s.w.	3	3	57	cir. st.
	6	8	s.w.	2	1	50	
	10	7	s.w.	4	0	48	
	12	8	n.w.	3	3	47	
7	6¾	2	n w.	5	10	31	

FEBRUARY—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. F.	REMARKS.
	9	+ 4	n.w.	5	0	26	
	12	5	n.	5	1	24	
	3	5	n.	4	0	23	
	6	8	n.e.	3	5	21	
	9½	2	n.e.	3	0	18	
8	6½	2	s.e.	3	0	18	
	9	8	s.e.	3	0	23	
	12	7	s.e.	2	0	39	
	3	15	s.e.	2	0	47	
	6	13	s.e.	2	0	42	
	9½	5	s.e.	2	5	41	
9	6½	7	s.e.	2	10	42	
	9	15	s.e.	2	10	48	
	12	12	s.e.	2	10	59	
	3	13	s.e.	2	10	61	
	6	12	s.e.	2	10	56	
	10	5	s.e.	2	10	54	
10	7	3	e.	3	10	52	
	9	−38	s.e.	2	10	52	rain from 8 to 11.
	12	+ 3	s.e.	2	10	55	
	4	7	s.e.	2	10	57	cu. [with thunder and lightning.
	7	6	s.e.	2	8	54	between 8 and 9 short but strong rain,
	9	14	s.w.	3	10	55	high wind all night.
11	7	5	s.w.	5	10	45	
	9	8	s.w.	4	10	46	
	12	10	s.w.	4	5	54	cu.
	3	8	s.w.	4	8	54	"
	7	8	s.w.	4	9	49	
	10	4	s.w.	4	0	46	
12	6½	8	s.w.	3	0	35	
	9	12	s.w.	3	0	41	
	12	14	s.w.	2	0	52	
	3	7	s.	2	3	56	
	6	12	s.	1	8	49	
	9	12	s.	1	10	47	
13	6½	7	s.e.	3	10	47	
	9	34	s.	2	10	49	about 10 drizzling rain.
	12	22	s.e.	3	10	53	
	3½	3	e.	2	10	56	
	6	7	e.	2	10	55	
	9½	3	e.	2	10	50	fine rain.
14	6½	9	s.e.	2	10	49	
	9	2	s.e.	2	10	47	fine rain all the morning.
	12	4	s.	2	10	45	
	3	−65	s.w.	4	10	43	fine rain.
	3¼	−55	s.w.	4	10	43	" "
	3½	−50	s.w.	4	10	43	fine rain with snowflakes.
	3¾	−35	s.w.	4	10	43	" " " "
	4	−27	s.w.	4	10	41	rain with snowflakes, then snowing.
	5	+ 9	s.w.	4	10	39	snowing.

FEBRUARY—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. F.	REMARKS.
	6	+ 5	s.w.	3	10	38	snowing.
	9½	4	s.w.	4	10	36	snowing in the night.
15	6	25	w.	4	10	32	fine snowing until 8.
	9	6	w.	4	10	35	
	12	16	w.	4	10	39	
	3	12	s.w.	4	10	40	cu.
	6	8	s.w.	4	10	37	"
	9½	10	w.	3	10	35	some snowing in the night.
16	6½	20	w.	4	10	28	fine snowing.
	9	20	w.	3	10	29	snowing nearly all the forenoon.
	12	7	w.	3	10	31	snowing until nearly 3.
	3	20	w.	3	10	32	snowing after 4.
	6	16	w.	3	10	28	
	10	9	w.	4	10	26	
17	6¾	4	w.	3	10	24	some snow flakes. [ing.
	9	20	w.	4	10	27	" " " afterwards thick snow-
	12	18	w.	4	10	26	snowing.
	3½	12	w.	3	10	27	
	6	2	w.	4	9	26	
	9½	20	w.	2	0	22	moonshine and brilliant stars.
18	6½	28	s.w.	2	10	19	hazy.
	9	28	s.e.	2	10	26	"
	12	20	s.e.	2	8	26	
	3	15	s.e.	3	8	37	
	6	14	s.e.	3	10	36	a short rain shower at 7.
	9½	4	s.e.	2	10	37	
19	6½	28	s.	2	10	37	fog 1.
	9	30	s.w.	2	5	42	
	12	15	w.	3	3	47	
	3	13	w.	4	1	52	
	6	12	n.w.	4	0	43	
	9½	10	w.	3	0	38	
20	6½	21	w.	3	0	33	hazy.
	9	18	w.	3	0	40	
	12	20	w.	4	5	47	
	3	5	n.w.	5	2	49	
	6	17	n.w.	4	0	43	
	10	17	n.w.	3	0	38	
21	6½	28	w.	2	10	31	fog 2.
	9	33	s.e.	2	8	37	"
	12	30	s.e.	2	7	49	hazy, cir. cu.
	3	10	s.e.	3	10	51	
	6	18	s.e.	2	10	47	
	10	6	s.e.	2	10	44	
22	6½	13	s.e.	3	10	49	cu.
	8	14	s.e.	2	2	52	afterwards high s. wind.
	12	–35	s.	4	1	67	a few stratus.
	1½	–32	s.	5	3	67	st. cu., especially towards n.
	3	–32	s.	4	2	69	cu. west.
	4	–15	s.	4	7	68	cu. all around.

FEBRUARY—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. F.	REMARKS.
	5½	+ 4	s.	3	10	65	
	8	7	s.	3	10	62	
	10	10	s.	3	10	62	from 4 to 5 in the morning very high wind
23	6½	8	w.	5	10	42	[and thunder storm with hail and rain.
	8½	13	w.	5	10	37	clearing up soon afterwards.
	12	14	w.	5	1	40	
	3	6	w.	5	5	41	
	6	3	n.w.	5	10	30	
	9½	5	n.w.	5	0	23	
24	6¾	5	n.w.	4	9	29	some snow flakes.
	9	15	n.w.	3	1	22	
	12	18	s.e.	2	0	30	
	3	16	s.e.	2	0	35	
	6	22	s.e.	3	0	31	
	9	7	s.e.	2	0	28	
25	6½	9	s.e.	3	2	28	
	8½	13	s.e.	4	1	34	
	12	11	s.e.	3	10	49	
	3	13	s.e.	3	10	55	
	7¾	10	s.e.	2	10	47	
	10	13	s.e.	2	10	46	
26	6¼	8	s.e.	1	2	40	hazy.
	9	13	s.e.	1	2	48	
	12	20	s.e.	2	0	58	
	3	8	s.e.	2	0	60	
	6	10	s.e.	2	0	54	
	9½	6	s.e.	1	0	49	
27	6	15	s.e.	1	10	44	
	9	2	s.e.	1	10	52	fog 1.
	12	12	s.e.	2	10	61	
	3	10	s.e.	2	1	62	
	6	10	s.e.	2	0	56	
	10	8	s.e.	2	0	50	moonshine.
28	6	13	s.e.	2	0	46	
	9	13	s.e.	2	0	54	
	12	11	s.	2	1	70	
	3	2	s.	1	10	74	cu. st.
	4½	6	s.w.	2	9	73	" "
	6	16	s.w.	2	10	69	" "
	9½	1	s.e.	1	5	63	

MARCH.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
1	6	+12	s.	1	10	60	57	82	
	9	9	s.	1	10	64	58	67	
	12	12	s.w.	3	8	76	65	52	cu. cir.
	3	8	s.w.	3	1	80	66	44	
	6½	7	s.w.	2	2	69	60	56	
	9½	3	s.w.	1	5	65	57	58	
2	6	5	s.e.	3	8	55	54	94	cu. cir.
	9	12	s.w.	3	3	65	59	68	cir. st.
	12	5	s.w.	3	5	75	63	48	st.
	3	3	s.w.	3	9	76	63	45	
	6	4	s.w.	2	10	71	62	57	
	10	1	s.w.	2	10	65	61	78	strong rain towards morning.
3	7	−55	n.w.	4	10	43.5	43	96	rain.
	9	−18	n.w.	3	10	42	42	100	drizzling rain all the morning.
	12	− 5	n.w.	2	10	40.5	40	95	" "
	3	+ 4	n.w.	3	10	39.5	38	86	
	6	15	w.	3	1	40	38.5	86	after sunset.
	9	13	w	3	0	38	37	91	
4	6½	17	n.w.	3	10	33	30	70	white frost.
	9	10	n.w.	4	2	31.5	27	53	
	12	11	n.w.	4	1	35	30	53	
	3	10	n.w.	4	10	37	31	47	
	6	9	n.w.	4	10	33	31	80	
	10	10	w.	3	0	30	30	100	
5	6	20	w.	3	0	24	24	100	
	9	15	n.w.	4	0	26.5	22	45	
	12	7	w.	3	4	33	29	60	cu.
	3	8	w.	3	1	36	32	61	
	6	11	s.w.	2	0	35	32	70	
	10	11	s.w.	2	0	33	30	70	
6	6	15	s.	2	0	30	30	100	
	9	20	s.e.	3	8	38.5	31	37	
	12	15	s.	2	1	51.5	43	43	
	3	10	s.w.	2	0	59.5	47	31	
	6	8	n.w.	3	1	55.5	45.5	40	
	9	7	s.w.	2	8	49.5	42	48	
7	6¼	1	n.e.	3	2	35	33	80	hazy.
	9	3	e.	3	9	41.5	38	70	
	12	10	n.e.	3	5	52	45	53	
	3	7	e.	3	0	62	51	41	
	6	3	s.e.	2	0	57	47	41	
	9½	1	s.e.	2	5	50	43	51	
8	6½	−30	w.	3	10	45	45	100	rain since 4.
	9	−50	n.w.	3	10	41.5	41	96	rain all the morning.
	12	+ 3	w.	2	10	41.5	41	96	
	3	16	n.w.	4	10	44	41	76	afterwards entirely clear.
	6	21	w.	3	0	44	39	60	
	9½	18	s.w.	3	0	39	36	73	
9	6	8	w.	5	6	34	32	79	
	9	12	w.	5	5	33	29	60	cu.

MARCH—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	12	+ 5	w.	5	3	34	31	71	cu.
	3	8	w.	5	8	39.5	33.5	47	"
	6	5	w.	4	0	37	32	53	
	9½	9	w.	4	0	33.5	31.5	79	
10	6¼	7	n.w.	4	5	21	20	85	cu. towards s.
	9	15	n.w.	3	5	24	21	60	
	12	17	n.w.	3	3	30	26	56	
	4	15	w.	3	0	38	32	45	
	6	19	w.	2	0	36.5	32	57	sun just setting.
	9½	12	w.	2	0	31.5	29	74	
11	6	9	s.e.	3	0	29	28	88	before sunrise.
	7	7	s.e.	3	0	30	29	89	
	8	15	s.e.	3	1	33	30	70	
	9	12	s.e.	4	4	37	32	53	cir. cu.
	10	6	s.e.	3	3	40.5	35	52	" "
	11	3	s.e.	3	5	43.5	38.5	60	" "
	12	5	s.	4	2	48.5	41	47	" "
	1	7	s.	3	4	52	44.5	50	" "
	2	7	s.	3	5	55	45.5	42	cu. and st.
	3	6	s.e.	3	3	56.5	46	38	cir. s.
	4	6	s.e.	4	1	57.5	47	59	
	5	4	s.e.	4	0	56	46.5	42	
	6	7	s.	3	0	54.5	45.5	44	
	7	13	s.	2	0	51.5	44	50	
	8	3	s.	2	3	51	44	52	
	9	2	s.	3	5	51	44	52	
	10	2	s.w.	4	3	50.5	43.5	51	
12	7	18	s.	3	10	55	47	50	overcast, hazy. [s.w. wind.
	9	23	s.	3	10	58	49.5	51	" " afterwards high
	12	1	s.w.	5	10	70	56	36	hazy.
	3	2	s.w.	4	5	72	57	34	very hazy, but sunshine.
	6	3	s.w.	3	7	65.5	56	51	
	9	1	n.w.	4	10	60.5	51.5	49	
13	6	12	n.w.	2	10	44	38.5	56	fog 1.
	9	8	n.w.	4	10	40.5	36	61	hazy.
	12	9	n.w.	4	5	42	35	42	
	3	5	n.w.	4	5	45	37	39	cu.
	6	4	n.w.	4	7	39.5	33.5	49	"
	9	7	n.w.	5	0	30	26	56	brilliant stars.
14	6	9	n.w.	4	10	26.5	24.5	75	some snow flakes.
	9	12	n.w.	4	9	28	25	64	" " "
	12	8	n.w.	4	10	32	29	69	
	3	7	w.	3	7	35.5	31.5	62	
	6	14	n.e.	3	0	34.5	31.5	70	
	10	6	n.e.	2	0	28.5	27	82	
15	6¼	15	s.e.	3	3	28.5	27.5	88	
	9	17	s.e.	2	6	37.5	31.5	46	
	12	14	s.e.	3	5	45.5	39	50	
	3	14	s.e.	4	8	52.5	44	45	
	6	8	s.e.	3	9	47	40	48	

MARCH—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	9	+ 7	s.e.	2	10	46	40	54	rain towards morning.
16	6¼	–44	s.	1	10	42	41	91	fog 2.
	9	+20	w.	1	10	45	43.5	88	
	12	18	n.	3	1	54.5	46	47	
	3	14	n.w.	4	8	56.5	46.5	41	
	6	13	n.	3	10	51.5	42	37	
	9	15	n.	2	7	46	40	54	high n. wind in night.
17	6½	11	n.	4	10	34	31	71	
	9	3	n.	5	10	33	31.5	84	some snow flakes.
	12	8	n.	4	9	37	32	53	
	3	7	n.	5	10	36.5	32	57	
	6	8	n.	4	10	31.5	28.5	69	
	10	7	n.	3	2	27	25	75	
18	5¾	7	n.	3	0	17.5	17	92	
	9	8	n.	3	0	22	19	58	
	12	7	n.e.	3	0	28	24.5	58	
	3	4	n.e.	3	0	34	30.5	66	
	6	15	s.e.	2	0	31.5	29.5	78	hazy.
	10	13	s.e.	2	4	30	29	89	
19	6	18	s.e.	3	10	30.5	30	95	
	9	7	s.e.	3	10	36.5	31.5	54	
	12	10	s.	3	7	50	41	39	
	3	7	s.w.	2	10	34.5	44	35	
	6	7	w.	2	10	49	40	37	afterwards fine rain.
	9	–30	n.w.	4	10	37	37	100	fine rain, afterwards snowing.
20	6	+12	n.w.	3	2	24	23	86	
	9	18	w.	3	0	28	26	76	
	12	12	s.w.	3	10	39	35.5	68	
	2	10	w.	4	10	38	33.5	58	
	6	6	w.	4	3	32.5	31	95	
	9	8	w.	3	0	28.5	28	94	
21	6	25	w.	2	0	22	21.5	93	fog 1.
	9	29	s.e.	2	0	28.5	28	94	hazy.
	12½	13	s.e.	3	0	40	35	56	
	3	12	s.e.	3	2	46	38	40	st.
	6	12	e.	3	6	42.5	36	48	
	9	13	e.	2	8	39	34	55	aura lunæ.
22	6¼	12	s.e.	3	9	39	34	55	
	9	6	s.e.	4	10	45	38	46	
	12	4	s.	3	10	55	48	56	
	3	18	s.e.	4	10	56	49	57	
	6	7	s.	3	10	57	50.5	60	
	9	7	s.	2	10	57	51	63	rain in night, and very high
23	6	3	w.	5	10	35.5	32.5	71	[wind.
	9	5	w.	5	3	33	29.5	64	
	12	10	w.	4	0	39	33	46	
	6	10	w.	4	0	43	37	51	
	9	10	w.	4	0	36.5	33	66	
24	6	30	w.	2	0	29.5	27	72	
	9	23	s.	1	0	39.5	32.5	35	

MARCH—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	12	+17	s.e.	1	2	52	42	35	st.
	3	6	s.e.	3	3	57	45	30	"
	6½	5	e.	2	4	53	41	29	"
	10	5	s.e.	2	9	51	42	40	
25	6	7	s.e.	3	2	48.5	40.5	44	[clouded.
	9	1	s.	3	3	60.5	47	31	afterwards high rain and over-
	12	1	s.	4	5	70.5	60	51	
	3	3	s.	3	7	73	62	50	
	6	−70	s.e.	3	10	64.5	58.5	67	[and fine rain.
	7	−73	s.e.	2	10	61.5	58.5	83	distant thunder and lightning
	9	−45	s.w.	3	10	60.5	60	97	strong rain; midnight, severe
									[thunderstorm; rain till morn.
26	6	−50	s.	2	10	53.5	53	96	rain with thunder.
	9	+ 7	s.e.	2	10	56.5	55	90	[an hour.
	10½	−85	s.e.	3	10	63	61	88	thunder and strong rain for half
	12	−13	w.	3	8	61.5	58.5	83	sunshine for a while.
	3	+ 5	s.w.	4	8	55.5	50.5	69	
	6	1	w.	4	10	44.5	40.5	68	
	9	2	s.w.	4	10	42	38.5	70	very high wind in night.
27	6	7	w.	4	10	32.5	30	74	
	9	12	w.	4	0	35	31	62	
	12	17	w.	3	0	46	40.5	58	
	3	12	s.w.	3	2	52.5	45	51	
	6	17	s.e.	2	2	50.5	42.5	45	
	9½	14	e.	2	9	45	40	61	
28	6	9	e.	3	10	46	40.5	58	
	9	7	s.e.	3	10	52.5	45	51	
	12	5	s.e.	3	8	62	51	41	
	3	6	s.e.	2	0	70.5	56	34	
	6	7	s.e.	2	2	66	54	40	
	9	3	s.e.	1	5	58.5	50.5	53	[stantly.
29	6	−45	s.e.	3	9	58	53.5	73	distant thunder almost con-
		−55							
		−70							
		−75							
		−44							
		−25							
		−85							
		−80							
		−70							
	7	−75	s.	3	10	61	57	77	a few drops of rain.
		−45							louder thunder, rain.
	7¼	−50							rain, thunder and lightning.
	7½	−25							rain, strong thunder & lightning
		−90							" " " "
		−80							" " " "
	8	−45	s.	2	10	61	58	83	strong rain for half an hour.
	9	−20	s.e.	2	9	64	60	77	clearing up a little.
	12	−30	w.	4	10	54	54	100	strong rain with thunder and lightning for several hours.

MARCH—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	3	-35	w.	4	10	50	49.5	96	fine rain for short time.
	6	+ 5	w.	4	10	45.5	43	80	
	9½	8	w.	3	10	44	41	76	
30	5¾	14	n.w.	3	1	35.5	34.5	90	cir.
	9	10	w.	2	2	41	37	65	
	12	21	n.e.	3	0	57	51	63	
	3	17	n.e.	3	8	54	46	49	
	6	11	n.e.	2	9	49.5	43.5	57	
	9	11	n.e.	2	7	45	41	68	
31	5¾	10	e.	3	1	39	37	82	
	9	13	e.	3	10	46	42	69	after 10 a violent thunderstorm, attended with hail and rain, lasting all day; but for want of proper isolation in the collecting apparatus, I have rejected the observations made from hence to 2d of April.

APRIL.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
2	12	+15	e.	1	10	59	49	43	
	3	18	e.	1	2	62	51.5	43	
	6	10	e.	2	1	58.5	50.5	54	
	9½	15	e.	2	0	51.5	47	69	
3	6	–40	s.e.	2	10	50	46	71	rain.
	9	–45	e.	2	10	49	46.5	85	"
	12	+ 9	e.	2	10	52	47	66	
	3	13	e.	3	10	54	49	67	a few drops of rain.
	6¼	15	e.	2	10	54.5	49.5	68	short rain about 5.
	9	11	e.	2	10	54.5	48.5	61	
4	6	10	e.	3	10	54.5	48	61	
	8½	9	e.	3	10	59	52.5	62	
	12	1	s.e.	4	10	67.5	62	72	
	3	1	s.e.	3	9	73	64	59	cu.
	6½	1	s.e.	2	10	69	63	70	"
	10	2	s.e.	3	10	66.5	61	71	" rain towards morning.
5	6	12	s.e.	3	10	59.5	58	91	
	9	3	s.e.	2	8	66	61	73	sunshine.
	12	2	s.	3	9	72.5	64	61	cu.
	3	6	s.	3	10	76	65	52	"
	6½	6	s.e.	2	8	67	61	69	
	10	8	s.e.	2	9	63.5	59.5	77	
6	6	3	s.e.	2	10	60.5	59	91	some drizzling rain.
	8½	4	s.e.	2	10	62.5	60	86	rain from 10 to 12.
	12½	1	s.	3	7	65.5	63.5	89	rain about 1.
	3	3	s.w.	3	9	68	60	60	
	6½	10	w.	2	1	60.5	53.5	62	most beautiful sunset, (Abendroth.)
	10	8	w.	2	0	56	51	69	
7	6¾	5	s.	2	2	49	47	85	
	8½	4	s.e.	2	10	61	54	61	rain between 10 and 11.
	12	7	e.	2	10	67.5	59	57	
	3	–60	s.e.	4	10	65.5	56	51	thundering, rain.
	4	–45	s.	2	10	56	54.5	91	rain, distant thunder and lightning.
	6½	+ 3	w.	3	10	50.5	48.5	86	
	9½	11	w.	3	7	47	44	77	
8	5¾	13	s.w.	3	8	46.5	44	81	
	8½	15	s.w.	3	10	51	47	72	some rain between 10 and 11.
	12	17	s.w.	4	9	57	50	58	
	3	15	s.w.	2	10	60	51	49	
	6¼	15	s.w.	3	10	49	45.5	74	
	9½	14	s.w.	2	5	44.5	42	80	
9	5½	10	s.w.	2	10	42.5	41	87	
	8½	15	n.w.	2	0	49	45.5	75	
	12	14	n.w.	3	9	56.5	49	54	
	3½	10	n.e.	2	9	59	50.5	51	
	6½	13	n.w.	2	10	57	49.5	54	
	10	17	n.w.	2	0	51	47.5	76	
10	5¾	18	s.e.	1	0	45	43.5	88	hazy.
	8	12	n.e.	2	0	53.5	49.5	73	
	12	11	e.	3	8	63	54	52	cu.

APRIL—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
	6½	13	n.e.	2	7	59.5	52.5	60	cu.
	10	8	n.e.	2	8	55	50	68	
11	6	6	n.e.	2	10	50	47	78	afterwards drizzling rain.
	8½	3	e.	2	10	51	45.5	62	fine rain about 10.
	12	5	n.w.	2	10	49	49	100	fine rain.
	3	4	n.w.	2	10	51.5	50.5	93	
	6½	1	s.w.	2	10	52.5	51.5	93	drizzling rain.
	10	5	s.w.	1	10	51	51	100	
12	6	−18	s.	1	10	50.5	50	96	strong rain.
	8½	− 6	s.	1	10	52	50.5	90	rain, with intervals.
	12	−25	s.w.	2	10	52.5	51.5	93	a strong shower about 12.
	3	−15	s.w.	2	10	56	52	75	during a rain shower.
		−25							
		−35							
		−45							
	3¼	−35							
	6½	+ 2	s.w.	3	8	54	49	67	
	9½	4	s.w.	3	9	51	47.5	75	
13	5¾	10	w.	4	10	46	43	77	cu.
	8½	16	w.	4	7	48.5	43	60	"
	12	8	w.	3	8	54.5	47.5	56	"
	3	14	w.	4	6	58.5	49	45	"
	6½	7	w.	3	2	56	47	45	
	10	14	w.	3	0	49	44	64	
14	5¾	14	w.	2	1	41.5	38.5	74	
	8½	23	w.	2	0	52.5	46	57	
	5	18	n.	2	10	55	46.5	47	hazy.
	9	6	n.	3	10	51.5	45	56	
15	5¾	17	n.e.	2	10	45.5	42	72	hazy.
	8½	24	n.e.	2	2	53	45	48	
	12	16	n.w.	3	2	58.5	48	40	
	3	8	n.w.	3	5	60	50	44	cu.
	6½	8	n.w.	4	1	55.5	45.5	40	
	10	13	n.w.	3	0	49	43	57	
16	5½	20	n.	3	0	34.5	33	84	
	9	12	n.	4	0	40.5	35.5	56	
	12	3	n.	4	1	47.5	39	39	
	7	13	n.	3	0	47	39	41	moonshine.
	9½	15	n.	3	0	44	39	60	"
17	5¾	18	n.e.	3	0	36	33.5	76	cu. hazy.
	8½	22	s.e.	3	0	47	41	55	
	12	11	s.e.	2	1	57	48	46	
	3	3	s.e.	3	2	62.5	52	44	
	6½	4	s.	1	2	60	52	54	
	9	5	s.	3	8	59	51	54	cu.
18	5¾	8	w.	3	2	52	45	53	
	9	23	w.	4	3	56	46	40	afterwards very high wind.
	12	-65	w.	5	1	60	47.5	31	very high wind with clouds of [dust.
	3	-58	w.	5	6	61	47	26	cu.
	6½	+ 8	w.	4	4	55	45	39	"

APRIL—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
	9½	+ 2	w.	5	8	49.5	41	41	cu.
19	5½	11	n.w.	3	0	38.5	34.5	63	sunrise.
	8	16	n.w.	3	0	46	39	47	
	10	4	n.w.	4	0	50	39.5	29	
	12	6	n.	4	0	52	41.5	32	
	2	6	n.w.	3	0	55.5	44.5	39	
	4	3	n.w.	2	0	56	47	45	
	6	9	n.w.	2	0	54	44	38	
	8	7	e.	2	0	50	43	51	moonshine.
	10	12	e.	2	0	47	41	55	"
20	5¾	5	s.e.	3	7	44.5	39.5	60	
	9	6	s.	3	8	57	47	41	
	12	7	s.e.	3	6	66	53	36	short rain shower about 1.
	3	-24	s.e.	4	0	64	53	43	
	6½	+10	s.	2	0	63	53	36	
	9	8	s.	2	2	57	50	58	
21	5¾	14	s.e.	2	6	53.5	49	70	cir. st.
	8½	9	s.	2	10	65	56	53	bet. 9 and 10 lightning s.w., fol-
	12	2	s.	4	3	76	61.5	40	[lowed by high s.e. wind.
	3	-35	s.	2	5	81	62.5	30	st., hazy, afterwards high wind.
	7	+ 3	s.	3	5	74.5	62	46	hazy.
	10½	7	s.	3	8	72	62	54	
22	5¾	10	s.	3	2	67.5	61	67	
	8½	2	s.	2	8	74.5	65.5	59	
	12	3	s.	2	8	84	69.5	45	
	3	2	s.e.	3	7	82	69	49	
	7	3	s.	2	0	73	65.5	64	
	9	5	s.	2	0	70.5	64.5	71	moonshine.
23	5½	10	s.	2	4	66	63	84	bet. 6 and 7 a few drops of rain.
	8½	6	s.	2	2	73	67	72	
	12	3	s.	3	7	80	70	59	cu. [pouring rain for ½ hour.
	2½	0	w.	5	10	76	76	100	thunder storm, with hail and
	3	-28	s.w.	3	10	64	64	100	a few drops of rain.
	4	+ 3	w.	4	9	67	63.5	82	
	7	3	w.	4	10	62.5	58	75	
	9½	2	w.	4	7	55	49	62	cu. cir.
24	5½	7	s.w.	3	0	46	43.5	81	
	9	3	s.w.	3	0	61	52.5	52	
	12	2	w.	4	3	64.5	50.5	30	cu.
	3	7	w.	4	3	68	54.5	36	
	7	11	w.	2	0	63	53.5	49	
	9½	33	w.	2	0	56	51.5	72	moonshine, full moon.
25	6	23	s.w.	2	0	51	47	72	
	8	13	s.w.	2	2	63	53.5	49	st.
	12	4	s.w.	3	5	77	59.5	30	"
	3	3	s.	3	8	80	61.5	29	hazy.
	7	5	s.e.	2	2	69	56.5	41	
	10½	7	s.	2	3	62	53	51	
26	6	7	s.e.	2	0	61.5	55	64	
	9	10	s.	2	0	71.5	62.5	58	

APRIL—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	Force.	Sky.	THER. FAR. Dry Bulb.	Wet Bulb.	Rel. Hum.	REMARKS.
	12	+ 2	s.	3	5	79.5	67	49	cu.
	3	1	s.	3	10	77.5	67	55	"
	7	3	s.e.	3	0	71.5	65	69	
	9	6	s.e.	3	5	70	64	70	
27	6	1	s.	2	10	60	60	100	fine rain.
	9	1	n.w.	3	10	52.5	52.5	100	rain all the morning.
	12	1	n.w.	3	10	44.5	44.5	100	rain until 2.
	3	9	n.	4	9	51	47.5	75	sunshine.
	7	11	w.	2	9	54	51.5	84	
	10	10	s.w.	2	0	47	46.5	88	
28	5¼	10	s.w.	2	0	42.5	42	96	moonshine and sun rising.
	9	20	s.w.	2	0	61	53.5	58	
	12	18	s.	1	0	69.5	55.5	35	
	3	17	s.	2	2	72.5	57.5	35	
	6	10	s.	2	0	68	56	42	
	9½	11	s.	1	0	61	53.5	57	
29	5¼	10	s.w.	2	3	53	49	73	st.—sun rising.
	9	9	n.w.	4	2	61	50.5	43	
	12	9	n.w.	3	3	65.5	54	42	
	3	5	n.	3	6	67.5	56.5	47	
	6	2	n.w.	4	10	57	51	63	afterwards slight drizzling rain.
	9½	4	w.	2	10	52.5	52	96	
30	5	8	w.	2	0	50	45	65	sun rising.
	9	9	w.	2	0	61.5	52	48	
	12	8	s.w.	2	0	68	53.5	31	
	3	6	s.w.	3	3	71.5	56	32	
	6	5	w.	2	0	68	53.5	31	
	9	7	w.	2	0	59.5	50	46	

MAY.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
1	6	+18	n.w.	2	0	45.5	41.5	68	
	9	13	n.	2	0	53	45	48	
	12	15	n.e.	2	0	60	50	44	
	3	10	n.e.	3	0	61	50	48	
	6	13	n.e.	3	2	58	49	47	
	9	11	n.e.	4	0	51.5	45	56	
2	5¼	10	e.	3	3	39.5	37.5	82	
	9	15	e.	4	2	52	45	53	
	12	11	s.e.	3	7	62	52	46	
	3	8	s.	3	0	66	55.5	48	
	6	7	s.e.	3	0	65	55.5	51	
	10	8	s.	2	0	59	53	65	
3	5½	8	s.w.	3	3	60	55	71	
	9	2	s.w.	3	2	70.5	62	59	st.
	12	1	w.	2	6	76	65	52	cu.
	3	–30	w.	4	7	74.5	62.5	48	cu. and nimbus, afterwards high
	6	-25	n.	5	1	61	54	61	[n.w. wind, and clearing up.
	9	+ 9	n.	5	10	48.5	45	74	
4	5½	8	n.e.	3	10	46	44	84	overcast.
	9	5	e.	2	10	50.5	47	75	"
	12	13	e.	3	3	60	58.5	91	hazy.
	3	15	s.e.	3	5	66	57	54	"
	6	10	e.	3	10	62	55.5	64	
	9	6	e.	3	10	58	53	70	[lightning.
5	6	-65	s.e.	4	10	54.5	54.5	100	strong wind, with thunder and
	7	-70	e.	3	10	55	55	100	fine rain.
	9	+ 1	s.e.	3	10	59.5	58.5	94	" "
	10	1	s.	2	7	62	60.5	91	sunshine.
	12	1	s.	2	5	71.5	67	78	cu.
	2	–12	s.w.	6	8	76	62.5	42	cu. and nim.
	3	–33	s.w.	7	4	72	55	26	cu., sunshine.
	4	+ 3	s.w.	5	5	69	57	43	" "
	6½	5	s.w.	4	2	63.5	54.5	53	
	9	7	w.	2	2	57	51.5	66	
6	5½	7	s.	2	10	57	51.5	67	
	8½	8	s.w.	2	9	62.5	55.5	61	
	12	-70	w.	6	4	68	51.5	26	cu.—gale since 11½.
	1	–35	w.	5	4	70	53	24	"
	2	–60	w.	6	3	69	52.5	24	"
	3	–30	w.	6	7	66	52	32	nim. s.
	4½	–28	w.	5	3	66	52	32	cu., sunshine.
	6	+ 3	w.	3	3	64.5	52.5	38	" "
	10	4	w.	2	0	56.5	48.5	52	
7	5½	7	s.w.	2	0	52	45.5	56	
	8½	–25	w.	4	0	64.5	51.5	35	very high wind afterwards.
	10	–50	w.	5	0	66	51.5	29	
	12	–55	w.	5	0	69	53	27	
	3	–60	w.	5	2	72	53	19	
	6	+ 2	w.	4	0	68	53	30	
	9½	7	w.	3	0	59	50.5	51	

MAY—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
8	5½	+14	w.	3	0	48.5	46	81	
	8½	8	w.	2	6	61	54	61	
	12	7	w.	2	7	67	58	55	
	6	2	w.	2	2	67.5	57	48	cir.
	9	6	w.	2	0	58	53.5	73	
9	5½	4	s.e.	2	1	51	50	93	
	8½	7	s.e.	2	1	69.5	59.5	52	
	12	7	s.e.	2	5	75	62.5	46	st.
	3	8	s.e.	1	10	78.5	65	45	
	6	5	e.	1	10	72.5	62	52	[rain beginning.
	8	−75	e.	3	10	70	62	61	distant thunder and lightning,
	9½	−45	e.	2	10	60	60	100	thunder and lightning, rain.
10	5¼	+ 9	w.	2	1	60	59	94	
	8½	7	n.w.	3	4	64.5	60	75	
	12½	10	w.	2	6	71	54.5	47	cu. cir.
	3	7	w.	2	7	73	60	42	
	6	7	n.w.	1	9	68.5	58.5	51	[midnight.
	9½	12	w.	1	5	61	57.5	80	thunderstorm and rain after
11	5	−50	n.e.	2	10	55.5	54	90	thunderstorm and rain.
	8½	−45	e.	2	10	51.5	51.5	100	some rain.
	12½	+ 9	e.	2	10	62	57	72	
	3	10	e.	2	10	64	59.5	75	
	6½	8	e.	2	10	61	58	83	
	9½	2	e.	1	10	58.5	57.5	94	drizzling rain.
12	4¾	10	n.e.	1	10	52	52	100	rain.
	8½	1	e.	1	10	54	54	100	
	12	1	e.	1	10	59	57	88	
	3	1	n.	1	10	55.5	55.5	100	fine rain.
	3½	−45	n.	2	10				rain, with thunder and lightning
	6	+ 1	s.e.	1	10	56	56	100	
	9	1	n.w.	1	10	56	56	100	
13	5¼	1	s.w.	1	10	57	57	100	cu.
	8½	1	s.w.	2	10	60	57	82	"
	12	5	w.	4	9	60.5	54.5	66	
	3	8	w.	4	10	56.5	51	66	
	6	12	w.	3	7	55.5	50.5	65	
	9½	24	w.	2	0	49	48	92	moonshine and brilliant stars.
14	5½	16	w.	3	0	44	43	92	
	9	18	w.	3	0	59.5	51.5	54	
	12	13	n.	2	0	63	54	52	
	3	10	s.	1	0	67	56	46	
	6	11	w.	1	0	65.5	54	42	
	9	17	w.	1	0	57	52	69	
15	5½	23	w.	1	0	50.5	48	82	
	8	20	w.	2	2	58.5	53	67	
	12	12	w.	4	4	61	51.5	47	cir. cu.
	3	8	w.	4	0	66	55	45	
	6	10	w.	4	2	63.5	52	40	
	9	11	w.	2	0	54	49	67	
16	5	25	w.	1	1	46	44	84	just after sunrise.

MAY—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	9	+23	n.w.	2	0	62	52	46	
	12	14	n.	2	2	64.5	53	41	
	3	12	n.	2	2	67	55	41	
	6	7	n.	2	1	66	55	45	
	9	14	n.e.	1	0	59	53.5	68	
17	5	15	n.e.	1	7	50	49.5	96	
	9	21	n.e.	1	6	60.5	55.5	71	
	12	19	e.	1	5	72	59.5	45	
	3	14	e.	3	3	73	60	42	
	6	12	e.	2	0	69	59	52	
	9	7	e.	1	0	61	50	40	
18	5	4	s.e.	1	10	55	51.5	78	cu.
	9	17	s.e.	2	0	71	59	45	
	12	20	s.e.	2	3	76.5	63.5	42	cir. cu.
	3	10	s.	1	5	82	67	42	" "
	6	9	s.e.	1	2	76	64	49	
	9	6	s.	1	5	67.5	61	67	
19	6	5	s.e.	1	10	64.5	60.5	77	
	9	18	s.e.	1	10	72	65	66	
	12	3	s.e.	1	10	75	68	68	
	3	0	s.e.	1	10	72	68	81	drizzling rain for two hours.
	6	4	s.e.	1	8	71	69	90	
	9	3	s.e.	1	0	65.5	65.5	100	
20	5½	5	w.	4	10	56.5	55.5	94	
	9	2	w.	4	10	57	54	81	
	12	2	w.	4	10	51	50	93	fine rain.
	3	1	w.	4	10	51	49.5	89	
	6	2	n.w.	3	10	49.5	49	96	
	9	2	n.w.	4	10	48.5	48	96	
21	5	5	n.w.	3	10	50	47.5	82	cir. cu.
	8½	13	n.	3	9	54	50	74	" "
	12	7	n.e.	4	3	63	53	47	
	3	4	n.	4	1	66	54	40	
	6	7	n.e.	3	0	64	54	48	
	11	10	n.e.	2	0	54	49.5	71	
22	5½	12	n.e.	2	0	53	47.5	63	
	8½	13	n.e.	2	0	66	56	49	
	12	15	s.e.	2	0	70	59	48	
	3½	9	s.e.	2	2	73	60	64	
	7	7	s.e.	2	0	67	58	55	sun setting.
	10	5	s.e.	1	0	60	55	71	moonshine.
23	5¾	8	s.e.	1	10	55	51.5	78	overcast—a little rain before 9.
	9	-42	s.	4	9	61	56	71	high wind.
	12	+12	s.w.	2	8	75	66	60	cir. cu.
	3	9	s.e.	3	3	76.5	66	55	cir.
	6	6	s.e.	3	10	70.5	63	64	
	9	7	s.e.	3	10	68	62	69	
24	5¼	3	s.e.	2	6	62	60.5	86	
	6½	-90	s.e.	3	10	65	62.5	81	constant thundering, beginning
	9	+11	s.e.	3	10	68	64	79	[of rain, thunderstorm for 1 hr.

MAY—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS
	12	+12	s.e.	3	2	74	69.5	79	
	3	3	s.	3	2	84.5	75.5	65	
	6	7	s.	2	0	84	74	60	
	9	5	s.	1	0	75	70.5	79	
25	5	7	s.w.	2	2	69	66	85	cir.
	9	2	s.w.	2	5	81	72.5	64	
	12	2	s.w.	3	5	87	76.5	60	
	3	5	s.	2	3	89	76	53	cu.
	6	8	s.w.	2	1	87	73	51	
	9	2	s.w.	2	0	77	70.5	71	
26	5½	4	s.	3	5	71	67	80	
	8	1	s.w.	4	0	81.5	72	61	
	12	1	s.w.	4	3	88	74	49	cu.
	3	2	s.w.	5	2	89	73	43	
	6½	−45	s.w.	6	0	82	66.5	42	
	8½	−80	s.w.	7	0	75	63	48	clouds of dust.
	9½	+ 5	s.w.	5	0				high wind in the night.
27	5½	7	w.	3	0	57	54	81	
	8½	4	w.	4	0	64	56.5	60	
	12	4	w.	3	3	71	61.5	55	cu.
	3	3	w.	4	6	75	62	44	"
	6	4	w.	3	2	74	61	43	
	9	6	w.	2	0	66	60.5	71	
28	5½	10	w.	1	0	59	57	88	
	8	9	w.	1	0	72	63	58	
	10	10	w.	2	1	76	63.5	46	
	12	8	s.w.	2	4	81	66.5	43	st.
	3	4	w.	1	10	82	67	42	cu., afterwards high wind.
	6	2	n.e.	4	10	69.5	59	51	
	10½	4	n.e.	2	10	60	57.5	85	
29	5	5	n.e.	2	10	58	57	94	rain from 8 to 9.
	9	4	n.e.	2	10	58	57.5	97	drizzling rain all the morning.
	12	3	n.e.	2	10	59	58	94	drizzling rain.
	3	1	n.e.	4	10	62	59	83	
	6	2	e.	2	10	60	56	76	
	9	3	n.e.	3	10	58	55	82	
30	6	4	n.e.	2	10	53	50	80	
	9	9	e.	2	9	64	59	73	
	12	8	e.	2	8	72	64.5	68	
	3	4	e.	2	8	73	67	72	
	6	2	e.	2	6	70	65	73	
	9	3	e.	2	10	65	62	84	
31	6	6	e.	2	10	63.5	61	86	
	8½	12	s.w.	4	10	66	63	84	beginning of fine rain.
	12	1	s.e.	2	10	65.5	65	97	fine rain.
	3	2	s.e.	1	10	71.5	70	92	
	6	1	s.e.	1	10	70	68	90	
	9	1	s.e.	2	8	66.5	66.5	100	

JUNE.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
1	5¼	+ 1	s.e.	1	10	66	66	100	fog 2.
	8½	1	s.e.	1	10	74.5	72	88	[wind & thund'storm for ½ hr.
	12	1	s.	1	10	83	76.5	74	cu. nim., afterwards high south
	3	0	s.	3	10	76	75	95	heavy rain for 10 minutes.
	6	0	s.	1	10	75	73.5	93	
	9	1	s.	1	10	71.5	71.5	100	rain from 8—9.
2	5 m	0	s.e.	1	10	70	69 5	97	
	9ev	1	s.w.	2	10	73	70.5	88	
3	6	1	s.w.	2	10	70	69	95	
	8	2	s.w.	2	10	71.5	70	93	afterwards heavy rain for 1 hr.
	12	1	n.e.	1	10	72	70.5	92	trifling rain.
	3	1	n.w.	2	10	73	70.5	88	
	6	0	n.w.	3	10	70.5	68	88	beginning of a rainshower.
	10	1	n.w.	1	5	65	64.5	97	
4	5	1	n.w.	2	0	60	60	100	
	9	1	n.w.	3	0	70.5	64	68	
	12	5	n.w.	3	2	74	63	51	
	3	3	w.	2	5	78.5	67.5	54	
	6	−75	w.	4	10	64	64	100	thunderstorm with heavy rain
	11	+10	n.w.	2	2	62	60	88	[for 1 hour.
5	5½	14	n.w.	2	3	65	63	89	
	9	13	n.e.	2	1	75	66.5	61	
	12	15	s.e.	2	4	78	69.5	64	
	3	8	s.e.	2	5	82	72	59	
	6	9	s.	3	5	81	70	56	
	9	6	s.	2	6	70	67	85	
6	5½	3	s.	1	10	68	67	95	
	7	12	s.	1	10	69	68	95	distant thundering with trifling
	9	1	s.	1	8	74	71	86	[rain for about 1 hour.
	12	0	s.	2	5	86	77	65	
	3½	−40	n.e.	3	9	81	74	70	nim., distant thunder for sever-
	6	+ 5	e.	2	10	74	70	81	[al hours with trifling rain.
	10	1	e.	1	9	69	67	90	
7	6	2	s.e.	2	2	69	66	85	
	8½	1	s.e.	2	0	81	73	66	
	12	2	e.	3	2	87	76	59	
	2½	−90	s.	4	10	81	73	66	beginning of a severe thunder-
	6	+ 2	s.e.	2	8	78.5	73	76	[storm and rain.
	9	1	s.e.	1	5	72	70	90	
8	5½	1	s.e.	1	2	70	68	90	cir.
	9	1	s.e.	1	0	81.5	74	69	
	12	0	s.e.	1	5	84.5	76	67	cu.
	3	5	s.e.	2	6	88.5	76.5	56	"
	6	5	s.e.	1	2	86	75.5	60	
	9	2	n.e.	2	5	76	72.5	84	
9	6	1	e.	1	1	74	68.5	75	
	8	2	e.	2	3	81	71	59	
	1	4	e.	3	2	84	72	53	
	3	6	n.e.	3	2	84.5	71.5	50	
	6	5	e.	3	0	80	70	59	

JUNE—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	9	+ 1	e.	2	0	72	67.5	78	
10	5½	2	n.e.	3	0	70	65.5	78	
	9	6	s.e.	2	0	83	71	53	
	12	4	s.e.	3	2	86.5	72.5	47	
	3	9	s.e.	3	4	87	73	48	cu.
	6	7	s.e.	3	0	84.5	72	51	
	9	8	s.e.	2	0	76	70.5	75	
11	5	2	s.	2	5	70	67	85	
	7½	4	s.	2	6	82	73	63	
	12	1	s.w.	1	10	91	79	57	from 1 to 7 thunderstorms and
	2	–20	n.e.	2	10	83	76	72	[rain at intervals.
	6	–30	s.	1	10	80	76.5	85	
	10	+ 1	n.w.	2	4	73	70	85	
12	6¼	12	n.w.	3	0	68	63	75	
	8	10	n.w.	3	0	71	64	66	
	12	6	n.	3	0	78	66	50	
	3	5	n.	3	1	80	66.5	46	
	6	9	n.w.	2	2	81	67	45	
	10	8	n.w.	2	1	73	67	72	
13	5¼	6	n.e.	2	2	65	63	89	
	8½	7	e.	2	2	72.5	68.5	81	
	12	8	s.e.	2	5	85	70	44	
	3	7	s.e.	2	7	87.5	71	41	cir.
	6	7	s.e.	2	3	83	71	53	
	9	6	s.e.	1	0	73.5	68	75	
14	5½	5	s.e.	1	3	69	65.5	83	
	9	6	s.	1	3	82	70	65	
	12	4	s.	2	0	85.5	72	49	
	3	3	s.	3	0	89	74.5	48	
	7	2	s.	2	0	84	74	60	
	9½	1	s.	2	2	76	71.5	79	
15	5½	1	s.w.	2	10	74	70	81	
	8	3	w.	3	8	80.5	72.5	66	
	12	4	w.	3	0	88	73	46	
	3	4	s.w.	3	0	92	74	40	
	6	2	s.w.	3	3	90	77	53	
	9	1	s.w.	3	3	81	74.5	72	distant lightning.
16	5½	5	w.	3	0	68	62.5	72	
	9	1	n.w.	4	1	72	64.5	64	
	12	1	n.	4	4	74	65	59	cu.
	3	2	n.	4	5	74.5	64	54	"
	6	3	n.	4	3	74	64	56	"
	9½	4	n.	4	0	63	58	72	
17	5¼	4	n.e.	3	7	57	54	81	
	8½	9	n.e.	2	10	65	58	63	
	12	16	n.	3	2	70	59	48	
	3	12	n.	3	0	75	62	44	
	6	13	n.	2	0	74.5	60.5	40	
	9½	10	n.	2	0	64	59	73	
18	5½	5	s.w.	1	10	62	57	72	

JUNE—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	8½	+ 6	s.e.	1	8	72	63	58	
	12	7	s.w.	2	3	80	67.5	49	
	3½	8	s.e.	2	2	84	70.5	49	
	6	5	s.e.	3	5	80	70	59	
	9	4	s.e.	3	2	73	67.5	74	distant lightning s.
19	5½	2	s.	3	9	68	64.5	82	cir. cu.
	9	2	s.	2	5	82.5	72.5	60	" "
	12	6	s.	3	1	89.5	77	55	
	3	3	s.	3	1	93	79	52	
	6	3	s.e.	3	2	89	78	59	
	10	2	s.e.	1	0	78.5	74.5	82	
20	5	9	s.	1	0	74	70.5	83	
	9	2	s.w.	3	1	87.5	76	57	
	12	1	s.w.	4	5	94	78	46	
	3	1	s.w.	4	3	97.5	78	39	
	6	2	s.w.	4	0	92	76.5	47	
	9	1	s.w.	3	0	81	73	66	
21	5½	2	s.w.	2	0	76.5	70.5	73	
	9	1	s.w.	3	0	88	76	56	
	12	2	w.	3	1	90	77	53	
	3	2	w.	3	3	93.5	78	47	cu.
	6	3	s.w.	3	1	91	77.5	52	
	9	1	s.w.	2	1	82	75	71	lightning n.w. and s., cu.
22	5	3	n.	3	3	73	70	85	cu.
	8½	3	n.	2	8	80.5	73	68	"
	12	8	n.e.	3	4	87.5	74	50	
	3	10	n.	2	6	89	71	38	cir. cu.
	6	10	n.	3	9	83.5	71	51	" "
	9	8	n.	3	10	77	69.5	67	
23	5¾	15	n.	1	10	72	69.5	88	about 5 rain for a few minutes.
	8	7	n.	1	10	73.5	71.5	90	drizzling rain.
	12	4	n.e.	1	10	75	70.5	79	" "
	3	5	s.e.	2	10	80	73.5	72	
	6	7	s.e.	2	10	77	74.5	88	
	9½	2	s.e.	1	5	70	68	90	cir.
24	5½	5	s.e.	1	4	68	66.5	92	"
	8½	1	s.e.	1	9	78	72	73	
	12	1	s.e.	1	10	75	72	86	fine rain.
	3	3	s.e.	2	10	78	72.5	75	
	6	1	e.	1	10	75	72	86	
	9	1	s.e.	2	2	71	69	90	
25	5½	2	s.e.	1	3	70	69	95	
	9	2	s.w.	2	0	85	76	65	
	12	2	s.e.	3	6	91	80	66	cu., soon afterwards rain for ½ [hour.
	3½	2	s.	2	3	90.5	80	61	
	6	3	s.	2	1	87	77.5	63	
	9½	1	s.	2	8	80.5	75	77	lightning n.w., in night thun- [derstorms and rain.
26	5½	7	n.w.	3	8	66	63	84	
	8	7	n.w.	4	3	69.5	62.5	65	
	12	8	n.w.	3	1	75	63	48	

JUNE—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	3	+ 7	w.	3	0	79	64	40	
	6	8	n.w.	3	1	77	64	46	
	9	4	n.	1	0	70.5	65	73	
27	6	2	n.e.	2	10	67.5	62	72	
	9	1	s.e.	2	10	74.5	67	66	about 11 high n.w. wind and [trifling rain.
	12	3	n.e.	4	10	69	65	79	
	3	11	n.e.	4	7	78	70.5	67	st.
	6	12	e.	3	7	78	72	73	"
	9	1	e.	2	10	74	71	86	
28	6	1	n.e.	2	10	70	69	95	rain from 7—8½.
	9	2	n.w.	2	10	72	70.5	92	drizzling rain at intervals.
	2	1	n.w.	2	9	76.5	74	88	
	6	5	n.w.	3	5	78	72.5	76	cu.
	9	1	n.	3	10	70	67	85	sheet lightning s.
29	6	0	n.e.	2	10	67	66	95	
	8½	1	n.e.	2	10	71	68	86	drizzling rain.
	12	1	n.e.	3	10	74	70	81	" " bet. 2 & 3 hard.
	3	1	n.e.	3	10	69.5	69.5	100	" "
	6	1	n.e.	3	10	70	70	100	" " " 7 & 8 "
	9	1	n.e.	3	10	68.5	68.5	100	" "
30	6	0	n.	3	10	68	68	100	
	9	1	n.w.	3	10	70.5	69	97	
	12	1	n.w.	4	8	77	71	73	
	3	1	n.w.	4	10	78	70	65	
	6	1	n.w.	3	8	75.5	69	71	
	9	1	n.	2	0	69	67.5	92	the comet.

JULY.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
1	5½	+ 1	n.w.	3	5	65	64	94	st.
	8	4	n.w.	3	1	73.5	66.5	67	
	12	2	n.	4	5	76.5	66	55	cu.
	3	7	n.	4	3	75	64	52	
	6½	6	n.	4	0	73	63	55	
	10	6	n.	4	0	63	57.5	69	
2	5	6	n.e.	3	0	54	49.5	71	
	8½	10	n.e.	3	1	67.5	56.5	46	st.
	12	6	e.	2	2	72	61.5	52	"
	3	5	n.e.	3	3	76	64	49	
	8	12	n.e.	2	0	68.5	61.5	65	
	10	11	n.e.	3	0	64.5	61.5	83	
3	5½	14	n.e.	3	0	62	58	77	hazy.
	8	6	e.	2	0	73.5	64	57	
	12	7	s.e.	2	0	78	66	50	
	3	5	s.e.	2	0	80	67	48	
	6	4	s.e.	2	0	78	67	54	
	10	4	s.e.	1	0	68.5	63.5	75	
4	6	8	s.e.	1	0	67.5	63.5	79	
	8½	5	s.e.	3	0	81	69	52	
	12	5	s.e.	2	0	82	70.5	54	
	3	5	s.	1	0	85	72	50	
	6	6	s.e.	1	2	82	71.5	58	
	9	2	s.	1	0	74	69	77	
5	5½	1	s.	2	9	71.5	68	83	cu.
	8½	2	s.	2	3	84	74	60	
	12	3	s.	2	5	90	78	56	nim. [der and lightning.
	3	–80	w.	3	10	85	76.5	67	begin'g of rain with some thun-
	6	+ 1	s.w.	2	10	72	71	95	slight rain.
	9	1	s.w.	1	0	70.5	70	97	
6	5½	1	s.w.	2	9	69	67.5	92	
	8½	1	s.	2	2	82.5	74.5	67	st.
	12	1	s.	2	2	87	79	69	
	3½	1	s.	2	3	90	80	63	cu.
	6	4	s.	2	0	87	77.5	63	
	9	2	s.e.	1	0	77.5	74	84	
7	5¼	1	s.e.	1	2	72	71.5	98	
	9	1	s.	1	2	86	76.5	63	
	12½	2	s.	2	5	93	80	55	cu. [and heavy rain for ½ hr.
	3	1	s.	3	10	93.5	80	53	cu. nim., bet. 5 & 6 thund'storm
	6	–50	w.	2	10	74	74	100	dist't thund'g, rain bet. 8 & 9.
	9½	+ 1	w.	2	5	74.5	74.5	100	
8	5½	1	s.	1	1	79	74.5	80	
	9	1	s.w.	2	2	91.5	80	59	st.
	12	1	s.	2	7	93	81.5	59	cu.
	3	1	s.	3	8	94	81.5	56	cu. nim.
	6	4	s.w.	3	1	90	79	60	
	9½	3	s.	2	5	81.5	77	57	dist't lightning n., thund'storm
9	6¼	6	w.	5	10	69	67	90	[and rain through the night,
	9	1	s.w.	3	9	77.5	72.5	77	[with very high wind.

JULY—Continued.

Date.	Hour	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	REMARKS.
	12	+ 2	w.	3	1	82.5	75	69	
	3	1	w.	4	7	85.5	77.5	68	cu. nim.
	6	4	w.	3	2	83.5	77.5	75	
	10½	2	w.	3	0	76	68.5	67	
10	5½	8	w.	3	0	66	63	84	
	8½	7	n.w.	4	0	72	64	62	
	12	7	n.w.	4	5	75.5	66	58	cu.
	3	10	n.w.	4	5	76	66	56	"
	6	11	n.w.	4	1	73	64	59	
	9	9	n.w.	3	0	67	61.5	71	
11	5½	5	n.w.	3	0	59.5	58.5	94	
	8	7	n.w.	3	0	71.5	63.5	62	
	12	8	n.w.	3	6	77	67	57	cu.
	3	6	w.	3	5	79.5	69	57	
	6	10	w.	3	0	77	70	69	
	9	6	w.	2	1	70	66	80	
12	5½	2	w.	3	2	67.5	63.5	77	cu., short rain bet. 7 and 8.
	8½	1	n.w.	4	0	68	65	85	
	12	13	n.w.	4	1	75.5	66	58	
	3	8	n.	4	0	75	63.5	50	
	7	9	n.	3	0	72	62.5	55	
	9	6	n.	3	0	67	61	69	
13	5½	7	n.e.	3	0	60.5	56	74	
	8½	5	n.e.	2	1	70.5	63	64	
	12	5	s.e.	3	3	76	65	52	st.
	3	5	s.e.	1	7	82	68	45	"
	6	5	s.e.	2	6	77	66	53	
	9	6	s.e.	2	5	67.5	63	77	
14	6½	4	s.e.	1	1	72	64.5	64	
	9	7	s.e.	1	6	77.5	68	59	st. cu.
	12	5	s.e.	1	9	85	72	50	" "
	3½	3	s.e.	1	8	86	71	45	" "
	6	3	s.e.	2	3	81	70	56	
	10	1	s.e.	2	9	71.5	66.5	76	rain in night.
15	6	1	s.	2	10	69	68	95	
	8½	1	s.	2	10	71	68	86	
	12	1	s.w.	3	10	85	76	65	rain between 2 and 3.
	3	1	n.w.	2	9	75	74	95	cu. nim.
	10	1	n.w.	2	1	71.5	71	98	
16	5½	2	n.w.	4	4	67.5	63	77	st.
	8½	3	n.w.	3	0	73	67	72	
	12	4	n.	3	3	76	65	52	cu.
	3	4	n.	3	3	78	65	46	"
	6	5	n.w.	3	2	77	66.5	55	"
	9	6	n.w.	2	0	71	64.5	69	moonshine, comet disappearing.
17	5½	11	n.w.	3	2	61	60	94	st.
	8½	3	n.w.	2	5	75	66	60	"
	12	4	s.e.	2	4	80	70.5	60	
	3	5	s.e.	2	6	82	72	59	st. cu.
	6	3	s.e.	2	6	80	69.5	57	" "

JULY—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
	9	+ 2	s.e.	1	5	71.5	69	88	cir. cu.
18	5¾	1	s.e.	1	10	69.5	66	83	
	8½	2	e.	1	2	79.5	71.5	66	cir. st.
	12	3	s.	3	4	87	77	62	cu.
	3	4	s.e.	2	5	90	78	56	"
	6	5	s.	2	2	86	77	65	"
	9	1	s.	1	4	79.5	76	85	"
19	5½	1	s.	1	10	76	73	86	rain shower between 8 and 9.
	9	0	s. w.	1	10	76	73	86	
	12	1	w.	3	10	82	75	71	cu.
	3	2	n.	3	5	85.5	77.5	68	cu. nim.
	6	3	n.w.	3	1	83	74	64	
	9	1	n.w.	1	3	77	73.5	84	
20	5½	4	w.	3	0	70	68.5	92	
	8	2	n.w.	2	1	77.5	71	71	
	12	5	n.	3	5	83	71.5	54	
	3	7	n.w.	3	8	80	71	56	st.
	6	5	n.w.	3	9	78	69	62	st. cu.
	9	4	n.w.	3	10	73	67.5	75	
21	6	1	n.e.	2	10	67	61.5	72	overcast.
	9	6	n.e.	2	10	68.5	62	67	"
	12	9	n.e.	2	10	68.5	63	72	" a few drops of rain.
	3	5	n.e.	2	10	65.5	63.5	89	light rain.
	6	3	n.e.	3	10	64	60.5	81	
	9	1	n.e.	2	10	62	60	88	
22	6	1	n.	4	1	64	59	73	cir.
	9	3	n.	3	6	67.5	62	72	
	12	2	n.	4	8	72.5	63.5	58	cu.
	3	4	n.	4	8	74	63	51	
	6	1	n.	4	3	71	61.5	55	st. cu.
	9	5	n.	3	0	64	58.5	71	
23	5½	10	n.	3	0	55	53	87	full moon, setting w.
	9	1	n.	4	0	67	58.5	56	
	12	4	n.	3	3	73.5	62.5	51	cu.
	3	2	n.	2	3	74	62	48	
	6	3	n.	2	0	71	63	62	
	9	5	n.	3	0	67	61	69	
24	5½	4	n.	2	0	58	56.5	91	
	9	3	n.	2	2	77	65	49	st.
	12	2	s.e.	1	2	79	66	47	"
	3	2	s.e.	2	1	82	68	45	"
	6	4	s.	1	2	78	66.5	52	"
	9	2	s.	1	0	70	63.5	68	
25	5	1	s.	1	4	63	61	88	cir. cu.
	8½	1	s.	3	6	76	67	60	" "
	12	6	s.	3	0	82.5	71	54	
	3	2	s.	3	1	86.5	73.5	51	
	6	4	s.	2	2	82	73	63	st.
	9	4	s.	1	3	74	70	81	"

JULY—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
26	5½	+ 3	s.	1	7	72	71	95	cir. st.
	9	2	s.w.	2	6	80.5	72	66	st. cu.
	12	1	s.w.	3	5	88.5	75	51	
	3	8	s.	2	9	92	78	51	cir. cu.
	6	4	s.	2	8	85	75	61	" "
	9	1	s.	1	9	78	74	82	
27	5	4	s.	1	7	72	70	90	cir. cu.
	8½	1	s.	1	9	83	75	67	" "
	1	1	s.	1	2	92	78	51	cu.
	3	4	s.	3	6	93.5	78.5	49	cir. cu.
	6	3	s.	2	2	88	77	59	st.
	10	4	s.	2	3	80	74.5	76	distant lightning s.w.
28	6	1	s. w.	2	1	77.5	73.5	82	st.
	9	1	s. w	2	2	86.5	74.5	54	st. cu.
	1	3	n.	3	3	89	76	53	" "
	3	7	n.	3	3	89.5	76.5	53	cu. s.
	4	−20	n.	3	4	89	76.5	55	cu. nim. s.e. with distant thun- [der.
	6	+ 6	n.	3	1	88	76	56	
	9	1	n.	3	0	80	72.5	68	distant lightning e. nearly all [night.
29	5½	1	n.	2	0	72.5	69	83	
	8	1	n.	2	0	88	78	62	
	12	3	s. w.	3	0	95	80.5	51	
	3	1	s. w.	3	4	98.5	81	45	cu. nim.
	6	1	s. w.	3	0	93	79.5	53	
	9	1	s. w.	2	0	85	78	72	
30	6	3	s.	1	0	80	75.5	80	
	8	1	s.w.	3	1	91.5	78.5	54	st.
	12	4	s.e.	2	3	95	81.5	54	cu.
	3	1	s.	3	1	96	79.5	46	"
	6	1	s.	1	1	91	78	53	
	9	2	s.	2	0	82.5	76	74	cu.
31	5	2	s.	1	0	75	72.5	88	
	8	3	s. w.	2	0	90	78	56	
	12	2	s. w.	3	3	94	79	49	cu.
	3½	2	s.	2	3	98	80.5	45	"
	6	1	s.w.	2	0	93.5	79	50	
	10	1	s.w.	1	0	83	76	72	

AUGUST.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
1	5½	+ 2	s.w.	1	0	77	75	91	
	9	1	s.w.	1	0	94	82	58	
	12	6	n.e.	2	5	95.5	79	46	cu.
	3	6	n.e.	3	3	96.5	79	44	"
	6	8	n.e.	1	1	94	78	46	
	9	1	n.e.	1	0	86	76	62	
2	5	1	s.w.	1	0	76.5	73	84	
	9	4	s.w.	1	0	93.5	81	56	
	12	5	n.w.	3	2	95	79	47	cu. s.
	3	9	n.	3	1	96.5	76	36	
	6	9	n.	2	1	94	76	41	
	9	6	n.	1	0	89	76.5	55	
3	5½	1	s.e.	1	0	78	75.5	88	
	8	5	n.	1	0	92	81	60	
	12	6	n.e.	1	4	96	79	45	cu.
	3	5	n.e.	1	2	98	77	36	"
	6	6	n.e.	2	1	95	77	41	
	9½	7	n.e.	1	0	93	77.5	47	
4	5	1	n.e.	1	1	77	73.5	84	before sunrise.
	8	8	n.	1	0	92.5	80.5	58	
	12	3	n.e.	2	5	99	81	44	cu.
	3	4	n.e.	3	4	99.5	79	38	"
	6	1	s.w.	1	3	94	79.5	50	
	9	1	s.	2	0	83.5	76	70	lightning s.
5	5½	1	s.	1	3	77.5	75	88	cir. cu.
	8½	1	s.	1	2	92	80	57	cu.
	11	-60	n.e.	6	10	87	78	65	gale with thunder, but no rain.
	12	-50	n.e.	5	10	79	73	74	about 1 trifling rain.
	3	+ 3	s.w.	2	8	87	78.5	67	st.
	6	5	s.	1	8	85	75.5	63	"
	10	1	s.	1	0	77.5	74.5	86	
6	5½	0	s.	1	1	74	73	95	cir.
	9	1	s.	1	2	90	78.5	57	
	12	1	s.	2	1	94	78.5	48	
	3	2	s.e.	1	2	96.5	80.5	47	nim.
	6	2	s.e.	1	1	92	80	57	
	9	3	s.e.	1	0	84.5	78.5	75	
7	5¼	2	s.	1	0	77.5	76	93	
	8½	2	s.w.	1	0	90	79	60	
	12	1	s.e.	1	3	96.5	81	49	cu.
	3	2	s.e.	2	4	99	81	44	cu. nim.
	6	5	s.	1	0	93	80	55	
	9	2	s.	1	1	86	78.5	70	
8	5	1	s.	1	0	78	76	91	before sunrise.
	8	1	s.	1	0	89.5	80	64	
	12	1	s.e.	2	8	96.5	81.5	51	cu. nim.
	12¼	-70	n.w.	3	10	92	78	51	thunderstorm with rain for ½ hr.
	3	-50	s.w.	2	10	84.5	76	67	distant thundering.
	6	+ 1	s.w.	1	10	85	79	75	
	9	1	s.w.	2	10	80	75	78	distant lightning s.

AUGUST—Continued.

Date.	Hour.	Atmos Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
9	5½	0	s.w.	2	10	73	72	95	
	9	+ 1	s.w.	1	8	80	75	78	
	12	1	n.w.	3	9	85	78	72	cu.
	3	7	n.e.	2	10	90.5	80.5	63	cu. nim.
	6	1	s.	1	10	85	78.5	73	
	9	1	s.	1	5	80.5	77	85	distant lightning.
10	5¼	1	w.	1	10	72	71	95	
	8	2	s.w.	1	5	86	78.5	70	
	12	1	s.w.	1	10	88	78	62	
	3	1	n.w.	3	10	84	77	72	
	6	1	n.w.	3	7	83	76.5	74	
	9	1	n.e.	3	10	79.5	76	85	
11	5½	1	n.e.	1	3	75	73	90	cir.
	8½	1	n.e.	1	3	83.5	77.5	75	st.
	12	1	n.e.	2	8	94	82	58	cu.
	3	1	s.e.	2	7	94	81.5	57	
	6	2	s.e.	2	8	89.5	81	68	cir. cu.
	9	1	s.e.	3	5	82	78.5	85	distant lightning in n.w., after
12	6	0	s.w.	1	10	72	72	100	[midnight severe thunder-
	8½	1	w.	3	10	74.5	72	88	[storm, with pouring rain.
	12	1	w.	3	10	75	71	81	
	3	1	n.w.	3	10	69	69	100	very fine rain.
	6	1	n.	3	10	67	64.5	87	
	9	2	n.	4	10	66	62	78	
13	5½	1	n.w.	3	3	62	59	83	
	8½	1	n.	4	5	67	61	69	cu.
	12	2	n.	3	7	72.5	64	61	"
	3	7	n.e.	2	8	73.5	69	57	cu. nim.
	6	6	n.e.	2	2	71	63	62	
	10	1	n.e.	3	0	63	58	72	
14	5½	2	n.e.	2	0	56	54.5	90	at sunrise.
	9	5	n.e.	2	1	68	62.5	72	
	12	9	n.e.	2	6	73.5	65	61	cu.
	3	6	n.e.	2	5	77	66.5	55	"
	6	8	n.e.	2	2	74	65	58	
	9	2	n.e.	2	0	66.5	63	82	
15	6	12	n.e.	1	0	61.5	59.5	88	
	8½	15	n.e.	1	0	72	64.5	64	hazy.
	12	8	n.e.	2	3	76	65	52	
	3	5	n.e.	2	9	79	68	54	st. cu.
	6	8	n.e.	1	1	75.5	66.5	60	cir.
	9	5	n.e.	1	0	69	65.5	82	moonshine.
16	5¼	1	n.e.	1	2	60.5	60	97	
	8½	6	n.e.	1	1	77	67	57	cir. st.
	12	9	n.e.	3	3	80.5	71	61	
	3	11	n.e.	2	4	83	70.5	51	cu.
	6	10	n.	1	1	81.5	70	54	
	9	6	n.	1	0	72.5	67	74	
17	6	6	n.	1	0	63.5	61.5	88	
	9	8	n.	1	0	76	66	56	

AUGUST—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
	12	+ 5	n.	3	0	82.5	68	44	
	3	7	n.e.	3	0	84	70	47	
	6	9	n.e.	2	0	82.5	70.5	53	
	9	2	n.e.	2	0	74	67	67	
18	5	1	n.e.	2	2	66	63.5	87	st., before sunrise.
	9	3	n.e.	3	2	77	69	65	st.
	12	3	n.e.	3	5	83	72	56	"
	3	4	n.e.	2	8	88.5	76.5	56	cu. nim.
	6	2	n.e.	2	10	83	75	67	" " [night.
	9	0	n.e.	1	10	78	74	82	" " afterwards rain all
19	6	–40	n.	1	10	71	71	100	fine rain.
	9	+ 1	n.e.	1	10	71	71	100	" " until 11.
	12	0	n.e.	1	10	77	74	86	" "
	3	1	n e.	1	9	80	73	51	
	6	1	n.e.	1	8	78	72	73	cu.
	10	1	n.e.	1	2	71	70.5	97	
20	5½	1	e.	1	6	67.5	66.5	95	cir.
	9	1	e.	1	9	77	73	82	cu.
	12	1	e.	1	6	83.5	75	66	"
	3	1	e.	1	8	85.5	75.5	61	"
	6	1	e.	1	2	81.5	75	73	"
	9	1	e.	1	4	77	74	86	full moon.
21	5½	2	e.	1	1	71.5	71	98	cir. st., sunrise & moon setting.
	8½	2	e.	1	3	81.5	76.5	77	cir. cu.
	12	1	s.	1	5	90	79	60	cu. [with hard rain for ½ hr.
	3	–40	s.	3	10	86	78.5	70	nim., beginning of thund'storm,
	6	+ 1	s.w.	1	7	80	76	83	[with n.w. wind and rain.
	9	0	s.w.	1	10	75	73.5	93	cu. nim., afterwards thundering
22	6	5	n.	4	10	61	61	100	drizzling rain.
	9	4	n.	4	10	65	62	84	
	12	1	n.	4	10	66	63	84	cu.
	2	1	n.	3	8	72	65	66	cu.
	6	7	n.	3	0	73	64.5	61	
	9½	1	n.	2	3	66	62	78	
23	5½	3	n.	3	0	57	55	87	
	8	4	n.	3	0	63	58	72	
	12	7	s.e.	3	0	72	60.5	48	
	3	10	n.e.	3	0	74	61	43	
	6	8	n.e.	3	0	72	61.5	52	
	9½	7	n.e.	2	0	63.5	61.5	88	
24	6	3	n.e.	1	1	58	56.5	91	
	8½	2	n.	1	0	69.5	63.5	70	
	12	5	e.	2	2	77	66.5	55	
	3	9	s.e.	2	1	79	67.5	53	
	6	4	s.e.	1	1	75	65.5	58	
	9	3	n.e.	2	2	67	63	79	
25	6½	2	s.e.	2	4	65	61	78	ci. st.
	9	3	s.e.	2	3	73.5	66	65	ci.
	12	5	s.e.	1	10	81	69	52	
	3	2	s.e.	1	10	76	68	64	

AUGUST—Continued.

Date.	Hour.	Atmos. Elect	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	6	+ 5	s.e.	2	10	72	66	72	
	9	2	e.	2	5	68.5	65.5	85	
26	5½	1	e.	2	1	63	61	88	
	8½	1	s.e.	1	0	75	68.5	71	
	12	3	s.e.	1	6	83	71.5	54	cu.
	3	3	s.e.	2	10	80	69.5	57	"
	6	5	s.e.	1	10	77	69	65	"
	9	1	s.e.	1	2	70	68	90	
27	6	3	s.e.	1	1	64	63	94	
	9	3	s.e.	1	0	74.5	69	75	
	12	4	s.e.	1	4	79	71	66	cu.
	3	7	e.	1	3	82	71	56	"
	6	5	e.	1	1	78.5	70.5	66	
	9	1	e.	2	0	71	68	86	
28	5½	3	e.	1	10	65	65	100	fog 1.
	8	1	e.	1	0	74	69	77	
	12	3	e.	1	5	82.5	73	61	cu.
	3	5	e.	1	5	83.5	73	58	"
	6	2	s.e.	1	2	78.5	72	71	
	10	2	s.e.	1	0	70.5	68.5	90	
29	5½	2	s.e.	1	1	63	62.5	97	
	8½	3	s.e.	1	2	76	68.5	66	ci.
	12	5	n.w.	3	2	81	70.5	58	cu.
	3	4	n.w.	3	3	82	71	56	"
	6	4	n.w.	3	0	79	71	66	
	9	3	n.w.	3	0	71	67	80	
30	5½	3	n.w.	2	0	60	59	94	
	9	2	s.e.	1	0	74	67	67	
	12	5	s.e.	2	0	80	67	85	
	3	7	n.e.	2	0	81.5	67	78	
	6	4	n.e.	1	0	77.5	66.5	53	
	9	4	n.e.	1	0	70	66.5	83	
31	6	1	s.	1	0	61.5	61	97	
	8½	2	s.e.	1	0	75	68	68	
	12	8	s.e.	3	0	84	71	50	
	3	9	s.e.	3	0	85.5	71	46	
	6	4	s.e.	2	0	80	70	59	
	9	1	s.e.	2	0	75	67	64	

SEPTEMBER.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
1	6½	+ 1	s.e.	2	0	70	66.5	83	
	8½	1	s.e.	2	0	79	72	67	
	12	1	s.e.	3	3	89	76	53	cu.
	4	3	s.e.	3	0	90	75.5	48	
	6	2	s.e.	3	6	84	74	60	
	9	1	s.e.	2	0	78	72.5	76	
2	6	2	s.e.	3	0	73	71	90	
	8½	1	s.	3	2	81.5	75	73	ci. st.
	12	1	s.e.	3	7	92.5	81	59	st. cu.
	3	0	s.	3	9	94.5	79.5	49	cu.
	6	3	s.	3	2	86	76	62	st.
	9½	−12	n.	4	10	66	64	89	thund'storm, beginning of rain.
3	6	+ 3	n.e.	3	10	70	68.5	92	
	9	5	n.e.	2	10	76	71	77	
	12	12	n.	3	10	79	71	66	short rainshower bet. 1 and 2.
	3	1	n.	3	10	77	73	82	
	6	1	n.e.	3	10	75	71.5	84	
	10½	1	n.	3	5	71	66	76	
4	6	4	n.e.	2	3	66	62	78	ci. st.
	9	2	n.e.	3	4	75	67	64	st.
	12	7	n.e.	3	9	78	69	62	st. ci.
	3	6	n.e.	3	10	76	68.5	66	overcast.
	6	4	n.e.	3	10	70.5	65.5	76	"
	9½	1	n.e.	3	6	68.5	63.5	75	
5	5½	2	n.e.	2	2	61	60	94	
	9	6	n.e.	1	0	73	68	77	
	12	1	s.e.	2	3	81.5	73	65	hazy.
	3	1	s.	2	5	85	74.5	59	cu.
	6	3	s.w.	2	2	80.5	72	64	"
	9	1	s.w.	1	1	74	70.5	83	distant lightning n.
6	6	4	n.w.	3	0	62	60	88	
	9	2	n.w.	3	0	68.5	63.5	75	
	12	7	n.w.	3	0	76	65.5	54	
	3	4	w.	4	4	78	65	46	st. cu.
	6	8	w.	3	1	75	65	56	
	9	3	n.w.	2	4	69	65	79	
7	5	2	n.	3	0	58	55	82	
	9	6	n.	3	0	65	60	73	
	12	4	n.w.	3	2	71	61	54	st.
	3	4	n.	3	3	73.5	62	49	"
	6	8	n.	3	6	69	61.5	63	"
	9	3	n.	3	2	65	59.5	71	
8	6	3	n.	3	2	55	54.5	97	ci.
	9	3	n.e.	2	0	63	59.5	81	
	1	5	n.w.	3	0	75.5	65	54	
	3	2	n.	3	0	78	65.5	48	
	6½	1	n.	3	0	72	64 5	64	
	10	1	n.	3	0	66	62	78	
9	6	2	n.e.	3	1	60	58.5	91	st.
	9	3	e.	2	1	69	63.5	72	"

SEPTEMBER—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Remarks.
	12	+ 5	e.	2	2	81	70	62	st.
	3	2	s.e.	2	0	83.5	70.5	50	
	6	1	s.e.	2	3	78	68	58	st.
	9	2	s.e.	2	2	71	66	76	
10	5	1	s.e.	3	10	68.5	66	88	ci. cu.
	8½	1	s.	2	2	75	72	86	ci. st.
	12	1	s.w.	4	9	90	78	56	cu.
	3	1	s.w.	4	10	85	76.5	67	"
	6	2	s.w.	3	9	79	73.5	76	after 7 fine rain. [rain in night.
	9	0	s.w.	3	10	71	70.5	97	fine rain, dist't lightn'g s., more
11	6	0	s.w.	2	10	71	70.5	97	afterwards rain.
	9	0	n.	3	10	65	65	100	rain.
	12	1	n.w.	3	10	71	67.5	83	
	3	1	n.w.	4	10	72	66.5	74	
	6	1	n.w.	3	10	69	65	79	
	10	1	n.w.	3	10	65	61.5	81	
12	6	2	n.w.	2	8	63	61.5	91	ci. cu.
	8½	1	n.w.	2	5	68	63.5	77	" "
	12	7	w.	1	5	76	68	64	cu.
	3	5	s.e.	2	7	76.5	68.5	65	"
	7	7	s.e.	1	6	67.5	65	87	
	9	1	s.e.	1	5	64	63	94	
13	6	1	s.e.	2	3	61	60.5	97	ci. st.
	9	1	s.e.	3	10	70	66.5	83	
	12	0	s.e.	3	10	69	68	95	rain.
	3	1	s.e.	2	10	69	69	100	"
	6	1	s.e.	3	10	70	69.5	97	
	9	1	s.e.	3	10	71	70.5	97	
14	6	1	s.e.	3	10	72	72	100	[11 and 12.
	8½	1	s.w.	3	8	80	75	78	cu., thunderstorm and rain bet.
	12	0	n.w.	2	6	74.5	74	98	
	3	1	s.e.	2	3	85	79.5	78	cu.
	6	2	s.e.	2	2	81	78	87	[night.
	9	2	s.e.	4	10	77.5	73	80	cu. nim., afterwards rain all
15	6	1	s.w.	2	10	67	67	100	
	9	1	n.w.	2	1	78.5	70	64	
	12	1	s.w.	1	1	82.5	74	65	
	3	1	s.	1	5	86.5	76	60	st. cu.
	6	7	s.w.	1	8	80.5	73.5	70	" " thunderstorm and rain
	11½	0	s.w.	1	9	69.5	69.5	100	[bet. 7 and 10.
16	6	0	n.w.	3	10	68	68	100	heavy rain between 6 and 7.
	8	1	e.	1	10	71	71	100	
	12	1	s.w.	3	10	80	74.5	76	cu.
	3	2	w.	3	5	79.5	71	64	"
	6	1	s.w.	3	6	72	68.5	83	st.
	10	1	w.	2	1	66	65	94	
17	6	1	w.	3	10	62	61	94	
	8½	1	w.	3	10	66	63.5	87	
	12	2	w.	2	10	72.5	67.5	77	
	3	2	n.e.	2	2	72	66	72	

SEPTEMBER—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
	6	+ 1	e.	2	0	69	66	85	
	9	1	e.	2	0	64	63	94	fullmoon.
18	6	1	s.e.	3	1	62	61	94	st.
	9	1	s.e.	3	2	73	70	85	
	12	1	s.e.	3	3	83	76	72	cu.
	3	2	s.e.	3	4	85	77.5	70	"
	6	5	s.e.	3	0	79	75	82	
	9	2	s.e.	2	0	75	73.5	93	moonshine.
19	6	1	s.e.	2	0	70.5	70	97	
	9	1	s.e.	2	0	80	75	78	
	12	1	s.	3	1	87	77.5	63	
	3	3	s.	3	3	89	78	59	cu.
	6	2	s.	2	0	81.5	76.5	79	
	9	1	s.	1	0	76.5	73.5	86	
20	6	1	s.	1	8	72	71.5	98	cu. nim.
	9	2	s.w.	3	7	80	76	83	ci. cu.
	12	1	s.w.	4	10	86	77.5	67	cu. nim.
	3	1	w.	4	10	68	65	85	" " a few drops of rain.
	6	1	n.w.	4	10	64	59.5	75	overcast.
	9	1	n.w.	3	10	62	58.5	80	"
21	6	1	n.w.	3	10	59	57	88	cu.
	8½	7	n.w.	4	10	60	56	76	"
	12	5	n.w.	4	10	63	58	72	"
	3	6	n.w.	4	5	64	57.5	65	
	6	10	n.w.	3	0	62	57	72	
	9	3	n.w.	3	0	55	53.5	90	
22	6	1	n.w.	1	0	49.5	49	96	
	9	2	n.w.	2	0	63	59	77	
	12	5	w.	2	0	70	62	61	
	3	4	s.w.	2	0	73	64	59	
	6	5	s.w.	1	0	67	61.5	71	
	9	1	s.w.	1	0	61	58.5	85	
23	6	5	s.w.	2	0	55.5	55	97	moonshine and sunrise.
	8½	6	s.w.	1	0	64	60	77	
	12	7	n.e.	1	0	75.5	63.5	49	
	3	12	n.e.	2	0	77	66	53	
	6	18	n.e.	1	0	72	63	58	hazy.
	9	5	n.e.	1	0	63.5	61	86	
24	6	1	s.e.	1	0	57	56	94	
	8	1	s.e.	1	0	62	58.5	80	
	12	4	s.	2	5	80	70	59	st.
	3	7	s.e.	2	7	79	70	62	"
	6	3	s.e.	1	10	71.5	65.5	71	
	9	2	s.e.	2	8	66	62.5	82	
25	6	1	s.e.	2	5	60	59	94	ci. st.
	9	1	s.e.	3	8	71	66	76	ci. cu.
	12	1	s.	4	7	78	69.5	63	
	3	2	w.	3	10	65	64	94	beginning of drizzling rain.
	6	1	s.w.	3	10	64	64	100	drizzling rain.
	9	0	s.w.	3	10	58	58	100	rain until midnight.

SEPTEMBER—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
26	6	+ 3	w.	3	0	50	49.5	96	
	9	6	w.	3	0	54	50	74	
	12	8	w.	4	7	57	52	69	cu.
	3	3	w.	4	10	52	49	79	cu. nim.
	6	2	w.	2	2	50.5	48	82	
	9	5	w.	3	0	46	45	92	
27	6	1	n.w.	3	10	45	42	92	overcast.
	9	3	w.	4	10	47.5	45.5	85	"
	12	1	n.w.	4	10	49	46.5	81	"
	3	2	w.	4	10	51.5	48.5	79	"
	6	6	n.w.	3	10	49.5	47.5	85	"
	9	1	n.w.	3	10	49	46.5	82	
28	6	10	n.w.	3	0	41.5	41.5	100	
	9	15	w.	3	0	48.5	43.5	63	
	12	7	w.	4	5	56	50	63	cu.
	3	7	s.w.	3	4	59	52	59	"
	6	14	s.w.	2	0	55	50	68	
	10	5	s.w.	2	0	48.5	46.5	85	
29	6	3	s.e.	2	9	48	47	92	cu.
	9	2	s.e.	2	7	54	51	80	"
	12	11	s.e.	3	10	65	58	63	"
	3	12	s.e.	2	10	65	57	58	ci. st.
	6	6	s.e.	2	10	59	55	76	
	9	2	s.e.	2	7	54	52	87	
30	6	3	e.	2	10	50	49	93	
	8½	3	s.e.	3	10	54	51.5	84	
	12½	8	s.e.	3	1	68	60.5	63	
	3	3	s.e.	3	7	71	62	57	st.
	6	2	s.e.	3	2	64	58.5	70	
	9	1	s.e.	2	5	57.5	55.5	88	

OCTOBER.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	REMARKS.
1	6	+ 3	s.e.	3	3	52	51.5	96	ci.
	8½	3	s.e.	2	2	61	59	88	ci. st.
	12	1	s.e.	4	6	75.5	67	62	ci. cu.
	3	1	s.e.	4	4	75	66.5	62	cu. st.
	6	2	s.e.	3	10	69	64	75	
	9	2	s.e.	2	8	66	63	84	rain in night.
2	6	1	s.e.	2	10	62	62	100	
	8½	0	s.e.	1	10	65	65	100	drizzling rain until 10.
	12	1	s.	2	10	71	69	90	
	3	1	s.	2	6	74	70	81	
	6	0	s.	1	10	71	69	90	
	9	1	s.	1	6	66	66	100	
3	6	1	s.e.	2	7	66	66	100	
	8½	1	s.	2	10	72	70.5	92	
	12	1	s.	3	5	80	74	74	cu.
	3	1	s.	2	9	81	74	70	"
	6	1	s.e.	3	9	75	72	86	"
	9	1	s.e.	3	0	70.5	69.5	95	
4	6	1	s.e.	2	2	67	67	100	st.
	8½	1	s.e.	2	7	75	72	86	st. cu.
	12	0	s.	3	5	82	75	71	" "
	3	0	s.e.	3	3	81	74	70	" "
	6	0	n.w.	3	10	69	69	100	rainshower.
	9	1	s.w.	1	5	70	70	100	heavy rain after midnight.
5	6	0	s.w.	2	10	65	65	100	rain.
	8½	1	s.w.	2	10	66	66	100	fine rain nearly all morning.
	12	1	w.	2	8	69	68	95	[and negative electricity.
	3	1	n.w.	3	10	63	61.5	92	afterwards rain with thunder'g
	6	1	n.w.	3	10	57	57	100	rain.
	9	2	n.w.	3	10	56.5	56	97	
6	6	1	n.w.	2	2	52	51	93	
	9	7	n.w.	2	1	56	52	75	
	12	11	n.w.	3	3	62	55.5	64	cu.
	3	6	n.w.	3	2	64	56	57	
	6	9	n.w.	2	0	59	55	76	
	9	4	n.w.	2	0	55	54	94	
7	6	6	s.e.	2	2	51.5	51	96	
	8½	5	s.e.	3	5	58	56	88	cu.
	12	5	s.	3	1	68	60.5	63	
	3	10	s.w.	2	4	79	61	30	cu.
	6	15	s.	2	0	63	59	77	
	10	7	s.	1	0	57	56	94	
8	6	12	s.	1	0	51	51	100	
	8½	12	s.	1	0	59.5	58.5	94	
	12	8	s.	3	0	71	62.5	59	
	3	7	s.e.	3	0	71	62	57	
	6	5	s.e.	3	0	63.5	59	75	
	9	4	s.e.	2	0	58.5	56	85	
9	6	12	s.e.	3	2	51	50.5	96	st.
	9	8	s.e.	3	3	59	55.5	79	"

OCTOBER—Continued.

Date.	Hour.	Atmos. Elect	Wind.		Sky.	Ther. Far.		Rel. Hum.	Remarks.
			Direc.	Force.		Dry Bulb.	Wet Bulb.		
	12	+13	s.e.	3	4	68	61	65	st.
	3	10	s.e.	3	8	70.5	63	64	"
	6	4	s.e.	3	10	67.5	60.5	62	st. cu.
	9	3	s.e.	2	4	59	56	82	
10	6	3	s.e.	2	1	53.5	53	96	
	8½	6	s.e.	2	4	61	59	88	ci. st.
	12	2	s.	2	10	73	66	67	cu.
	3	0	w.	3	10	61	61	100	fine rain.
	6	0	w.	4	10	49	49	100	rain.
	9	0	w.	3	10	47	47	100	rain till midnight.
11	6	7	s.w.	3	0	39.5	39	95	
	9	15	s.w.	3	2	50	47	78	st.
	12	10	s.w.	3	0	55.5	49.5	63	
	3	12	s.w.	3	1	59	52	59	st.
	6	13	s.	2	0	53.5	49.5	73	
	9	3	s.	3	3	50.5	48	82	ci. cu.
12	6	6	s.w.	3	0	46.5	45.5	92	
	8½	33	w.	3	0	54	51	80	
	12	8	w.	4	0	64	55.5	55	
	3	4	w.	3	0	68	57.5	49	
	6	17	w.	3	0	60	55	71	
	9	7	w.	2	0	52.5	49.5	79	
13	6	10	s.w.	2	0	44	44	100	
	9	16	s.w.	2	0	56	53.5	81	
	12½	7	s.	2	0	71.5	62.5	58	
	3	6	s.	1	0	74	64	56	
	6	7	s	1	0	66	61	73	
	9	1	s.	1	0	60	57.5	85	
14	6	14	s.	1	0	52	51.5	96	
	9	14	s.	1	0	63	59	77	
	12	6	s.w.	2	0	76.5	66	55	
	3	9	s.w.	2	0	81	71	59	
	6	10	s.w.	2	7	70	63	66	
	9	5	s.w.	1	2	62	60	88	
15	6	7	s.	2	10	57	56.5	97	fog 1.
	9	11	s.	1	10	65	61.5	81	
	12	1	s.	1	10	70.5	65.5	75	
	3	4	s.	1	10	71.5	66.5	76	
	6	0	s.w.	1	10	67	65	89	a few drops of rain.
	9	6	e.	2	10	64.5	63	92	rain in night.
16	6	−15	e.	2	10	59.5	59.5	100	fine rain.
	9	0	e.	2	10	63	61.5	92	
	12	0	s.e.	2	10	68	65.5	87	
	3	0	s.e.	1	10	67	63	79	
	6	+ 1	s.e.	2	10	61.5	60	91	
	9	0	s.e.	1	10	59.5	59	97	
17	6	1	s.e.	2	10	56	56	100	
	9	2	n.e.	1	10	61	59	88	
	12½	3	n.w.	3	8	67	61	69	
	3½	0	n.e.	2	10	66	61.5	76	a few drops of rain.

OCTOBER—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	Barom-eter.	REMARKS.
	6	+ 3	n.w.	2	10	62.5	59.5	83		
	9	1	n.w.	3	10	62	58	77		high wind all night.
18	6	0	n.	5	10	56	54	87	29.400	
	9	0	n.	4	10	54.5	54	97		
	12	0	n.w.	4	10	56.5	54.5	87		
	3	1	n.	4	10	56.5	54	84		
	6	1	n.	4	10	55.5	54	90		
	9	1	n.	3	10	54	53	93		
19	6½	1	n.w.	3	10	50.5	49.5	93		
	9	4	n.w.	4	0	54	51	80	570	
	12	3	n.w.	4	2	63	57	67		
	3	7	n.w.	4	0	65	54	43		
	6	17	n.w.	3	0	58.5	51.5	58		
	9	11	n.w.	3	0	52.5	48	70	660	full moon.
20	6	8	n.w.	2	0	43	41	83		
	9	12	n.	2	0	50.5	46	68	735	
	12	8	n.e.	3	0	61	51	45		
	3	3	n.e.	3	0	63	54	52		
	6	12	n.e.	2	0	56.5	51	66		
	9	10	n.e.	2	0	50	48	85		
21	6	11	e.	1	0	43	42	92		
	9	13	e.	1	0	50	47	78		
	12	15	e.	1	0	62	54	56		
	3	7	e.	1	0	65	57.5	60		
	6	16	e.	1	0	60	55	71		
	10	6	e.	2	0	52.5	51.5	93		
22	6	9	w.	3	0	47	46	92		
	9	8	w.	3	10	50	47	78		rain between 11 and 12.
	12	1	w.	3	10	44	44	100		
	3	4	w.	3	10	47.5	44	74		
	6	12	w.	4	10	47	42.5	66		
	9	2	w.	4	10	42	38.5	71		
23	6	5	w.	2	0	34	34	100		
	9	14	w.	3	0	43	40	75	750	
	12	20	w.	3	0	53	46	54		
	3	7	w.	4	1	57	48	46		
	6	6	w.	3	0	50	44	58		
	9	12	w.	2	0	44.5	40.5	68		
24	6	17	s.w.	2	10	32	31.5	95	830	afterwards fog 2.
	8	32	s.	1	10	36.5	36.5	100		fog 3.
	12	12	s.e.	2	1	55	47	50		
	3	5	s.e.	3	2	57	49	52		
	6	6	s.e.	2	2	51	45	59		
	9	6	s.e.	1	0	46	42	69		
25	6	6	s.e.	3	3	41	39	82		
	8½	14	s.e.	3	7	48.5	44	67		drizzling rain about 11.
	12½	12	s.	2	10	60	53	60		
	3	1	s.	2	9	56	52	75	770	drizzling rain.
	6	7	s.	1	10	55	51	74		fog 2.
	9	27	s.	1	7	51.5	49.5	86		fog 1.

OCTOBER—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	Barom-eter.	REMARKS.
26	6	+15	w.	2	10	46.5	45.5	92		fog 1.
	9	1	n.	3	0	51	46.5	68	29.860	
	12	8	n.w.	3	0	61	52	50		
	3	7	n.w.	4	0	63	52	42		
	6	20	n.w.	1	0	56.5	49	54		fog 1.
	9½	20	n.w.	2	0	50	44	58		
27	6½	10	s.e.	1	0	37	36.5	95		hazy, sun just rising.
	9	23	s.e.	1	0	47	47	100		
	12½	19	e.	1	0	56	47.5	49		
	2	23	e.	2	0	58	49	47	900	
	6	7	e.	1	0	51	45	59		
	9	6	s.e.	2	0	46	42	69		
28	6	14	s.e.	1	0	36	35.5	95		
	9	15	s.e.	2	0	46	42	69	715	
	12	13	s.	2	0	61	51.5	47		
	3	12	s.e.	3	0	63	53	47	535	
	6	10	s.e.	3	0	56.5	49	54		
	9	11	s.e.	2	0	51.5	46.5	66		
29	6	13	w.	3	0	51.5	45	56		
	9	22	w.	4	0	53	46	54	410	
	12	−60	s.w.	5	1	55	47.5	52		ci. cu.
	3	−45	s.w.	4	5	56.5	47	43	375	cu. nim.
	6	0	s.w.	4	0	50	44	58		
	9	−25	s.w.	4	10	51	44.5	55		very high wind through [the night.
30	6½	+ 2	w.	4	0	41	37.5	70		
	9	1	w.	5	0	43	38	59		
	12	1	w.	4	2	48	42	56		
	3	0	w.	3	0	52.5	47.5	67		
	6	9	w.	2	3	49	43.5	60		fog 1.
	9	6	w.	2	0	42	39	74		
31	6½	20	n.w.	2	10	37.5	36	86		fog 2.
	9½	17	n.w.	2	10	41.5	39.5	83	685	overcast.
	12	27	n.w.	2	10	43.5	40.5	76		"
	3	16	n.	3	10	43.5	40	71		"
	6	14	n.	3	10	42.5	40	79		"
	9	13	n.w.	3	10	42	40	83		"

NOVEMBER.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Barometer.	REMARKS.
1	6	+12	n.w.	2	10	41	39	82		overcast, fog 1.
	8½	8	n.	3	10	43	40	83		"
	12	2	n.	4	10	47	42.5	66		"
	3	2	n.	4	10	48	43	63		"
	6	3	n.w.	3	10	46	42.5	72	29.580	"
	9	3	n.w.	4	10	44	40.5	71		"
2	6	5	n.w.	3	10	43	40.5	79		"
	9	2	n.w.	3	10	45.5	42.5	76		"
	12	8	n.w.	1	5	52.5	49	76	465	cu.
	3	8	n.w.	2	10	54	48	61		"
	6	12	n.w.	3	10	51	46.5	69		" fog 1.
	9½	7	n.w.	2	10	48	45	78		
3	6½	5	n.w.	2	10	44	42.5	88		trifling rain at 7.
	9	18	n.w.	3	10	43	43	100		
	12	7	w.	3	10	50.5	45	62		cu.
	3	7	w.	3	0	53.5	45.5	48	510	
	6	8	w.	2	0	47	43	70		
	9	4	w.	2	5	42.5	41	87		
4	6	2	s.	2	10	36	35.5	95		fog 1, white frost.
	9	12	s.	2	0	45.5	42	72		
	12	16	s.	1	8	61	51.5	48		st.
	3	5	s.w.	2	2	64	52.5	40	400	"
	6	7	s.w.	2	4	58.5	46.5	66		
5	6	20	s.	1	10	42	41	91		fog 1.
	9	5	s.	2	9	49	46	78		st. cu.
	12	6	s.	2	0	63	53	47	370	
	3	–45	s.w.	4	0	71.5	56	31	200	
	6	+20	w.	3	3	67	56	46		
	10½	10	w.	3	3	66.5	53.5	36	280	
6	6	17	n.w.	3	0	53	46.5	58	535	
	9	8	w.	4	0	55	47.5	52		
	12	0	n.w.	4	4	60	50	44	600	st. cu.
	3	6	w.	4	0	61.5	53	53		
	6	15	w.	3	0	57	52	69		
	9	9	s.e.	1	10	51	47.5	76		
7	6	9	s.e.	2	10	44	41	76		
	9	10	s.e.	2	3	52.5	47.5	66		st.
	12	12	s.e.	3	1	64.5	60	75	515	"
	3	15	s.e.	3	5	67.5	56.5	47		"
	6	10	s.e.	2	0	61	57.5	80	450	
	9	12	e.	1	0	57	56	94		
8	6	15	w.	2	10	48	47.5	96		
	9	10	w.	2	0	51.5	50	89	480	hazy.
	12	7	n.w.	3	0	59.5	50	46		"
	3	5	n.	4	10	60	51	47		
	6	7	n.	4	8	55	48.5	59		
	9½	8	n.	4	3	49	44.5	67		
9	6½	20	n.w.	3	5	42	39.5	79		
	9	23	n.	3	2	45	41.5	72	580	st. ci.
	12	25	n.	2	7	53	45	48		" "

NOVEMBER—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	Barometer.	REMARKS.
	3	+ 9	n.	1	8	58	47.5	39	29.505	ei. cu.
	6	22	s.e.	2	0	50	43	51		
	9	8	s.e.	2	5	45.5	41	65	465	
10	6½	10	s.e.	2	10	47	46.5	96	330	
	9	3	s.	2	10	54	52.5	90		
	12½	8	s.	3	10	68	60.5	63		
	3	2	s.	2	10	66	59	63	225	
	7	1	s.	1	10	60	56.5	79		
	9½	0	s.	1	10	60	54	65	310	
11	6½	27	n.w.	3	2	42.5	40	79	660	
	8½	18	n.w.	3	3	44	41	76		
	12	17	n.	2	3	50	42.5	49	760	st.
	3	28	n.e.	3	2	54	45	43		"
	6	7	n.e.	2	10	50.5	43.5	51		
	9	5	n.e.	2	10	51	44	52		
12	6½	12	s.e.	2	10	54.5	49.5	68		cu.
	8½	17	s.	2	3	59	54	70		
	12	15	s.	3	0	72.5	63	56	680	
	3	10	s.	3	2	76.5	65	51		st.
	6	3	s.	1	0	68	60.5	62		
	9	1	s.	1	0	64	59	73		moonshine.
13	6	13	s.	1	2	59	56.5	85		
	9	7	s.	1	1	63	59	77		
	12	8	n.w.	2	1	71.5	64	64		
	3	16	n.	3	7	69	60.5	59		cu. st.
	6	3	n.	2	10	63	56	62		
	9	3	n.	2	10	57	51	63		a few drops of rain bet. 11 & 12, some lightn'g and distant thunder.
14	6½	14	n.e.	2	10	49	47.5	89	590	
	9	18	n.e.	1	5	51	49	86		afterwards fog 1.
	12	20	w.	3	10	63	58.5	75	490	hazy.
	3	8	w.	3	10	64.5	57	60		"
	6	10	w.	2	10	58	53	70		
	9	6	w.	2	0	52	49	79		moonshine.
15	6	22	w.	2	0	37	36	90		
	9	24	w.	3	0	43	38.5	63	640	
	12	12	n.w.	4	0	51	42.5	42		
	3	9	n.w.	4	0	53	42	30		
	6	15	n.w.	3	0	48	39	36		
	9	10	n.	3	0	42	36	50		
16	6½	17	n.	2	0	30.5	29.5	94		
	9	14	n.e.	2	0	35	32.5	75	840	
	12	11	n.e.	3	1	46	40	54		
	3	19	e.	2	4	48	41	49		st.
	6	15	n.e.	2	0	41.5	36	53		moonshine.
	9	3	e.	2	10	41	36	57	750	heavy rain in night.
17	6½	7	s.e.	1	10	38	37	91		
	9	3	s.e.	1	10	40	38.5	86		
	12½	6	s.e.	1	10	45	42.5	89		

NOVEMBER—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	Barometer.	REMARKS.
	3	+ 4	s.e.	1	10	44.5	42	80		
	6	1	s.e.	1	10	41.5	40	87		
	9	1	s.e.	1	10	38.5	38	95		
18	6½	5	s.e.	1	10	34.5	34.5	100		fog 2.
	8½	7	s.e.	1	10	36	34.5	85		"
	12½	5	e.	1	10	47	43.5	74		
	3	19	e.	3	10	49.5	45	68		sunshine at the time.
	6	7	e.	2	10	43.5	40.5	75		
	10	4	e.	1	10	41.5	38	70		moonshine.
19	6½	2	s.e.	3	10	44	40	68	29.500	
	9	10	s.e.	4	10	47	43	70		
	12	1	s.e.	3	10	54	50	74		sprinkling rain since 11.
	3	–20	s.e.	4	10	59.5	56.5	82	205	sudd'n shower with thun.
	6	+ 1	s.	1	10	58	58	100		[& lightning, afterw'ds
	9	4	s.w.	4	0	56	56	100		[heavy rain until 7.
20	6	4	s.w.	3	0	44	41	76	410	moonshine.
	9	8	s.w.	4	0	46	41	62		
	12	7	s.w.	3	0	52	45.5	56		
	3	6	s.w.	3	0	53	45	48	520	
	6	16	s.w.	2	0	46	41	62		
	9	14	s.w.	2	0	40	37.5	78		
21	6½	6	s.e.	1	0	33	31	80		moonshine, white frost.
	9	9	s.e.	3	0	42	38	66	640	
	12	12	s.e.	3	3	55	46.5	47		st.
	3	4	s.e.	3	6	58.5	48.5	43	540	"
	6	1	s.e.	3	8	55	47	50		
	9	3	s.e.	2	5	51	45	59		rain in night.
22	6	1	w.	2	10	50	50	100	375	fine rain.
	9	0	w.	4	8	37	34	71		
	12	2	w.	5	3	38	33.5	58		cu.
	3	0	w.	4	10	35	32	70	460	overcast.
	6	4	s.w.	3	0	35	32	70		
	9	4	s.w.	4	0	36	34 5	85		
23	6	7	w.	4	0	30	28	78		moonshine.
	8½	14	w.	4	0	31.5	27	53		afterwards high wind.
	12	10	s.w.	4	0	36	30	45	400	
	6	1	s.w.	4	10	35.5	30	49		
	9	0	w.	4	0	33	29	60		high wind all night.
24	6	0	w.	4	10	26	25	87		
	9	1	w.	4	10	29.5	26	61	360	
	12	4	w.	4	10	31	28.5	74		
	3	5	w.	4	10	32	30	79		
	6	7	w.	4	10	31.5	30	84	410	
	9	4	w.	3	10	31	29	78		
25	6½	17	s.w.	2	10	31.5	30.5	89	490	
	9	20	s.w.	3	10	33.5	31	75		afterwards fog 2.
	12	6	w.	3	10	34.5	31.5	71		
	3	8	s.w.	2	3	35.5	32	65		
	6	20	s.w.	2	0	33	31.5	84		fog 1.
	9	21	s.w.	2	0	29	28	88		

NOVEMBER—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	Barometer.	REMARKS.
26	6	+14	s.e.	2	10	29	28	88		
	9	15	s.e.	3	5	32	30	79		st. ci.
	12	7	s.e.	3	10	42	37	58		
	3	5	s.e.	4	10	43	38	59	29.465	
	6	4	s.e.	3	10	42	38	66		
	9½	5	s.e.	2	10	42	38.5	71		
27	6½	14	w.	4	0	26.5	24	69		
	12	15	w.	4	0	30	25	45		
	3	15	s.w.	3	2	35.5	30	49	640	st.
	6	42	w.	2	0	33	28	50		fog 2.
	9	17	w.	2	5	31	27.5	62		
28	6½	2	s.e.	2	10	33.5	31	75	440	
	9	3	s.e.	3	10	34	32	79		
	12	12	s.e.	2	10	39	37.5	86	300	
	3	6	s.e.	2	8	46	43.5	81	200	
	6	27	s.e.	2	8	45	45	100		fog 1.
	9	2	s.e.	1	10	40	40	100		fog 2.
29	6	10	n.w.	3	10	31	29	78	490	
	9	3	n.w.	3	10	30.5	27.5	67		overcast.
	12	21	n.w.	3	10	30	27	67		"
	3	20	n.w.	3	10	27	24.5	70		"
	6	14	n.w.	3	10	26.5	24.5	75	575	
	9	17	n.w.	3	0	24.5	23	80		
30	6½	23	s.w.	2	0	20.5	20	92		
	9	30	s.	3	2	25	23.5	80		
	12	28	s.e.	3	7	37.5	32	49		ci. cu.
	3	17	s.e.	3	5	39.5	34	51	500	ci. st.
	6	18	s.e.	3	5	34.5	31.5	71		
	9	16	s.e.	2	10	34.5	32	74	465	

DECEMBER.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Barometer.	REMARKS.
1	7	+ 5	n.w.	3	10	37	33.5	66	29.460	
	9	8	n.w.	3	8	29	27	77		
	12	13	n.w.	4	5	29.5	26.5	67		
	3	23	n.	4	5	27.5	23	47		ci. st.
	6	22	n.w.	3	10	25	22.5	67	650	
	9	9	n.w.	3	10	24	21	60		heavy snow in night, the
2	6½	22	n.	2	10	16.5	16	91	665	[first this winter.
	9	19	n.	3	10	17	16	83		
	12	20	n.	2	2	20	18	70	710	
	3	26	n.	3	0	21	18	56		
	6	36	n.	3	0	18	16.5	76		fog 1.
	9½	34	n.	3	0	12.5	12	90		
3	6½	15	e.	3	10	14.5	14	91		
	9	34	s.e.	3	10	16.5	15.5	83		snowing from 9 to 10.
	12	19	s.e.	3	10	23	19	46		
	3	17	s.e.	3	0	25	23	74		
	6	14	n.w.	3	0	22.5	21	79	685	
	9	32	s.e.	3	0	20	19	85		
4	6½	17	s.e.	3	10	23.5	23	93		
	9	37	s.e.	3	0	29	27	77	610	
	12	22	s.	2	0	43.5	38.5	59	550	
	3	17	s.e.	3	0	47	41	55		
	6	21	s.e.	2	0	41.5	38	70		
	9	9	s.e.	2	0	40	36.5	69		
5	6½	8	e.	2	0	40.5	38	78		
	9	16	s.e.	3	0	47	44	77		
	12	5	s.e.	3	3	59	55	76	410	
	3	1	s.	3	10	59	55.5	79		
	6	1	s.e.	2	10	57	55	87		
	9	1	s.e.	2	0	53	51.5	90	690	
6	6½	6	s.e.	2	0	51	50	93		
	9	3	s.e.	3	3	56.5	54	84	840	cu.
	12	1	s.	3	3	62.5	58.5	77		"
	3	1	s.	3	10	61	58	83		
	6	0	s.	3	10	60	58	88	790	
	9	0	s.	3	10	58.5	56.5	88		
7	7	8	s.	2	10	56.5	56.5	100	685	very fine rain.
	9	10	s.	2	10	58	58	100		rain till 10.
	12	0	s.e.	3	10	59	58	94	580	
	3	0	s.	3	10	61.5	60	91		
	6	0	s.	2	10	59	58.5	97		
	9	1	s.	3	0	53.5	53	96	620	
8	6½	1	s.	2	5	51	51	100		
	9	2	s.w.	2	1	53	53	100		
	12	1	s.	2	5	63.5	60	81		cu.
	3	1	s.	2	7	65	60	73	580	st.
	6	1	s.	2	2	61	59	88		
	9	1	s.	2	3	56	55.5	97		
9	7	1	s.e.	2	9	55	55	100	510	fog 1.
	9	1	s.e.	2	1	60	59.5	97		

DECEMBER—Continued.

Date.	Hour.	Atmos Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	Barometer.	REMARKS.
	12	+ 1	s.	3	4	71	66	76	29.440	cu.
	3½	1	s.w.	3	0	73.5	65.5	63		
	6	4	s.	1	0	67	63	79		
	9	1	s.	1	0	64	62	89		
10	6	0	s.	1	0	59	59	100		
	9	1	s.	3	0	64	61.5	86		
	12	1	s.w.	3	10	71	64	66		cu.
	3	8	n.w.	4	10	58	51.5	61	520	"
	6	10	n.	4	0	56.5	47	43	680	
	9	8	n.	4	0	37	31	47	735	
11	7	30	n.w.	2	0	25	22	61	30.080	
	9	15	n.e.	3	3	26.5	23	57		
	12	18	n.e.	2	0	31	26.5	52	135	
	3	14	w.	3	0	36	30	45		
	6	30	w.	2	0	34.5	29	48		fog 1.
	9	33	e.	2	0	29	27	77		
12	6½	8	s.e.	1	0	24	23	86	110	white frost.
	9	27	s.e.	2	0	29	26	66		
	12	22	s.e.	3	0	37	31.5	50		
	3	21	s.e.	3	0	40.5	33	36	040	
	6	20	s.e.	2	0	36.5	33	66		
	9	20	s.e.	1	2	32	30	79		
13	6½	22	s.e.	2	0	29	28	88		
	9	32	s.e.	2	0	34	31	71		
	12	30	s.	1	0	43	41	83	29.970	
	3	37	s.e.	3	4	50	42.5	48		st.
	6	18	s.e.	2	2	43.5	39.5	68		
	9	15	s.e.	1	2	41	37.5	69	910	
14	7	5	s.e.	2	10	36	35	90	880	fog 1.
	9	20	s.	3	0	42	38	66		
	12½	14	s.w.	3	6	58	50	53		st.
	3	15	s.w.	2	4	59	50	48	830	
	6	35	s.w.	2	0	55	47.5	53		fog 1.
	9	12	w.	2	5	47	42	62		
15	7	15	n.	3	10	34	32.5	84	910	hazy.
	9	12	n.	2	0	36	34	80		"
	12½	16	n.	2	0	48	43	63		"
	3	13	n.	1	0	52	46	60		
	6	15	n.	1	0	46.5	42.5	69		fog 2, full moon.
	9	13	n.	1	0	39	38	91		
16	7	18	s.w.	1	10	33	33	100		fog 2, white frost.
	9	24	s.w.	1	0	36	35.5	95		fog 1.
	12	21	s.w.	1	0	50.5	47	75		
	3	14	s.w.	2	0	55.5	49	59		
	6	25	s.w.	1	0	49	45	71	860	fog 1, moonshine.
	10	20	s.w.	2	0	40.5	39.5	91		"
17	6½	16	s.w.	2	10	33.5	33.5	100		fog 1, white frost.
	9	22	s.	2	0	40	38	82		
	12	20	s.w.	2	0	55.5	48.5	56	800	
	3	17	s.w.	2	0	61	50.5	43		

DECEMBER—Continued.

Date.	Hour.	Atmos. Elect.	Wind. Direc.	Wind. Force.	Sky.	Ther. Far. Dry Bulb.	Ther. Far. Wet Bulb.	Rel. Hum.	Barometer.	Remarks.
	6	+18	s.w.	2	0	53	46	54		moonshine.
	9	9	s.w.	2	0	48	43	63		"
18	6½	15	s.w.	1	5	38	37	91		"
	9	19	s.	1	0	41	40	91		
	12	15	s.w.	1	0	57	49	52		
	3	13	s.w.	1	0	62	53	51		
	6	13	s.w.	1	0	53.5	48	64		
	9	12	s.w.	1	0	48.5	44.5	70		moonshine.
19	7	10	s.e.	1	0	46	44	84	29.720	
	9	16	s.	3	0	52	48	73		
	12	10	w.	3	2	65.5	55.5	49		st.
	3	13	s.w.	3	3	66	54.5	42		
	6	15	s.w.	2	6	58	51.5	61	660	
	9	8	n.w.	4	8	48	43	63	720	
20	6½	7	n.w.	4	5	33.5	28.5	51	910	
	8½	10	n.	4	10	31	28	68		
	12	15	n.w.	4	10	28.5	25.5	65	980	
	3	9	n.w.	4	10	26.5	22.5	51		
	6	8	n.	4	10	24	20	47		
	10	8	n.	4	10	20.5	18	63	30.025	
21	7	7	n.e.	3	10	19	17	69		
	8½	13	n.	3	10	20	17.5	63		
	12	13	n.e.	3	10	23	20	59		
	3	1	n.e.	3	10	24	21	60	29.925	begins snowing.
	6	30	n.e.	2	10	21.5	21.5	100		snowing.
	10	−50	n.e.	2	10	24	24	100	810	" till midnight.
22	7	+ 2	s.e.	2	10	29.5	29.5	100	600	
	9	−45	e.	2	10	31.5	30.5	89		afterwards fine rain.
	12	+15	w.	2	10	33	32	89	470	snowing.
	3	−50	w.	3	10	31.5	31	95		" whole afternoon.
	6	−25	n.w.	4	10	25	24	87		
	9	− 8	n.w.	3	10	23	22	86	510	
23	7	+ 2	n.w.	4	10	20.5	20	92	700	
	9	16	n.w.	4	0	19	18	84		
	12	17	w.	3	0	23	21.5	79		
	3	24	w.	3	0	27	24	63		
	6	21	w.	2	0	23.5	22.5	86	760	
	9	26	w.	2	0	22	21	86		
24	7	7	s.e.	3	0	21	21	100	620	
	9	24	s.e.	3	1	25	24	87		
	12	20	s.e.	3	0	34	31	71	480	
	3	8	s.e.	3	0	36	31	54	410	
	6	15	s.e.	3	0	32.5	31.5	89		
	9	7	s.e.	2	0	31.5	30.5	89		
25	7	17	n.e.	1	5	29.5	29	94		hazy.
	9	22	n.e.	1	10	32.5	30.5	79	440	fog 1.
	12	23	s.e.	3	3	37	32	53		
	2½	13	s.e.	2	8	42	38	66		st.
	6	7	s.e.	1	10	42	41	91	350	
	9	3	s.	1	10	43	43	100		

DECEMBER—Continued.

Date.	Hour.	Atmos. Elect.	WIND. Direc.	WIND. Force.	Sky.	THER. FAR. Dry Bulb.	THER. FAR. Wet Bulb.	Rel. Hum.	Barom-eter.	REMARKS.
26	7	+ 2	s.	1	10	55	54	94	29.275	cu.
	8½	6	w.	3	10	46	42.5	73		
	12	5	w.	4	1	33.5	32	84	610	st.
	3	2	w.	5	2	30.5	27	62	710	"
	6	2	w.	4	0	26.5	24	69	880	
	10	2	n.w.	4	0	23	21	72	985	
27	7	9	n.w.	3	0	13	12.5	90	30.110	
	9	30	w.	3	0	14	12.5	73		
	12	21	w.	2	0	22	19	58		
	3	25	e.	2	0	25	22	61		
	6	32	e.	1	0	24	22	73	065	
	9	10	e.	1	0	21	20	85	010	fog 1.
28	7	19	e.	1	0	20.5	19.5	85	29.880	"
	9	22	s.e.	3	0	24	22	73		
	12	24	s.e.	3	0	34.5	30.5	61	750	
	3	19	s.e.	3	1	40	32.5	39	670	
	6	23	s.e.	2	5	37	32.5	57		
	10	14	s.e.	1	8	35	31.5	66		
29	7	9	w.	2	2	31	28.5	73		
	9	25	n.w.	2	0	36	31	54	720	hazy.
	12	27	n.w.	1	0	42	35.5	46		
	3	19	n.w.	2	0	44.5	37.5	46	795	
	6	24	n.w.	2	0	39	34.5	59		fog 1.
	9	15	n.w.	1	0	33	32	89		
30	7	22	e.	1	0	26	26	100	890	fog 1.
	9	21	s.e.	2	0	30	28.5	84		
	12	25	s.e.	2	2	41	35	49		
	3	14	s.e.	2	2	45	39	53	810	
	6	13	s.e.	1	10	40.5	36.5	64		
	9	14	s.e.	2	5	40	36	64	750	
31	7	20	s.	2	0	39	36	73	620	
	9	27	s.	3	0	43.5	39	63		hazy.
	12	23	s.	2	2	57.5	49	50	535	
	3	12	s.	2	4	60	51	49	460	st.
	6	10	s.	3	5	54.5	47.5	56		
	9	11	s.w.	3	0	53	46.5	58	410	

MONTHLY MEAN OF POSITIVE ATMOSPHERIC ELECTRICITY
IN 1861.

MONTHS.	At 6 A. M.	At 9 A. M.	At 12 M.	At 3 P. M.	At 6 P. M.	At 9 P. M.	Mean of the whole month.	Thunder-storms.
January,	15.8	19.4	20.3	15.6	15.2	12.7	16.5	0
Febru'y,	12.8	15.3	13.9	10.5	11.5	8.9	12.1	2
March,	12.0	12.0	9.8	8.1	9.0	8.0	9.8	3
April,	10.8	11.1	7.1	7.0	7.7	9.3	8.8	2
May,	9.3	9.5	8.1	6.6	6.1	7.2	7.8	5
June,	4.2	3.6	4.5	4.8	5.2	3.0	4.2	7
July,	3.7	3.0	4.0	4.0	4.5	3.3	3.7	3
August,	2.3	3.0	3.8	4.8	4.4	2.4	3.4	5
Sept'r,	2.2	3.0	4.1	3.5	4.3	1.9	3.2	3
October,	7.7	10.7	8.0	6.6	8.7	6.4	8.0	1
Nov'ber,	11.1	11.6	10.7	9.9	10.7	7.4	10.2	1
Dec'ber,	11.5	17.8	15.9	13.7	17.2	12.4	14.7	0
Mean,	8.6	10.0	9.2	7.9	8.7	6.9	8.5	32

MONTHLY MEAN OF TEMPERATURE (THERMOMETER F.)
IN 1861.

MONTHS.	At 6 A. M.	At 9 A. M.	At 12 M.	At 3 P. M.	At 6 P. M.	At 9 P. M.	Mean of the whole month.
January,	26.9	29.5	35.3	37.4	33.5	30.8	32.2
Feb'uary,	34.2	35.4	43.7	46.7	42.8	39.7	40.4
March,	37.1	41.1	48.2	51.6	47.6	43.4	44.8
April,	49.6	56.5	62.7	65.1	59.8	55.1	58.1
May,	54.7	62.9	68.7	70.8	67.1	60.2	64.1
June,	68.5	76.6	81.5	82.7	79.8	72.5	76.9
July,	67.9	77.5	82.8	83.9	80.1	73.0	77.5
August,	67.8	78.8	83.8	84.7	81.5	75.0	78.6
Sept'ber,	60.9	67.8	75.3	75.3	70.5	64.9	69.1
October,	49.1	55.0	62.9	67.5	58.5	54.4	57.9
Nov'ber,	36.1	42.3	51.1	52.1	49.2	45.0	46.0
Dec'ber,	33.6	36.1	43.8	45.6	41.5	37.4	39.7
Mean,	48 9	54.9	61.6	63.6	59.3	54.3	57.1

MONTHLY MEAN OF RELATIVE HUMIDITY IN 1861.

MONTHS.	At 6 A. M.	At 9 A. M.	At 12 M.	At 3 P. M.	At 6 P. M.	At 9 P. M.	Mean of the whole month.
January,	....	....	....	....	....	....	72.2
Feb'nary,	....	....	....	....	....	....	63.3
March,	83.3	63.7	58.9	52.4	58.9	70.1	64 5
April,	77.4	62.4	53 2	51.7	57.3	67.2	61.5
May,	83.5	67.5	59.0	54.7	58.4	74.5	66.3
June,	86.2	70.5	60.6	59.4	66.4	81.9	70.8
July,	84.3	64.0	56.4	54.8	60.9	77.4	66.3
August,	91.9	68.9	59.2	56.4	62.8	78.5	69.6
Sept'ber,	93.1	78.4	66.2	65.2	74.7	86.5	77.3
October,	92.7	82.1	65.2	62.5	74.0	82.9	76.6
Nov'ber,	84.4	74.3	60.0	56.1	66.8	72.6	69.0
Dec'ber,	87.7	81.7	64.8	58.5	71.2	81.7	74.3
Mean,	86.4	71.3	60.3	57.2	65.1	77 3	69.5

DIRECTION OF WINDS IN 1861.

MONTHS.	E.	N.	N.E.	S.W.	N.W.	S.	W.	S.E.	Prevailing Winds.
January,	11	3	12	22	38	18	28	61	s.e.
Feb'nary,	4	2	2	35	24	19	41	60	s.e.
March,	12	11	10	23	30	19	42	40	w. & s.e.
April,	16	10	9	26	21	35	34	26	s. & w.
May,	26	10	23	21	8	13	49	35	w. & s.e.
June,	12	21	22	20	25	26	8	41	s.e.
July,	3	31	14	21	26	46	15	29	s.
August,	18	24	58	17	11	18	3	37	n.e.
Sept'r,	6	14	18	26	30	13	21	52	s.e.& n.w.
October,	12	9	5	21	30	33	30	46	s.e. & s.
Nov'ber,	7	15	8	22	27	20	36	44	s.e. & w.
Dec'ber,	9	19	9	25	23	33	17	51	s.e. & s.
Year,	136	169	190	279	293	293	324	522	s.e.

METEOROLOGICAL TABLE FOR 1860—ST. LOUIS, MO.—By DR. G. ENGELMANN.

MONTHS.	BAROMETER, Reduced to Freezing Point.				THERMOMETER, (Fahrenheit.)				Evaporation. *	Force of Vapor.	Relative Humidity.	Quantity of Rain and Melted Snow.	PREVAILING WINDS.	Proportion of Cloudiness.	No. of Thunderstorms.
	Mean of the Observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.	Mean of the Observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.							
Jan.	**29.647**	**30.188**	29.256	0.923	33.8	65.0	**-3.0**	**68.0**	3.2	0.136	69	1.80	W., next S. and S.E.	3.8	
Feb.	29.549	30.138	**28.659**	**1.479**	37.6	63.0	2.0	61.0	3.6	0.151	68	2.60	S.E., then W.	4.7	
Mar.	29.569	29.884	28.978	0.906	49.8	76.5	25.0	51.5	7.7	0.169	**49**	**1.16**	W. and S. E.	**3.0**	2
April	29.451	29.818	28.661	1.157	59.0	85.5	37.0	48.5	8.3	0.263	53	2.03	S.E. & S., then W. & N.W.	3.6	5
May	**29.390**	29.743	29.045	0.698	72.1	93.0	43.5	49.5	**10.1**	0.424	55	2.29	W., then S.E., S. & S.W.	3.5	7
June	29.444	29.746	29.021	0.725	76.2	94.0	57.0	37.0	8.4	0.567	64	**6.58**	E. and S.E.	3.6	**12**
July	29.454	29.701	29.225	0.476	**82.1**	**104.0**	**61.0**	**43 0**	**10.1**	**0.651**	60	2.97	E., N.E. and S.E.	3.1	6
Aug.	29.465	**29.684**	**29.344**	**0.340**	78.3	100.0	57.0	**43.0**	8.6	0.613	65	2.96	S., S.E. and N.W.	3.6	6
Sept.	29.565	29.810	29.271	0.539	67.7	95.0	44.0	51.0	6.8	0.446	67	2.11	S.	4.3	1
Oct.	29.533	29.901	29.201	0.700	58.9	87.0	29.5	57.5	6.7	0.303	63	1.58	W., then S.E. and N.	3.3	2
Nov.	29.507	29.838	29.031	0.807	40.9	70.0	7.0	63.0	4.2	0.164	65	1.63	W. next S.E.	5.2	
Dec.	29.638	29.131	28.950	1.181	**30.5**	**52.5**	4.0	48.5	**2.3**	**0.129**	**76**	2.08	S.E. next W.	**6.2**	
1860.	29.519	30.188	28.659	1.529	57.2	104.0	-3.0	107.0	6.6	0.335	63	29.79	S. E., next W.	4.0	41

* Mean difference of dry and wet bulb thermometers.

METEOROLOGICAL TABLE FOR 1861—ST. LOUIS, MO.—By DR. G. ENGELMANN.

MONTHS.	BARMOMETER, Reduced to Freezing Point.				THERMOMETER, (Fahrenheit.)				Evaporation.*	Force of Vapor.	Relative Humidity.	Quantity of Rain and Melted Snow.	PREVAILING WINDS.	Proportion of Cloudiness.	No. of Thunderstorms.
	Mean of the Observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.	Mean of the Observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.							
Jan.	29,579	29.953	28.864	1.089	**31.6**	**54.0**	**8.0**	46.0	**2.7**	**0.127**	72.2	1.16	S.E., next W.	4.7	
Feb.	29,492	29.968	28.878	1.090	39.8	74.0	14.5	59.5	4.4	0.150	63.3	2.01	W. and S.E.	**5.3**	2
Mar.	29,559	29.945	29.099	0.846	44.2	79.5	20.5	59.0	5.6	0.163	57.1	**7.38**	S.E.	4.9	7
April	**29.384**	29.712	29.050	0.662	57.9	83.0	35.0	48.0	8.1	0.250	**53.5**	3.18	W.	4.4	3
May	29.439	29.801	**28 611**	**1.190**	64.3	90.5	40.5	50.0	8.6	0.333	56.5	4.39	W., next S.E.	4.7	4
June	29.475	**29 664**	29.309	**0.355**	76.8	98.0	**57.5**	**40.5**	8.0	0.598	66.3	4.96	S.E.	4.4	**9**
July	29.508	29.772	29.287	0.485	77.5	99.5	54.0	45.5	**9.4**	0.558	60.5	2.04	S., next S.E.	**3.0**	3
Aug.	29.512	29.737	29.208	0.529	**78 4**	**101.5**	56.5	45.0	8.6	**0.615**	64.7	3.44	N.E., next E.	**3.0**	5
Sept.	29.559	29.891	**29 316**	0.575	68.9	95.0	42.0	53.0	5.9	0.498	**72.8**	4.14	S.E.	4.0	5
Oct.	29.529	29.906	29.224	0.682	57.2	82.0	34.5	47.5	5.6	0.311	67.5	2.85	S.E.	4.0	1
Nov.	29.451	29.785	29.068	0.717	46.2	77.5	21.0	56.5	5.9	0.176	57.6	1.39	W., then S.E. and S.W.	5.2	2
Dec.	**29.688**	**30.152**	29.242	0.910	39.8	74.5	14.0	**60.5**	3.7	0.167	69.7	**1.09**	S.E., next S.	3.7	
1861.	29.516	30.152	28.611	1.541	56.9	101.5	8.0	93.5	6.4	0.329	63.4	38.03	S.E.	4.3	41

* Mean difference of dry and wet bulb thermometers.

Difference of Temperature and of Relative Humidity in City and Country. By George Engelmann, M.D.

At a former occasion (Jan. 16, 1860, Trans. Vol. I., p. 693) I communicated to the Academy a Paper on the Difference of Temperature of the City and the Country near St. Louis; and proved by a table of comparative observations, made in the year 1859 by Mr. A. Fendler, in the valley of Rock Spring creek, near the Pacific Railroad machine shop, and by myself at the corner of Elm and Fifth streets, that the temperature outside the city is lower than in the heart (the closely built up part) of the city. Mr. Fendler elaborated the same theme more fully in an interesting article published in the Smithsonian Report for 1860, p. 403.

Mr. Fendler's observations for 1860 were fragmentary, but, as far as they went and could be compared, they indicated the same facts. Towards the end of that year he transferred the field of his labors to Tower Grove, Mr. H. Shaw's Missouri Botanic Garden, and there he has most assiduously continued his meteorological observations. From his journals, kindly communicated to me, and my own, I have compiled the following tables.

The Missouri Botanic Garden is situated on a moderate rise in the centre of a wide prairie, now entirely under cultivation, surrounded at the distance of one mile or more by ranges of gently sloping hills or ridges; it lies to the southwest from the city proper, about three miles distant; its elevation is a little higher than that of my station.

The table on the next page explains itself; it gives the mean of the monthly observations made at both points of observation at the hours of 7 A. M., 2 P. M., and 9 P. M., and their differences; also the monthly means and extremes, and their differences. The extremes, it is necessary to observe, are not absolute, Mr. Fendler having failed to observe the temperature at sunrise, when, generally, it is lowest; they are only the extremes at the hours of observation.

The table proves again that the mean temperature is higher in the city than in the country; and further, when compared with former observations, that the difference of temperature between my location and the Missouri Botanic Garden is greater than between the same place and Mr. Fendler's former place of observation, no doubt, because farther removed from the influences of the city.

The differences were found to be:

1859, at 7 A. M., 1.8; at 2 P. M., 0.3; at 9 P. M., 2.1: mean, 1.4.
1861, " 2.1; " 1.5; " 2.8: " 2.1.

A. FENDLER'S THERMOMETRICAL OBSERVATIONS AT THE MISSOURI BOTANIC GARDEN, COMPARED WITH DR. ENGELMANN'S OBSERVATIONS IN THE CITY OF ST. LOUIS.

1861	7 O'CLOCK A. M.			2 O'CLOCK P. M.			9 O'CLOCK P. M.			MEAN.			MAXIMUM AT 2 P. M.			MINIMUM AT 7 P. M.		
	ENGELMANN.	FENDLER.	F.—E.	ENGELMANN.	FENDLER.	F.—E.	ENGELMANN.	FENDLER.	F.—E.	ENGELMANN.	FENDLER.	F.—E.	ENGELMANN.	FENDLER.	F.—E.	ENGELMANN.	FENDLER.	F.—E.
Jan.	26.4	24.5	-1.9	36.5	34.8	-1.7	32.0	30.3	-1.7	31.6	29.9	-1.7	54.0	51.0	-3.0	8.0	6.0	-2.0
Feb.	33.5	32.1	-1.4	46.2	44.7	-1.5	39.6	38.0	-1.6	39.8	38.3	-1.5	74.0	70.0	-4.0	14.5	14.0	-0.5
Mar.	38.3	36.8	-1.5	50.8	48.9	-1.9	43.6	42.1	-1.5	44.2	42.6	-1.6	79.5	76.5	-3.0	21.0	17.0	-4.0
April	53.0	51.0	-2.0	64.9	62.7	-2.2	55.7	54.6	-1.1	57.9	56.1	-1.8	83.0	81.0	-2.0	38.0	35.0	-3 0
May	59.5	57.6	-1.9	72.1	69.5	-2.6	61.4	59.5	-1.9	64.3	62.2	-2.1	90.0	86.0	-4.0	46.5	42.0	-4.0
June	73.4	71.3	-2.1	83.7	82.0	-1.7	73.3	70.0	-3.3	76.8	74.4	-2.4	98.0	95.0	-3.0	64.0	59.0	-5.0
July	73.1	71.8	-1.3	85.2	84.1	-1.1	74.1	69.2	-4.9	77.5	75.0	-2.5	99.5	99.0	-0.5	61.0	60.0	-1.0
Aug.	73.2	71.4	-1.8	86.3	85.0	-1.3	75.7	71.2	-4.5	78.4	75.9	-2.5	101.5	103.0	+2.5	61.0	59.0	-2.0
Sept.	63.4	61.4	-2.0	77.0	75.9	-1.1	66.2	62.8	-3.4	68.9	66.7	-2.2	95.0	93.0	-2.0	44.0	42.0	-2.0
Oct.	50.8	47.3	-3.5	65.7	64.8	-0.9	55.2	51.8	-3.4	57.2	54.6	-2.6	82.0	82.0	0.0	35.0	28.0	-7.0
Nov.	40.0	37.0	-3.0	53.0	51.9	-1.1	45.7	43.2	-2.5	46.2	44.0	-2.2	77.5	78.0	+0.5	21.0	16.5	-4.5
Dec.	34.3	31.8	-2.5	46.7	46.3	-0.4	38.4	35.6	-2.8	39.8	37.9	-1.9	74.5	76.0	+1.5	14.0	6.5	-7.5
Means	51.6	49.5	-2.1	64.0	62.5	-1.5	55.1	52.3	-2.8	56.9	54.8	-2.1	84.0	82.5	-1.5	35.7	32.1	-3.6
Extremes...	......	......	......	......	......	......	......	......	......	......	......	......	101.5	103.0	+2.5	8.0	6.0	-2.0

Thus the law, found in 1859, is confirmed by another year's observation:

The difference is greatest at 9 P. M., less so at 7 A. M., and least at 2 P. M.

I have no doubt that observations, made at sunrise, would prove the difference of temperature at that time of the day to be greater than at any other hour. With the rising of the sun the difference steadily diminishes until the temperature of the day has reached its maximum, when it increases again through the evening and night to the period of minimum temperature at sunrise.

The mean difference of temperature in city and country was found, in 1859, to be a little less than the mean of the 7 o'clock observations; in 1861 it was equal to the same. The differences in both years are greater in the summer and fall months, less in the winter and spring months.

The last columns of the table show that the minimum temperatures (at least, at the hours of observation) are always lower in the country than in the city, to the amount, on an average, of 3.6 degrees. The maxima are usually, but not always, lower in the country, but the difference is on an average, only, of 1.5 degrees; and the highest temperature, during the very hot weather in the beginning of August, was found higher in the country than in the city.

Another interesting result is obtained by comparing both sets of observations in regard to the difference of Evaporation and of Relative Humidity in city and country. The amount of evaporation is indicated by the difference of the dry and wet bulb thermometers. Mr. Fendler's wet bulb thermometer was generally not as much below my wet bulb as his dry bulb was below mine, consequently the difference was almost always less at his station than at mine; three times it was equal, and twice (at 7 A. M. in January and in December) it was even a little greater in the country.

The average results for the year may be summed up thus:

	7 A.M.	2 P.M.	9 P.M.	MEAN.
Difference of Dry Bulb Thermom's.	2.1	1.5	2.8	2.1
Difference of Wet Bulb Thermom's.	1.2	0.2	1.8	1.1
Difference of the differences..........	0.9	1.3	1.0	1.0

The following table exhibits the difference of Evaporation and Relative Humidity, at the different hours of observation, in each month of the year:

1861.	DIFFERENCE OF EVAPORATION, F.=E.				DIFFERENCE OF RELATIVE HUMIDITY, F.=E.			
	7 A.M.	2 P.M.	9 P.M.	MEAN.	7 A.M.	2 P.M.	9 P.M.	MEAN.
Jan.	+0.1	-1.0	-0.3	-0.4	-2.0	+8.6	+1.8	+2.8
Feb.	-0.2	-1.1	-0.3	-0.5	+1.1	+6.3	+1.3	+2.9
Mar.	-1.0	-1.2	......	-0.8	+8.3	+5.7	+1.2	+5.1
April	-1.2	-2.6	-0.6	-1.4	+6.5	+10.6	+2.8	+6.6
May	-1.8	-2.1	-0.9	-1.6	+8.9	+6.0	+3.8	+6.2
June	-1.5	-2.7	-1.9	-2.1	+6.8	+8.3	+6.4	+7.2
July	-0.7	-1.3	-2.7	-1.5	+2.5	+4.1	+10.7	+5.8
Aug.	-1.2	-0.8	-2.1	-1.4	+5.1	+1.9	+8.0	+5.0
Sept.	-1.5	-0.4	-1.8	-1.2	+7.9	+1.0	+8.7	+5.9
Oct.	-1.5	-0.9	-1.2	-1.2	+11.5	+3.5	+6.0	+7.0
Nov.	-0.7	-1.1	......	-0.6	+4.3	+5.4	-2.6	+2.4
Dec.	+0.3	-0.1	-0.3	......	-2.5	+0.3	-1.1	-1.1
Mean	-0.9	-1.3	-1.0	-1.1	+4.9	+5.1	+3.9	+4.6

This table proves as a general rule, perhaps contrary to preconceived opinion, that the Evaporation is less in the country than in the city, and that, consequently, the Relative Humidity is greater there, though the single data seem to be so irregular as to suggest doubts as to their perfect reliability.

The greatest difference in Evaporation as well as in Relative Humidity seems, on an average, to occur at the warmest time of the day, at 2 P.M.; and the least difference of Evaporation at 7 A.M., and the least difference of Relative Humidity at 9 P.M. The table proves further that the differences of Relative Humidity are much smaller in winter (November to February) than in the warmer months of the year. It was found, on an average, to amount to nearly 5 per ct., but in June and October it reached 7 per ct.; while in January, February and November, it was under 3 per ct., and in December it seems to have been even a little less in the country than in the city. In winter and spring the differences are much greater on mornings and evenings; in the latter part of summer and in fall, they are much higher in the middle of the day than at any other period.

Another interesting result of Mr. Fendler's observations is, that the quantity of rain for the whole year was, at his place of observation, over three inches less than I found it in town, though in the months of August, September, November and December he recorded a larger fall of rain than I did. A difference in the instruments, or in their exposure, may partly account for the different results; but it coincides with a well known and often noted fact, that over a large city, and immediately on the banks of a large river, the fall of rain is heavier than in the interior. Still farther off the river, and especially in the great prairies east as well as west of us, the fall of rain is stated to be still smaller.

The following results of our comparative observations may be considered as substantiated:

1. The Temperature is lower in the country than in the city.

2. The Difference is greatest at night and least in the middle of the day.

3. It is greater in summer and autumn, and less in winter and spring.

4. The daily as well as annual Ranges of the Thermometer are therefore greater in the country, and greatest in summer and autumn.

5. The Evaporation is greater in the city than in the country, and the difference is greater in daytime than at night, and greater in summer than in winter.

6. The Relative Humidity is greater in the country than in the city; the difference is smaller in winter, and greater in spring, summer, and autumn—during the months of active vegetation.

7. The annual Fall of Rain is greater in the city than in the country, though in some months this rule may be reversed.

These facts, especially 2, 4 and 6, explain to a great extent the difference in the hygienic condition of city and country; but it would be foreign to the subject of this paper further to enter into this interesting and eminently practical investigation.

FALL OF RAIN IN ST. LOUIS DURING TWENTY-THREE YEARS—1839 to 1861.

Years.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Winter.	Spring.	Sum'er.	Fall.	Sept. of year before to Feb'y.	March to August.
1839....	2·21	2·50	2·59	5·46	7·93	7·26	5·71	2·89	2·45	3·96	2·48	2·00	47·44	5·21	15·98	15·86	8·89	11·21	31·84
1840....	1·80	1·38	2·10	3·31	4·58	6·27	2·36	7·15	3·96	6·30	1·73	0·71	41·65	5·18	9·99	15 78	11·99	14·07	25·77
1841....	0·84	0·88	4·99	3·85	2·38	1·67	3·09	5·63	3·22	6·81	5·44	3·93	42·73	2·43	11·22	10·39	15·47	14 42	21·61
1842....	0·45	3·90	2·21	3·48	3·22	5·12	1·76	2·64	2·17	2·57	2·38	2·39	32·29	8·28	8 91	9·52	7·12	23·75	18·43
1843....	2·34	1·90	3·49	4·87	4·15	3·95	2·49	1·32	2·19	1·55	4·82	1·72	34·79	6 63	12·51	7·76	8·56	13·75	20·27
1844....	3·36	1·73	4·84	3·86	11·26	6·85	8·13	0·45	0·30	2·25	1·17	1·61	45·81	6·81	19·96	15·43	3·72	14·57	35·39
1845....	1·83	1·07	3·18	2·28	4·42	10·01	4·75	6·23	1·03	1·16	1·10	0·93	37·99	4·51	9·88	20·99	3·29	28·23	30·87
1846....	2·98	1·27	1·27	4·84	3·75	5·21	0·84	4·73	4·84	2·71	2·11	10·90	45·45	5·18	9·86	10·78	9·66	8 47	20·64
1847....	2·12	3·58	2·28	3·98	4·36	8·61	5·37	0·90	3·26	8·74	8·63	0·89	52·72	16·60	10·62	14·88	20·63	26·26	25·50
1848....	1·86	2·27	6·61	3·16	8·10	17·07	5·37	9·74	1·12	2·41	1·91	5·74	65·36	5·02	17·87	32·18	5·44	25 65	50·05
1849....	4·18	0·56	2·70	2·64	2·71	6·46	9 40	5·15	5·81	2·17	2·11	1·82	45·71	10·48	8·05	21·01	10 09	15·92	29·06
1850 ...	1·94	4·10	5·63	7·68	7·47	1·47	4·83	2·10	3·74	2·71	6·24	2·59	50·50	7·86	20·78	8·40	12·69	17·95	29·18
1851....	0·61	6·74	3·14	4·70	2·83	6·19	1·77	8·97	0·49	1·51	1·99	3·90	42·84	9·94	10·67	16·93	3·99	22·63	27·60
1852...	0·99	2·12	7·67	2·28	5·19	10·25	3·36	1·60	1·47	5·26	3·29	3·48	46·96	7·01	15·14	15·21	10·02	11·00	30·35
1853....	0 52	1·67	0·79	3·24	3·64	3·23	4·10	5·48	4·67	0·96	1·51	1·08	30 89	5·67	7·67	12·81	7·14	15·69	20·48
1854....	1·18	3·11	7·49	7·60	6·30	3·21	0·92	1·80	1·44	4·15	1·94	1·49	40·63	5·37	21·39	5·93	7·53	12·51	27·32
1855....	4·66	0·70	2·89	2·65	7·46	4·27	5·17	6·53	3·89	3·89	5·16	3·10	50·37	6·85	13·00	15·97	12·94	14·38	28·97
1856....	1·03	3·64	1·06	6·35	3·03	1·24	4·61	6·32	3·51	2·10	4·90	4·29	42·08	7·77	10·44	12·17	10·51	20·71	22·61
1857....	0·41	7·74	1 80	1·72	4·81	3·71	2·82	4·15	3·18	3·02	3·80	1·87	39·03	12·44	8·33	10·68	10·00	22·95	19·01
1858 ...	3·42	2·12	3·96	6·07	10·64	6·69	8·03	2·87	3·86	7·73	4·92	8·52	68·83	7·41	20·67	17·59	16·51	17·41	38·26
1859....	2·32	5·35	7·32	4·89	6·60	11·02	5·54	2·93	4·44	1·80	5·43	3·76	61·40	16·19	18·31	19·49	11 67	32·70	38·30
1860....	1·80	2·60	1·16	2·03	2·29	6·58	2·97	2·96	2·11	1·58	1·63	2·08	29·79	8·16	5·48	12·51	5·32	19·83	17·99
1861....	1·16	2·01	7·38	3·18	4·39	4·96	2·04	3·44	4·14	2·85	1·39	1·09	38·03	5·25	14·95	10·44	8·38	10 57	25·39
Mean of 23 years,	1·91	2·74	3·76	4·09	5·28	6·14	4·15	4·17	2·93	3·40	3·31	3·04	44·92	7·69	13 13	14·46	9·64	17·33	27·59
Minim.,	0·41	0·56	0·79	1·72	2·29	1·24	0·84	0·45	0·30	0 96	1·10	0·71	29·79	2·43	5·48	5·93	3·29	8·47	17 99
Maxim.,	4·66	7·74	7·67	7·68	11·26	17·07	9·40	9·74	5·81	8·74	8·63	10·90	68·83	16·60	21·39	32·18	20·63	32 70	50·05

FALL OF SNOW (MELTED) IN ST. LOUIS IN 23 YEARS,
From 1839—1861.

YEAR.	JAN.	FEB.	MAR.	APR.	OCT.	NOV.	DEC.	Total for the Year.	Total for the Season.
1839....	0·02	....	0·38	....	....	0·40	1·60	2·40	0·92
1840....	1·20	0 05	0·05	....	....	0·24	0·16	1·70	3·30
1841....	0·71	0·45	1·39	....	....	0·07	0·10	2·72	2·95
1842....	0·01	0·39	0·01	....	....	0·99	0·05	1·45	0·58
1843....	1·46	0·81	0·87	0·21	0·03	0·44	1·72	5·54	4·39
1844....	0·53	0·13	0·73	....	....	0·05	0·03	1·47	3·58
1845....	0·91	....	0·48	....	....	0·49	0·17	2·05	1·47
1846....	1·16	1·25	0·03	....	....	....	1·62	4·06	3·10
1847....	0·99	1·20	0·87	....	....	....	0·06	3·12	4·68
1848....	0·56	....	0·24	....	....	....	1·41	1·21	0·86
1849....	0·81	0·10	....	....	...	....	1·46	2 37	1·32
1850....	0·70	1 02	1·84	0·63	....	....	0·88	5 07	5·65
1851....	....	1·23	0·04	0·65	....	1·29	0·18	3·39	2·80
1852....	0·71	0·23	....	....	....	0·06	0·06	1·06	2·41
1853....	0·15	0·92	0·06	....	....	....	0·73	1·86	1·25
1854....	1·15	....	0·08	....	....	0·08	0·22	1·53	1·96
1855....	0·55	0·23	0·80	....	0·18	....	0·24	2·00	1·88
1856....	1·03	1·58	0·93	....	....	....	....	3·54	3·96
1857....	0·41	....	0·16	0·04	....	0·09	....	0·70	0·61
1858....	....	1·14	....	....	....	0·50	....	1·64	1·23
1859....	0·81	0·14	0 05	0·09	....	0·01	1·98	3·08	1·59
1860....	0·43	0·22	....	....	....	0 44	0·35	1·44	2·64
1861....	0·39	0·04	0·03	....	....	....	0·59	1·05	1·25
Mean of 23 years,	0·64	0·48	0·39	0·07	0·01	0·22	0·55	2·37	2·36
Maxim.,	1·46	1·58	1·84	0·65	0 18	1·29	1·98	5·54	5·65
Minim.,	0·00	0 00	0·00	0·00	0·00	0·00	0·00	0·70	0·58

Fall of Rain (including melted Snow) in St. Louis, from 1839 *to* 1861.

By George Engelmann, M.D.

The foregoing Tables are the result of my observations continued through a series of 23 years. They exhibit in English inches the monthly quantities of atmospheric water, which is precipitated in the form of Rain or Snow, and their sums and averages.

My rain gage is placed on the roof of my house, but, unfortunately, not entirely free from the influences of currents of winds produced by neighboring chimneys and houses; the results, however, are probably not far from the actual quantities.

The first twelve columns of the first table give the monthly and the thirteenth the annual quantities; the next four exhibit the quantities of the four seasons, taking December, January, and February, for winter; March, April, and May, for spring, etc. The last two columns comprise the rain of the fall and winter months, and that of the spring and summer months.

The quantity of rain in the different years varies, as the table shows, between near 30 and near 69 inches, the average being nearly 45 inches.

The monthly amount of rain increases from January, when on an average it is less than 2 inches, to June, when it reaches over 6 inches; and then varies through the remaining six months of the year between 3 and 4 inches, being least in September.

The quantity of rain is smallest in December, January, February, and September, reaching only 3 inches or less; and greatest in May and June, over 5 inches. The quantity in the three summer months is greater than in any other season; the three spring months come near to it. The average amount of rain in the spring and summer months, over 27 inches, is about 62 per cent. of the annual fall; while only 17 inches, or 38 per cent., falls to the share of the other six months of the year. The last columns, however, of the table show that this is by no means so in each single year; we find 3 years among the 23, when the fall and winter rains predominated over the spring and summer rains.

The diagram, Plate 4, exhibits at one glance all these results. The middle line connects the mean quantities of rain for every month; the upper curve indicates the maxima, and the lower one the minima, of the monthly rains observed in the last 23 years. It will be seen that the curve of the mean quantities gradually rises from January to June, and then falls rather abruptly to July, remains almost on the same level in August, falls again in September nearly to the point it had attained in February, and then, in the last three months of the year, rises slightly to nearly the level of March.

Another series of observations establishes the fact, that the quantities of rain which descend in a given period of time, increase regularly from January to July, and decrease again from that month to January at the following ratio:

	Jan.	Feb.	Mar.	April	May.	June.	July.
Inches of rain per hour......	0·03	0·05	0·08	0·08	0·15	0·20	0 23

	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
" " "	0·19	0·13	0·10	0·07	0·06	0·10

So that in July nearly 7 times as much rain is precipitated in a given time as in January, and that the 4 inches of rain of the former month fall, on an average, in the short period of 18 hours, while the less than 2 inches of rain (or snow) of January require 55 hours for their precipitation.

The number of days on which it rained or snowed in each month during 29 years, from 1832 to 1861, is exhibited in the subjoined table:

		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Whole Year.
Number of days.	Average,	7	8	8	9	9	10	7	7	6	7	8	7	93
	Minimum,	3	4	3	4	4	4	4	2	1	2	3	3	69
	Maxim.,	12	13	15	14	16	18	14	14	12	13	11	12	115

We have in almost every year, in the months of June, July, or August, one or more falls of 2 and sometimes of 3 and even 4 inches of rain within a few hours, or even within a single hour; in a few exceptional instances, the quantity precipitated in 24 hours, or less, has reached as high as 5 and 6 inches. This has happened four times in the year 1848 (May 6th, June 2d, June 21st, and August 15th), and in no other year as far as I have observed it.

The second table (page 76) exhibits the amount of snow which fell during the same period of time, the snow having been melted and measured as inches of water. The average quantity, it will be seen, does not amount to quite $2\frac{1}{2}$ inches, which corresponds to about 2 feet of snow. This quantity of snow, however, never accumulates in our climate, and, indeed, snow rarely covers the ground for more than one, or at most two weeks at a time.

The greatest average quantity is recorded for January; next comes December and February, and then March. In April falls of snow have taken place only five times, and in October only twice, in the last 23 years.

The last column gives the quantities of snow for each winter, from October of the previous year to April of the year in which the number is placed. It will be seen that in the winter of 1841 to 1842 (one of the mildest winters we have had, and followed by the earliest spring), the snow water scarcely amounted to more than ½ an inch (about 5 inches of snow); in the winter of 1849 to 1850 it reached over 5½ inches (about 4–5 feet of snow), the average being nearly 2½ inches of snow water, corresponding to 2 feet of snow.

Stage of the Mississippi River at St. Louis in 1861.

By George Engelmann, M.D.

The diagram, Plate 4, exhibits, besides the three curves indicating the quantities of rain, and explained in the last paper, a fourth line recording the observations of the stage of our river, made by the City Engineer, Truman J. Homer, Esq., as published in the *Missouri Republican.*

Mr. Homer has established a new low water mark, based on his observations made in December, 1860, when he found the level of the river to be 2 feet 8½ inches lower than the former City Engineer, Mr. H. Kayser, had observed in 1840.

The City Directrix (as the top of the curbstone at the intersection of Market street and the Levee is called), to which all the street levels, etc., in the city are referred, is therefore, according to Mr. Homer's measurement, 33 feet 2½ inches, and the high water mark of June 27, 1844, 40 feet 9½ inches above the low water mark of 1860.

The zigzag line on the diagram shows the stage of the river in the first six weeks of the year to have been nearly stationary—between 2 and 3 feet above low water; it then rises suddenly, reaches in March 15 and 17 feet, in April 21 feet, and in May 25 feet; falls in June to between 19 and 16 feet; rises again in the beginning of July to more than 23 feet, but falls later in the month to 14 and 13 feet; in August it gradually recedes to 7 feet; remains nearly on the same level through September; rises again in October for a short time to over 13 feet; comes down to 8 feet; remains in November at between 6 and 8 feet, and falls in December to 4 feet, though it fluctuates temporarily up to 9 feet.

In a practical point of view it is important to know, that, as a general rule, our river is lowest in mid winter; rises to a good boatable stage in early spring; to high water in April, May, and June; falls rapidly in July and August; and then more gradually continues to recede to December.

Heavy and extensive rains in the interior have at any season a temporary effect on the stage of the river, such as our diagram exhibits in several instances; but the Mississippi, with its long course and the immense area it drains, is not subject to such sudden and irregular floods as, for example, the Ohio or other smaller streams. Its great and regular rise takes place in April, May, and June, usually reaching its greatest height in the latter month, whence it is popularly known as the "June rise;" last year, however, it reached its highest point on May 15.

The ordinarily received opinion is, that the melting snows in the Rocky Mountains and on the northern plains at the head waters of the Missouri and the Mississippi rivers are the principal source of this great periodical rise. But though they may not be without some, and perhaps a considerable, influence, this rise too clearly coincides in time, and in amount, with our rainy season, not to be more immediately referable to the heavy rains which just then deluge the great extent of country drained by the confluents of our river.

In the table, Vol. I., p. 666, of these Transactions, the following errors will have to be corrected:

Line	12	from	below,	for	76	read	85.5
"	"	"	"	"	734	"	743.5
"	"	"	"	"	0.25	"	0.28
"	11	"	"	"	10	"	0.5
"	"	"	"	"	0.09	"	0.005
"	5	"	"	"	434	"	443.5
"	"	"	"	"	734	"	743.5
"	4	"	"	"	10	"	0.5
"	"	"	"	"	0.09	"	0.005

The editor of Silliman's Journal, vol. 30, p. 394, copying part of my paper on the elevation of St. Louis, refers to the following as further sources of information on the natural history of the Mississippi River:

Marr's Report of Observations at Memphis, made in 1849.

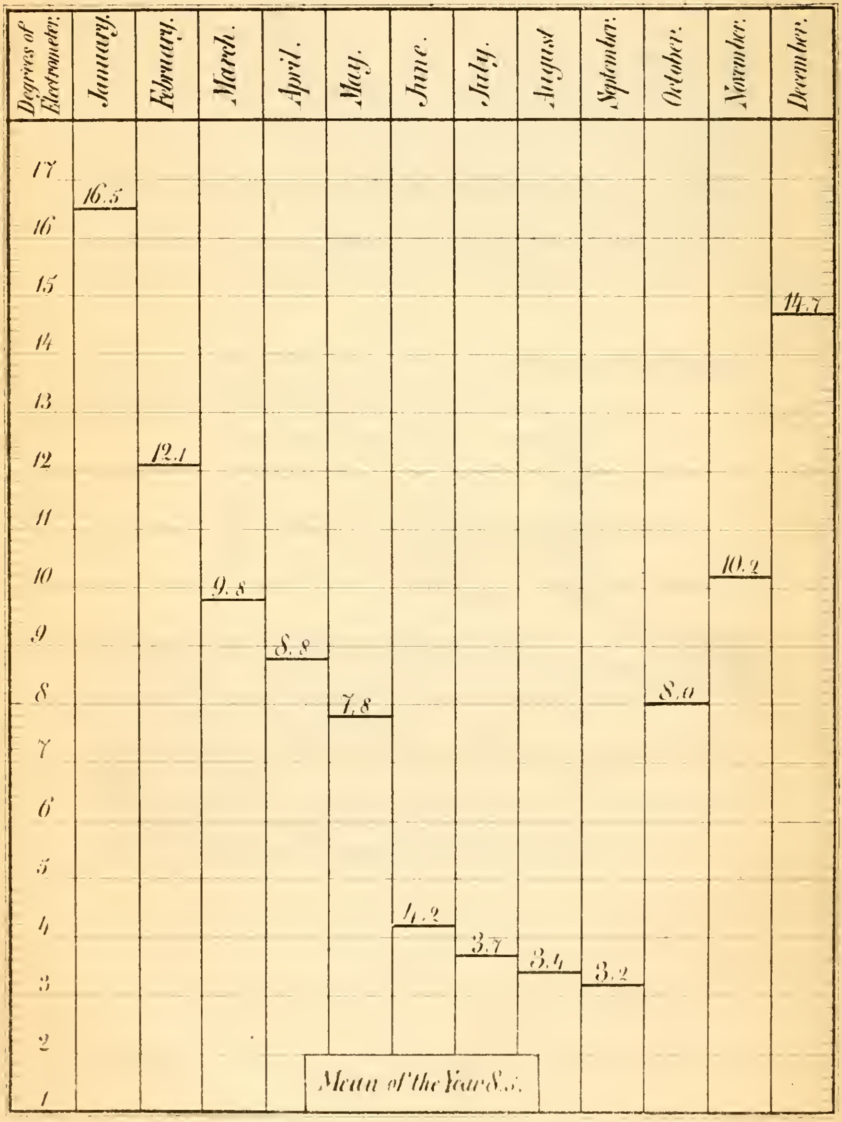
Ellet's Work.

Measurements of Riddell, Forshey and Dickenson, in the Acts of the American Association.

Lyell in Silliman's Journal, vol. 3, pp. 36 and 118.

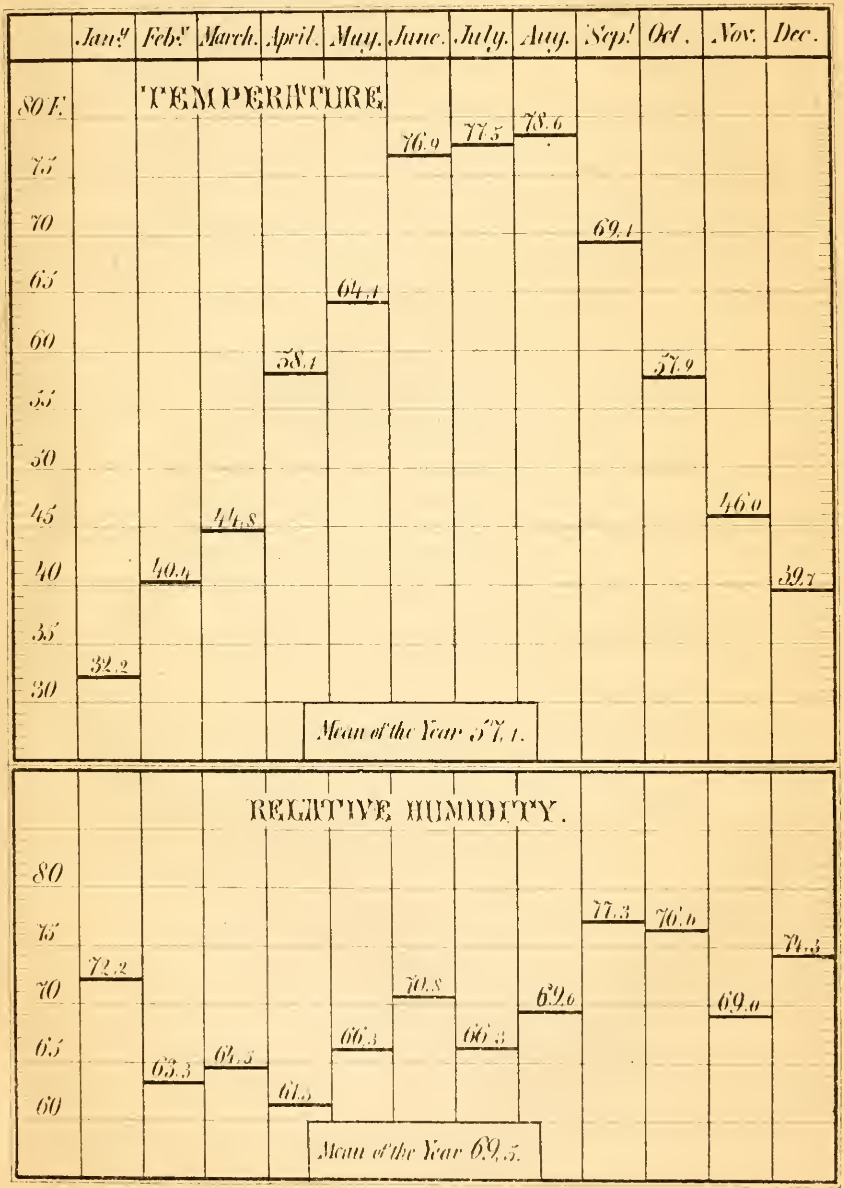
DIAGRAM,

showing the monthly mean *of positive atmospheric* electricity *in the year 1861 at St. Louis, Mo., based upon daily obervations at 6, 9, 12, 3, 6 and 9 o'clock from morning till night, by A. Wislizenus M.D.*



DIAGRAM,

showing the monthly mean of temperature and of relative humidity in 1861, at St. Louis, Mo., based upon daily observations cotemporaneous with those of atmospheric electricity, by A. Wislizenus M.D.



DIAGRAM,

showing the yearly mean of positive electricity, of temperature & of relative humidity of the atmosphere at the hours of 6, 9, 12, 3, 6 & 9 from morning till night, based upon daily observations at these hours through the year 1861 at St. Louis, Mo., by A. Wislizenus M.D.

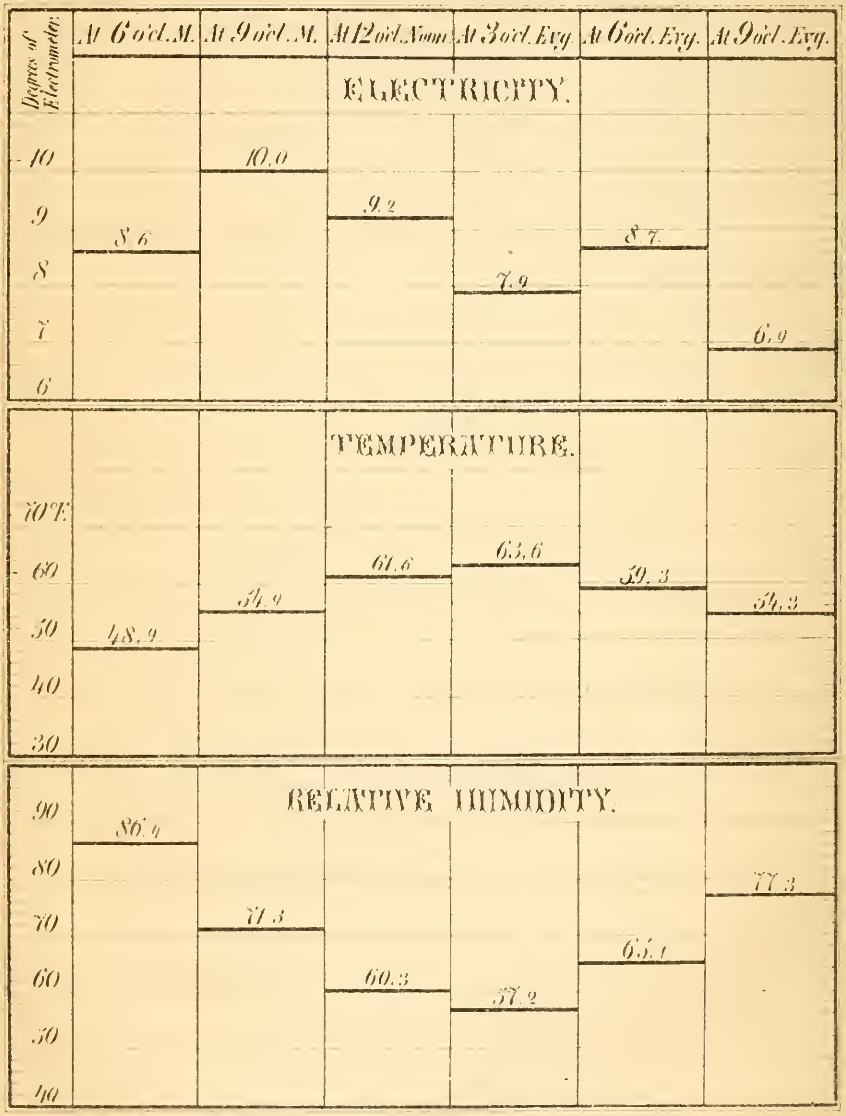
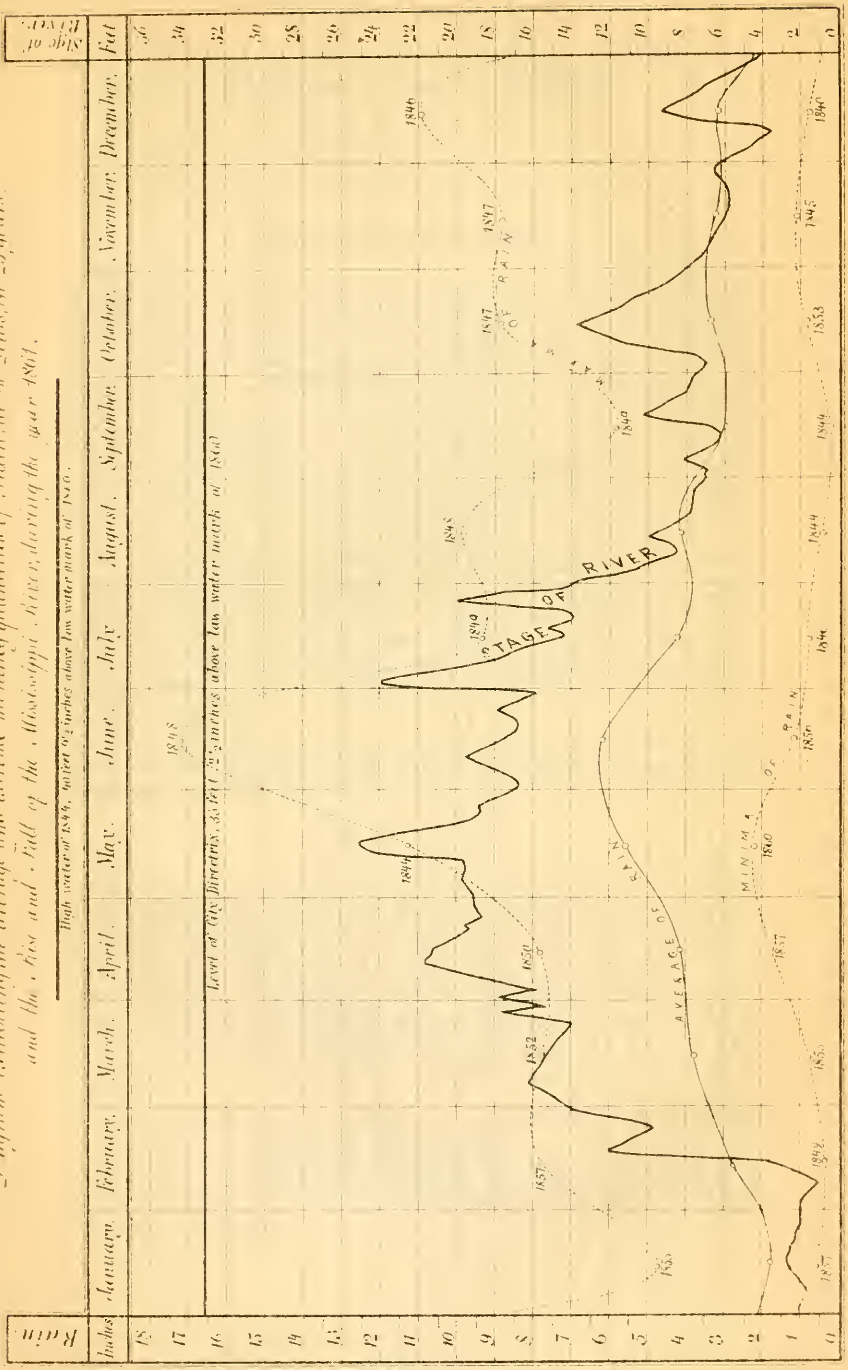


Diagram exhibiting the average and extreme monthly quantities of Rain at St. Louis, in 23 years, and the Rise and Fall of the Mississippi River, during the year 1861.



Descriptions of some New Fossils *from the Carboniferous and Devonian Rocks of Missouri.*

By G. C. Swallow.

[Read October 16, 1860.]

Pentremites Missouriensis.

Body large, ovate, convex below; *base* moderately convex: *basal plates* form a pentagonal convex disk; the three sides, formed by the union of two adjoining plates, are concave: *radial plates* deeply forked, with a high sharp, edge bordering the poral plates: *interradial plates* lanceolate, the two lower sides sigmoid; apex not so high as the convex summit of the body: *pseudambulacral areas* long; the two sides slightly convex, and sloping to the depressed central line. All the sutures, formed by the junction of the radial plates with each other, with the interradial plates, and with the basal plates, are bordered by fine striæ, and a distinct depressed line on each side of the suture and parallel to the edges of the plates.

This fossil most resembles the *P. Cherokeeus* of Prof. Troost; but it is longer, more ovate; the interradial plates are longer and their points not so high, and their lower margins convex or sigmoid. But the distinguishing characteristics are the striæ and depressed lines parallel to the sutures, as above named.

This rare and beautiful *Pentremites* is found associated with the *P. Cherokeeus* in the Archimedes Limestones of Missouri and Illinois.

Orthis Clarkensis.

Shell of medium size, transverse, subelliptical. *Ventral valve* convex near the beak, depressed in front, flattened towards the lateral margins; *beak* small, moderately elevated; *area* shorter than the width of the shell. *Dorsal valve* more convex, with a broad sinus on the middle of the anterior portion. *Surface* marked with numerous, small, rounded, tubular, radiating costæ (increased by implantation), and by fine concentric striæ, and by lines of growth more or less conpicuous.

It resembles the *O. Swallovii* of Prof. Hall, but its form and concentric striæ mark it as distinct.

This shell is abundant in the lower beds of the Keokuk Limestone, associated with *O. Keokuk*, at various localities in Iowa and Missouri.

Orthis Cooperensis.

Shell small, orbicular or subquadrate, widest at or below the middle, costate. *Ventral valve* convex towards the beak, depressed or flattened towards the margins, with a broad shallow sinus in front; *beak* long, strongly incurved; *area* small; *hinge line* one third as long as the width of the shell. *Dorsal valve* more convex, flattened towards the margins; *umbo* full; *beak* shorter, curved up nearly in contact with that of the opposite valve. *Surface* marked with fine, radiating costæ (increased by implantation), and with fine concentric striæ.

Length, .51; width, .49; thickness, .21.

This fossil was collected by Dr. Giddings from Warsaw Limestone in Cooper county, and by Dr. Norwood, at Barrett's Station, in St. Louis county, Missouri.

Orthisina occidentalis.

Shell large, very gibbous, transverse, wider below the middle, plicate, and decussate. *Ventral valve* very convex, highest towards the beak, descends nearly perpendicularly towards the cardinal extremities, which are slightly auriculate; margin broadly rounded or slightly concave in front, rounded towards the cardinal extremities; *area* slightly concave, triangular, sides shorter than the base; *deltidium* narrow, prominent, rounded; *umbo* depressed; *beak* small, pointed; *cardinal line* much shorter than the width of the shell. *Ventral valve* less convex, subelliptical; *umbo* full, projecting beyond the cardinal line; *beak* abruptly incurved to the cardinal line.

Length, 1.39; width, 1.75; thickness, 1.16.

Anterior margin of each valve marked with about ten broad, depressed plications, which disappear before reaching the middle of the shell. Whole surface ornamented with small radiating costæ (increased by implantation), and by fine concentric striæ or raised lines; and also by very distinct plications of growth near the margins. The umbo of the ventral valve has a few indistinct rugæ.

This shell most resembles the *O. Missouriensis;* but the ventral valve is not so high, area is wider and not so high, plications are more depressed and confined to the margins, and the markings on the plications are not diagonal. It is more convex than the *O. Shumardiana;* its radiating costæ are much smaller, and not striate as in that fossil.

This fossil was discovered in the Upper Coal Measures of Caldwell county, Missouri, by Mr. Wheeler.

TEREBRATULA GRACILIS.

Shell ovate-lanceolate, widest near the anterior extremity, punctate. *Ventral valve* strongly arched, flattened in front; *umbo* convex; sides, towards the beaks, descending rapidly, and drawn in to the junction with the other valve; *beak* long, strongly curved in; *foramen* elliptical; *sinus* obsolete in young shells, but more conspicuous in adults. *Dorsal valve* very convex along the middle, and but little arched from the umbo forward; *beak* small and strongly incurved. *Surface* very distinctly punctate; punctures so arranged as to give the appearance of oblique striations.

Length, .87; width, .60; thickness, .40.

This shell is very like the *T. millepunctata*, but it is less arched, not so flat and wide in front, and the sinus of the ventral valve is much less conspicuous.

This fossil is common in the upper divisions of the Archimedes Limestone at St. Mary's, Missouri, and Chester, Illinois.

TEREBRATULA PARVA.

Shell small or very small, ovate, gibbous; often very much thickened on the margin, making the thickness greater than the width. *Ventral valve* strongly arched, most convex near the beak, slightly flattened towards the anterior margin, thickened and contracted on the cardinal margin, rounded in front; *beak* large, prominent, strongly incurved; *foramen* small, circular. *Dorsal valve* shorter, more equally convex, thickened on the anterior margin; *umbo* large; *beak* strongly incurved. *Surface* marked with fine radiating and concentric striæ, and a few indistinct lines of growth, which are most numerous and distinct on the margin.

This shell is very variable in size and form, as the following measurements show:

Shell of ordinary form—length, .37; width, .27; thickness, .26.

Shell of gibbous form—length, .50; width, .28; thickness, .40.

Shell of wide form—length, .43; width, .35; thickness, .28.

This fossil is found at Keokuk, Iowa, and in Monroe and Cooper counties, Missouri.

TEREBRATULA ARCUATA.

Shell long, lanceolate, arcuate, sinuate, punctate, broadest below the middle. *Ventral valve* strongly arched, flattened on top, contracted and thickened on the hinge line and lateral margins; *sinus* broad and shallow in front; *beak* long and strongly incurved; *foramen* elliptical. *Dorsal valve* very convex, nearly straight from the umbo two thirds of the distance to the anterior margin, then curved abruptly down to the junction with the other valve; *umbo* large. *Surface* smooth, closely punctate, with a few very indistinct lines of growth.

This shell is somewhat like the *T. gracilis;* but it is much larger, more arcuate, and the dorsal valve is much more gibbous.

The *T. arcuata* is common in the Kaskaskia Limestone in Ste. Genevieve county, Missouri, and at Chester, Illinois, where it is associated with the *S. incrassatus.*

Terebratula brevilobata.

Shell small, elongate, ovate, gibbous, punctate, and lobate. *Ventral valve* very convex near the beak, strongly arched longitudinally; *beak* long, strongly incurved; *foramen* ovate or elliptical; *sinus* well defined and deep on the anterior portion, obsolete or wanting towards the beak. *Dorsal valve* shorter, very convex; *umbo* large; *beak* incurved beneath the foramen. This valve usually has a short mesial fold in front, with a deep narrow sinus on each side of it, dividing the front of the valve into three lobes, the middle being much the smallest. *Surface* beautifully punctate and marked by lines of growth.

Length, .60; breadth, .46; thickness, .35.

Variety a is smaller, wider, and thicker in proportion.

This shell is common in the upper divisions of the Archimedes Limestone in Ste. Genevieve county, Missouri.

Rhynconella arctirostrata.

Shell triangular or cuneate, valves nearly equal, costate, striate. *Ventral valve* most convex towards the beak, which is long, pointed, and strongly incurved. *Dorsal valve* most convex in front; *beak* small, pointed, and strongly incurved. Both valves flattened in the middle, and bent abruptly near the margins, forming perpendicular subrectangular faces on the sides and one more or less convex and rounded on the front. Each valve marked with from 14 to 16 rounded, radiating plications, which extend from the beak—two or three implanted—and are ornamented by fine longitudinal striæ, and by obsolete concentric folds. The angle at the beak very variable.

Obtuse specimen—length, .65; breadth, .80; thickness, .43.

Acute specimen—length, .60; breadth, .61; thickness, 45.

This shell is somewhat similar to the *T. subcuneata* of Prof. Hall, but there are several important differences. The *arctirostrata* has the beak strongly incurved; the flat surfaces on the sides larger, more rectangular, wider in front, and marked with the costæ curved over them.

This fossil is common in the Archimedes Limestone of Cooper county, Missouri. Collected by Dr. Giddings.

Rhynchonella perrostellata.

Shell elongate; wide and rounded in front; narrow, cylindrical, and elongate towards the beaks. *Valves* about equally convex, contracted and semicylindrical towards the beaks; the *dorsal* highest in front, and the *ventral* towards the beaks; both convex along the middle, abruptly curved towards their margins in front and on their sides, but sloping more gradually towards the junction of the lateral and anterior margins. *Surface* of each valve marked with about eighteen simple, sharp, radiating costæ, which are obsolete near the beak (one or two added by implantation). It is also ornamented with fine concentric striæ and distinct *plications* across the contracted portions.

Length, .75; width, .62; thickness, .48.

This shell is very unique, and easily recognized by the contracted prolongation of its valves towards the beaks. It was collected by Dr. Giddings from the Archimedes Limestone of Cooper county, Missouri; where it is associated with *R. subcuneata*, *R. arctirostrata*, and *T. sublanceolata*.

Spirifer translatus.

Shell small, ovate, gibbous, ovate, widest below the middle, punctate, decussate. *Ventral valve* strongly arched, very convex towards the beak; *umbo* large; *beak* strongly incurved over the area; *sinus* deep and wide in front, obsolete towards the beak, subangular in the bottom; *area* small, triangular; *foramen* rather small, triangular, equilateral; *cardinal line* short, length about one third the width of the shell. *Dorsal valve* suborbicular, gibbous and scarcely arched from the umbo to the anterior margin, flattened towards the lateral margins, raised into a rounded mesial fold in front with a rounded sinus on each side, making the edges of the valves sinuous; *beak* small, projecting a little beyond the cardinal line, scarcely incurved. *Surface* ornamented with very fine concentric and radiating striæ, small punctures, and lines of growth.

Length, .58; width, .51; thickness, .35.

This *Spirifer* closely resembles the *Spirigera formosa*; but its area and imperforate beak separate it from that species and genus.

It is a rare fossil in the upper divisions of the Archimedes Limestone near Chester, Illinois, and St. Mary's, Missouri.

Spirifer Kelloggii.

Shell small, convex, transverse. *Ventral valve* high; *mesial sinus* simple, narrow, deep; *beak* but little incurved; *area* high, arched, as long as the width of the shell; *foramen* narrow, closed at top. *Dorsal valve* smaller, less convex; *mesial fold* simple, narrow, and high. *Surface* marked with six or seven simple plications on each side of the mesial fold and sinus, and by fine, equal, imbricating, concentric lamellæ.

This shell resembles the *S. spinosus* of Norwood & Pratten; but its markings are different, having no spines and punctæ as that species.

This fossil is common in the lower beds of the Keokuk Limestone and the upper Chert beds below, where it is associated with *O. Keokuk*, *S. neglectus*, *P. vittatus*, *P. gradutus*, and *S. pseudolineatus.* Collected by Dr. Kellogg.

Spirifer lævigatus.

Shell large, transverse, sinuate, and smooth. *Ventral valve* moderately convex; *beak* moderately incurved; *sinus* broad, deep, regularly concave, extending from the beak to the anterior margin; *area* large, arched, as long as the width of the shell; *foramen* large, triangular, nearly as wide as high. *Surface* smooth. *Dorsal valve* not known.

It is a common shell in the lower beds of the Keokuk Limestone in Iowa and Missouri.

Spirifer latior.

Shall rather small, transverse, semiorbicular, lateral extremities long and pointed. *Ventral valve* convex, highest near the beak; *beak* small, slightly incurved; *area* large, subtriangular, as long as the width of the shell; *foramen* triangular, higher than wide; *sinus* well defined, marked with one large central fold, and one smaller on each side. *Dorsal valve* less convex; *beak* small, scarcely incurved; *mesial fold* well defined, depressed, marked with four plications. *Surface* marked with about sixteen rounded plications on each side of the mesial fold and sinus; plications rarely forked.

This rare fossil is found in the Chouteau Limestone of Cooper county, Missouri.

Spirifer clarus.

Shell small, convex, lenticular, decussate, sinuate. *Ventral valve* very convex; *umbo* large; *beak* small, strongly incurved; *area* small, triangular, length equal to one third of the width of the shell; *foramen* small, triangular, higher than wide; *sinus* obsolete or linear near the beak, but well developed in front. *Dorsal valve* less convex and nearly straight along the middle from the umbo to the anterior margin, transversely elliptical, flattened towards the lateral margins; *umbo* full; *beak* small, scarcely projecting beyond the cardinal line. *Surface* beautifully marked by fine concentric and radiating striæ; the exfoliated shell and the cast show large unequal radiating costæ.

Length, .57; width, .65; thickness, .37.

This beautiful fossil is rare in the upper divisions of the Archimedes Limestone in Ste. Genevieve county, Missouri.

Spirigera Plattensis.

Shell of medium size, very gibbous, long ovate, subtrilobate, junction of valves sinuate. *Ventral valve* very convex, strongly arched; *sinus* large, prolonged in front; *umbo* large; *beak* short, strongly incurved; *foramen* circular. *Dorsal valve* most convex near the beak, high and rounded from the umbo to the anterior margin; *beak* strongly incurved, cutting the periphery of the foramen. Whole *surface* punctate, and marked with numerous, unequal, distinct lines of growth.

Young shells less convex, ovate; margins nearly orbicular and scarcely sinuate; both valves convex near the beaks and flattened towards the margins.

Adult specimen—length, .88; width, .70; thickness, .55.

Young specimen—length, .51; width, .47; thickness, .38.

This shell is most like the *S. Hawni*, but it has no longitudinal costæ or striæ; its lines of growth are more numerous and more conspicuous. It differs from the *S. subtilita* in the same particulars; it is also proportionally longer and thicker, and the umbones are larger.

This beautiful shell is common in the Upper Coal Measures of the north-western counties of Missouri, and in Kansas and Nebraska.

Spirigera Singletonii.

Shell small, gibbous, broadly ovate, sinuate, subpolygonal in front. *Ventral valve* ovate, very convex, strongly arched; *umbo* full; *beak* large, strongly incurved; *foramen* circular; *sinus* wide and deep in front, obsolete towards the beak. *Dorsal valve* suborbicular, less convex, highest near the beak, raised in front, depressed on each side of the mesial fold into a rounded sinus; *umbo* full; *beak* small, cutting the periphery of the foramen. Whole *surface* marked with very distinct lines of growth. *Structure* punctate or fibrous.

Length, .78; width, .72; thickness, .46.

This symmetrical shell is most like the *Sp. Plattensis*, but it is much smaller, wider and shorter in proportion, and more angular in front. In all these particulars it differs from the *Sp. subtilita.*

This fossil is abundant in the Lower Coal Measures in Boone and Audrain counties, where it was discovered by M. G. Singleton, Esq.

Spirigera pectinifera.

Shell very large, transverse, elliptical, widest in the middle, sinuate, lamellose. *Ventral valve* depressed, most convex near the beak and on each side of the sinus in front, flattened towards the lateral margins; *beak* large, prominent, moderately incurved; *foramen* circular, oblique to the plane of the margins of the valves; *sinus* deep, concave in front, obsolete towards the beak. *Dorsal valve* more convex; *umbo* large; *beak* incurved beneath the foramen; *mesial fold* very prominent in front. *Surface* ornamented with numerous, thin, pectinated concentric lamellæ, and distinct lines of growth.

Length, 2.51; breadth, 3.28.

In general appearance this fossil resembles the *Athyris incrassata* of Prof. Hall; but its markings clearly distinguish it.

This rare shell I collected from the Geode Beds of the Archimedes Limestone at Keokuk, Iowa.

Spirigera reflexa.

Shell small, subrhombic, lamellose, widest above the middle, front subpointed or more sharply rounded. *Ventral valve* depressed towards the margins, convex in the middle and towards the beak, lateral margins turned down; *beak* small, moderately incurved; *foramen* circular, small, plane oblique to the margins of the valves. *Dorsal valve* more convex, more regularly arched, fullest above the middle, slightly flattened towards the lateral margins; *umbo* large and full; *beak* rather small, strongly incurved beneath the foramen. *Surface* ornamented by numerous, wide, concentric, pectinated lamellæ; those on the ventral valve less depressed than those on the opposite valve.

Length, .62; breadth, .64; thickness, .36.

This shell is most nearly allied to the *Spirigera Americana;* but its depressed ventral valve, very convex dorsal valve, and subrhombic form, give it permanent and important distinctions. It differs from the *S. hirsuta* in the same particulars, and in having a shorter beak, and in being wider above the middle; it is also larger. Some might be disposed to make this fossil and the *S. Clintonensis* mere varieties of the *S. Americana*, but the differences are marked, important and permanent; and, as it is more convenient "to know them by name," they may as well stand among the species, at least, until naturalists do better agree upon what shall constitute a species.

This fossil is rare at Barrett's Station, St. Louis county, Missouri, where it is associated with many fossils of the 3d Archimedes or Warsaw Limestone.

Spirigera Clintonensis.

Shell small, transverse, elliptical, depressed, subtrilobate, lamellose. *Ventral valve* most convex near the beak, flattened towards the lateral margins; *sinus* broad and deep on the anterior portion; *beak* small, incurved, truncated nearly parallel to the margins of the valves; *foramen* small, circular. *Dorsal valve* flattened towards the lateral margins, most convex near the middle; *mesial fold* broad, full, and rounded from the beak to the anterior margin, with a deep round sinus on each side in front, giving the shell a trilobate form and sinuous margin; the fold is often flattened or depressed along the middle; *beak* small, curved beneath the foramen, cutting its periphery. *Spiral appendages* large, 12 to 14 volutions on each side. *Surface* ornamented with numerous concentric, pectinated lamellæ.

Shell of common form—length, .60; width, .78; thickness, 36. Shell of the gibbous variety—length, .60; width, .76; thickness, .41.

This fossil is most nearly allied to the *S. Americana;* but it is much wider, more trilobate, and has more volutions in the spiral appendages.

This beautiful fossil is common at Chester, Illinois, and in Ste. Genevieve and Cooper counties, Missouri, in the 2d Archimedes or Ste. Genevieve Limestone, associated with *Spirifer Leidyi*, *S. spinosus*, and *Spirigera Americana*.

Spirigera Americana.

Shell small, lenticular, wide, obovate or slightly transverse; widest at or above the middle, lamellose. *Ventral valve* convex; highest near the beak; flattened towards the margins; sometimes slightly depressed, forming an indistinct sinus on the anterior portion: *beak* small, moderately incurved; *foramen* small, circular, oblique to the margins of the valves. *Dorsal valve* transversely elliptical, more convex; high and rounded from the beak to the anterior margin, with, sometimes, a slight, longitudinal mesial depression on the anterior portion; flattened towards the lateral margins: *beak* small and curved beneath the foramen, cutting its periphery. *Spiral appendages* large, with about 11 volutions on each side. *Surface* ornamented with numerous concentric, pectinated lamellæ; the teeth or spines often lie in longitudinal fascicles on the border, giving the appearance of plications. The cast is marked with indistinct longitudinal plications or costæ.

Length of medium specimen, .67; width, .68; thickness, .40.

Length of small specimen, .39; width, .37; thickness, 22.

This beautiful fossil most resembles the *Sp. plano-sulcata* of Prof. Phillips; but its beak is larger and less incurved; its dorsal valve more convex, and its ventral one less so. The *Spirigera hirsuta* of Prof. Hall has a larger beak, a more convex ventral valve, and a more flattened dorsal one, and only about half as many volutions in the spiral appendage.

This *Spirigera* is very abundant in the 2d Archimedes or Ste. Genenvieve limestone at Chester, Illinois, at St. Mary's, and other places in Missouri. It is associated with *Spirifer Leidyi*, *S. spinosus*, and *Productus elegans*.

Spirigera caput-serpentis.

Shell large, gibbous or depressed, wide, ovate, trilobate, costate and striate. *Ventral valve* very convex near the beak and on the raised lobes on each side of the sinus; strongly arched longitudinally: *sinus* deep and wide in front, obsolete towards the beak; angular at the bottom: *umbo* full: *beak* strongly incurved, truncate: *foramen* circular or ovate; plane, parallel to the junction of the anterior portion of the valves. *Dorsal valve* suborbicular or subquadrate; flattened towards the lateral margins; nearly straight from the umbo to the anterior margin: *mesial fold* full, broad, round, having a short, deep, round sinus on each side at the anterior margin, making the junction of the valves very sinuous: *umbo* full; *beak* small, strongly incurved beneath, and cutting the periphery of the foramen. *Spiral appendages* large; at least twenty volutions on each side. *Surface* marked with distinct lines of growth, by fine concentric striæ, and by obsolete, depressed, longitudinal costæ, which become more obvious in exfoliated or worn shells—they are still more distinct on the cast. Young shells less convex, with a thin linguiform, upturned projection in front.

Adult shell—length, 1.54; width, 1.56; thickness, 1.08.

Young shell—length, 1.03; width, 1.05; thickness, .66.

This fossil most resembles the *Spirigera subtilita* of Prof. Hall, but it is larger, wider in proportion, and more trilobate. It may be distinguished from the *S. differentiæ* of Prof. McChesney by its ovate and trilobate form; it is always wider below the middle. The *S. Charitonensis* is orbicular, has a small sinus. The *caput-serpentis* is more distinctly costate than any of the allied species, or perhaps *allied varieties.*

The fossil is common in the Upper Coal Measures of Missouri and Kansas.

Spirigera formosa.

Shell small, ovate, widest below the middle, usually gibbous, sinuate, punctate, trilobate. *Ventral valve* strongly arched, gibbous near the beak; *beak* large, strongly recurved, truncate parallel with the border of the valves; *foramen* circular; *mesial sinus* deep and broad in front; (in depressed varieties the front is prolonged into a lingulate process strongly curved up;) obsolete, or only a faint depressed line towards the beak. *Dorsal valve* gibbous; *umbo* full; *beak* recurved beneath the foramen, cutting its periphery; *mesial fold* high and rounded in front with a deep round sinus on each side, rendering the shell subtrilobate. *Surface* punctate; marked with distinct lines of growth, with numerous concentric striæ, and with radiating striæ when partially exfoliated.

Measurement. A gibbous specimen—length, .49; width, .44; thickness, .32. A depressed specimen—length, .48; width, .41; thickness, .24.

This little fossil was collected by Dr. Giddings in the upper divisions of the Archimedes Limestone, above Boonville.

Spirigera euzona.

Shell small, ovate, sinuate and banded. *Dorsal valve* very regularly convex, highest near the beak; *sinus* in front, with a sharp depressed line in at the bottom; *beak* large, prominent, incurved. *Dorsal valve* convex, highest above the middle, flattened towards the margins, with a sharp depressed line from the middle to the front margin; *umbo* full and large; *beak* incurved beneath the foramen. *Surface* marked with eight or nine broad, convex, concentric bands, with three or four striæ between each pair.

Length, .50; width, .46; thickness, .29.

This beautiful fossil is rare in the middle Archimedes beds in Cooper county. Collected by Dr. Giddings.

Productus Americanus.

Shell very large, ovate, very convex, strongly arched towards the beak; very much produced in front, costate and striate. *Ventral valve* very convex in the middle; strongly arched over the umbo to the beak; flattened or concave towards the margins; elevated and rounded from the middle to the anterior margin; flattened or slightly depressed from the middle towards the beak: *ears* very large, flattened, slightly arched along the cardinal margin: *beak* small, strongly incurved over the cardinal line, which is as long as the width of the shell. *Dorsal valve* very concave, closely following the curvatures of the opposite valve; flattened on the visceral region; depressed under the beak: *ears* well defined and flattened. *Surface* ornamented with small, round, depressed, crowded, radiating costæ (increased by implantations and by subdivisions); it also has fine raised concentric lines, which are most conspicuous on the costæ; space between the costæ narrow; but when exfoliated the costæ become narrower and the spaces between wider; the costæ often curved and geniculated: *ears* of the ventral valve marked with large, irregular rugæ, which extend up on to the sides of the valve; somewhat obsolete on the visceral region; ears and visceral region of the dorsal valve marked with unequal rugæ. It also has a row of spines on the cardinal margin.

Length, 3.50; width, 2.60; height, 1.35.

Variety magistos is larger, wider, and more depressed; the costæ striate longitudinally when exfoliated.

Length, 4.00; width, 4.00; height, 1.30.

Variety bombex smaller, more convex, more strongly arched; whole surface marked with distant, diagonal rows of spines.

This fossil most resembles the *P. æquicostatus* of Dr. Shumard; but it is much larger, longer in proportion, and very differently marked.

These magnificent fossils are abundant in the Limestones of the Upper Coal Measures of Harrison county, Missouri.

Productus auriculatus.

Shell of medium size, depressed, semi-orbicular, costate and striate. *Ventral valve* most abruptly arched near the margins; highest near the middle: *umbo* small: *beak* small, strongly incurved to the cardinal line: *ears* large, flat or slightly arched; recurved towards the centre of the valve: *cardinal line* long, extremities arched back and down. *Dorsal valve* concave, closely following the curvatures of the ventral valve; flattened or slightly concave in the middle; depressed under the beak; abruptly arched upwards in front and toward the lateral margins; *ears* well defined and flat. *Surface* marked with equal, small costæ (increased by implantation), by fine concentric striæ, and by a few obsolete transverse rugæ on the visceral region, which are more conspicuous on the ears, by a few lines of growth near the margin, and by a row of spines on the cardinal margin, twelve or fourteen on each side of the beak; inner surface of the dorsal valve marked with a prominent trifid cardinal process, fortified with three folds diverging from its base, one along the centre towards the anterior margin, the others curving outward and forward a little within the cardinal and lateral margins, at first high and narrow, then broad and depressed towards the anterior margin, where it disappears. There are several irregular, curved, radiating costæ on each side of the central fold. The margin is marked with radiating costæ.

Productus Fentonensis.

Shell large, hemispherical, very convex, costate. *Ventral valve* very regularly convex; highest near the middle; visceral region somewhat flattened; anterior and lateral margins form a regular semicircle: *cardinal line* as long as the width of the shell: *ears* small, scarcely defined; rounded at the outer angle. *Surface* marked with small, flat, radiating costæ, which are obsolete on the margins, and by concentric striæ, and small rugæ over the visceral regions. Inner surface coarsely punctate and marked with radiating costæ on the margins. It has a few spines on the cardinal border, and lines of growth on the margins. Dorsal valve not known.

Length, 1.89; width, 2.29; height, .98.

This fossil is very distinct from any known *Productus*. It was collected by Dr. Shumard, at Fenton, St. Louis county, Missouri.

Productus depressus.

Shell of medium size, depressed, semi-elliptical, regularly convex, costate and corrugate. *Ventral valve* regularly but moderately convex; slightly depressed or sinuate in front; anterior and lateral margins regularly curved into a semi-ellipse: *beak* small: *ears* rather large, indistinctly defined, somewhat flattened; outer angle obtuse: *cardinal line* as long as the width of the shell. *Dorsal valve* concave, closely following the curvature of the opposite valve, leaving but little space between them. Whole *surface* marked with small radiating costæ (increased by implantation), by unequal rugæ which are often most conspicuous near the margins, and also by transverse striæ.

This fossil is rare in the Keokuk Limestone at Fenton, St. Louis county, where it is associated with *P. vittatus*, *P. Fentonensis*, *P. gradatus*, and *S. Keokuk*.

Productus gradatus.

Shell of medium size, broad-ovate or sub-hemispherical, depressed, marked with broad, angular, spinose folds. *Ventral valve* ovate, moderately convex; highest near the beak, and flattened towards the cardinal extremities: *beak* small, strongly incurved over the hinge line; *sinus* broad, deeply rounded; *cardinal line* as long as the width of the shell; *ears* large, flat, subacute at the outer angle. *Dorsal valve* moderately concave, with a small, concave depression under the beak; *mesial fold* conspicuous; *ears* flattened. *Surface* marked with numerous, broad, concentric folds, which rise perpendicular in front, forming a sharp, carinated edge on the anterior side of each, and giving them the appearance of steps. The upper surface of each fold is convex and ornamented with five or six rows of depressed spines—those of the upper row the largest.

Length, 2.43; width, 2.32; height, 1.03.

This shell most resembles the *P. punctatus*, but has a larger sinus, and the concentric bands are carinated in front, and the spines are more depressed, and their bases more elongated on the shell. The *P. vittatus* is more elongated, more convex and but slightly sinuate; the markings are also very different.

This shell is common in the Keokuk Limestone at Keokuk, Iowa, and in Lewis and St. Louis counties, Missouri.

Productus coræformis.

Shell very small, elongate, ovate or oval, very convex, costate. *Ventral valve* strongly arched longitudinally; very convex along the middle from the beak to the anterior margin; front raised into a rounded mesial fold; sides descend rapidly to the lateral margins; *ears* small, sharply defined, arched, with a few spines on each along the cardinal line; *beak* long, pointed, strongly incurved; cardinal line shorter than width of the shell; greatest width near the middle. *Dorsal valve* not known. *Surface* marked by fine, rounded, often curved or contorted, radiating costæ (increased by implantation), and by corrugations on the ears, which often extend up over the visceral region.

Length, .71; width, .51; height, .37.

This shell is easily distinguished from all the American species by its form, and size, and markings. In form it resembles the *P. magistos*, but its ears are smaller in proportion, and its size is very much less. It may be a very small, elongated variety of the *P. cora*.

From the Archimedes Limestone of Cooper county, Missouri.

Koninckina Americana.

Shell very thin, hemispherical, slightly transverse. *Ventral valve* regularly convex, or slightly flattened in front; *beak* small, pointed, strongly incurved; *auricular appendages* small, rounded at the extremities; *surface* smooth, punctate, with a few concentric lamellæ of growth near the margins, and a few short depressed spines near the borders. Inner surface marked with a double plication from the umbo down the middle, and an obsolete fold on each side. *Dorsal valve* not seen.

Length, .56; width, .60; height, .23.

This very rare fossil was obtained from the 3d Archimedes Limestone at Barrett's Station, St. Louis county, Missouri.

ALLORISMA ANTIQUA.

Shell small, symmetrical and finely plicated; *beaks* prominent, incurved, contiguous; *cardinal margin* straight or concave; *anterior margin* slopes abruptly from the beaks to the end below the middle, whence it curves regularly to the ventral margin, which is slightly convex, curved abruptly to the posterior extremity above the middle; *valves* convex on the anterior and middle portions, compressed towards the posterior extremity and ventral margin, with a wide shallow sinus from the beak to the ventral margin. *Surface* marked with small concentric plications.

Length, 1.40; width, .77; thickness, .48.

This species is very much like the *A. regulare* of Prof. King; but it is much smaller, and the *regulare* has no sinus on the sides of the valves.

This shell is common in the Kaskaskia Limestone in Illinois and Missouri.

CYPRICARDIA(?) PIKENSIS.

Shell transverse, ovate, plicate; *beaks* high, incurved, approximate, near the anterior end; *cardinal margin* curved down at each end; *ventral margin* convex, most abuptly curved towards the anterior extremity; *anterior cardinal margin* convex, and slopes abruptly to the extremity below the middle; *posterior end* narrower, regularly rounded; *valves* flattened towards the margins; *surface* marked with broad concentric folds.

Length, 1.36; height, 1.00; thickness, .61.

This fossil is rare in the Coal Measures of Pike county, Missouri, where it was discovered by Mr. Broadhead.

CYPRICARDIA(?) SHUMARDIANA.

Shell small, ovate, plicate; *beaks* small nearer the anterior end, incurved, approximate; *cardinal margin* convex behind the beaks and concave before them; *anterior end* narrower, subacute, rounded from the extremity (which is above the middle) to the ventral margin, whence it arches more abruptly to the posterior extremity (which is above the middle and subangular); *valves* convex near the umbo, flattened below and concave towards the posterior cardinal border. *Surface* marked with numerous fine, high and rounded concentric plications.

Length, .34; height, ,23; thickness, .17.

This fossil was discovered by Dr. Norwood in the Ste. Genevieve Limestone, back of Prairie du Rocher, Illinois.

Cypricardia(?) Wheeleri.

Shell small, subtriangular, widest in front; narrow and pointed at the posterior extremity; distinctly sinuate from the beaks to the posterior ventral margin, making a depressed sharp ridge between it and the posterior cardinal slope: *umbones* large; *beaks* curved in and forward. *Surface* marked with a few concentric striæ. Structure punctate or fibrous.

This shell resembles the *C. occidentalis;* but it is much smaller, longer in proportion, and marked with concentric striæ.

This fossil was discovered by Mr. Wheeler, in the Upper Coal Measures in Caldwell county, Missouri.

Cypricardia(?) occidentalis.

Shell large, gibbous, subtriangular. *Valves* very convex; flattened towards the ventral margin; concave towards the posterior cardinal margin, where they form a thin sharp edge at their junction; slightly sinuate from the beaks to the posterior ventral margin: *umbones* large, full; *beaks*, near the anterior extremity, large, strongly curved in and forward, contiguous; *posterior end* narrow and acute; *posterior cardinal margin* convex, sloping to the extremity below the middle; *ventral margin* convex in front and middle, less convex or straight towards the posterior end; *anterior cardinal margin* convex, descending rapidly to the wide, slightly convex anterior extremity. *Surface* apparently smooth, with a few obsolete, depressed, concentric folds. *Structure* punctate.

Length, 2.84; height, 2.60; thickness, 1.98.

This rare shell was discovered by Mr. Wheeler in Harrison county, Missouri.

Cypricardia(?) Chouteauensis.

Shell small, transverse, elliptical, plicate, widest in the middle; *valves* convex from the umbo to the posterior margin, flattened or concave towards the posterior cardinal margin, marked with a broad shallow sinus from the umbo to the middle of the ventral margin; *beaks* nearly terminal, proximate; *anterior end* narrow, sharply rounded in the middle; *posterior end* wide, sharply rounded at the extremity, which is above the middle; *ventral margin* slightly concave in the middle; *cardinal margin* oblique, convex; *surface* marked with sharp, unequal, concentric plications.

Length, .41; height, .25; thickness, .19.

This fossil resembles, in its size and form, the *Cyp. transversa* of De Koninck, but its markings are very different, and like those of *Cyp. squamifera* of Prof. Phillips; but the shell is less, wider at the posterior extremity, and the beaks are not so near the end.

It was obtained from the Chouteau Limestone of Cooper county, Missouri.

Pecten Broadheadii.

Shell varying from small to medium in size, broad ovate; costæ ornamented with vaulted scales. *Left valve* very convex, regularly arched; *umbo* large; *beak* small; *anterior wing* sharply defined, triangular; separated from the margin by a deep angular sinus; anterior extremity acute: *posterior wing* obscurely defined, triangular; obtuse at the outer extremity; separated from the margin by a shallow rounded sinus. *Surface* marked with sharp radiating costæ, which are ornamented with concentric striæ, and, towards the margins, with vaulted scales, shaped like sections of curved, infundibuliform tubes. *Right valve* not known.

This beautiful fossil was discovered in the Upper Coal Measures of Harrison county, Missouri, by Mr. Broadhead.

Pinna Missouriensis.

Shell thin, long-lanceolate, subquadrilateral, more or less compressed and costate. *Anterior margin* straight or convex, and the *posterior* straight or concave; *valves* usually more convex on the anterior slope. *Surface*, on the middle and posterior slopes, marked with about twenty large rounded, radiating plications, which are crossed by unequal subconcentric, oblique folds and striæ, curving from the an terior slope, and becoming obsolete towards the posterior margin.

This fossil somewhat resembles the *P. flabelliformis* of Martin; but it is less compressed, more elongate, and very differently marked.

It is abundant in the Ste. Genevieve Limestone of Missouri and Illinois.

Avicula magna.

Shell very large, ovate; *hinge line* oblique, nearly as long as the shell. *Left valve* somewhat regularly convex, flattened towards the posterior margin; *umbo* full; *beak* projecting beyond the cardinal line: *anterior ear* well defined, triangular; separated from the lateral margin by a deep sinus; anterior extremity acute: *posterior ear* not defined by a sinus on the margin; outer angle obtuse: *surface* marked by large radiating plications and distinct lines of growth. *Right valve* unknown.

Length, 3.25; height, 3.55. Length of anterior wing, 1.26; of posterior wing, 1.27.

This shell was discovered in the Archimedes Limestone of Knox county, Missouri.

Conularia Osagensis.

Shell large, pyramidal; transverse section, forming a parallelogram with the shorter sides, convex, and about half as long as the other sides, which are but slightly convex; each corner has a deep angular sulcation; the sides are marked with high, narrow, transverse costæ (the spaces concave and much wider than the costæ), with a line or ridge along the middle of the wider sides; the ribs on each side of the mesial line are arched, convex towards the base of the shell, and do not always meet at the mesial line; the costæ on the shorter sides are more arched, and are also convex towards the base of the shell. The surface is polished.

This fossil is rare in the upper bed of the Archimedes Limestone near Boonville. Collected by Dr. Giddings.

Orthoceras Chesterense.

Shell tapers rapidly; transverse section orbicular; the cast is marked with subcarinated annulations—about seven in a space equal to the diameter—the space between regularly concave.

This fossil is rare in the Ste. Genevieve Limestone at Chester, Illinois, and near St. Mary's Missouri.

Euomphalus perspectivus.

Shell small, depressed, subconical: *volutions* five to seven; sharply carinated on the upper exterior margin and on the middle of the lower surface; flat or slightly concave on the upper side; slightly convex and nearly perpendicular on the outer surface of the inner volutions, causing the spire to ascend by regular steps: *umbilicus* broad, deep, infundibuliform, exhibiting all the volutions; *suture*, on the inside, distinct and impressed; *aperture* oblique, subangular. *Surface* marked with unequal transverse rugæ and fine striæ.

Diameter of base, .79; height of spire, .48; diameter of aperture, .30.

This fossil is abundant, in some localities, in the 1st Archimedes or Kaskaskia Limestone.

Euomphalus Boonensis.

Shell small, plano-concave; *whorls* three or four, carinated on the junction of the upper and outer margins; from which the outer surface is convex; thence flattened and sloping in to a subcarinated edge on the lower margin; convex from the lower edge to the suture; upper surface from the carina to the suture slightly convex: *suture* on each side impressed and conspicuous; *aperture* subangular. *Surface* marked with transverse striæ parallel to the periphery of the aperture.

Diameter, .90; diameter of aperture, .33.

This shell most resembles the *E. latus* of Prof. Hall; but its size and the shape of the volutions make it very distinct.

It is a rare fossil in the Encrinital Limestone of Missouri.

Dentalium Missouriense.

Shell of medium size, thin, terete, subarcuate, inflated at the aperture. *Surface* marked with small, distant, longitudinal costæ.

Length from two to three inches.

Very rare in the upper divisions of the Archimedes Limestone at Chester, Illinois, and St. Mary's, Missouri.

Pleurotomaria(?) Chesterensis.

Shell small, oblique, conical: *whorls*, five or six very convex; last whorl much larger, expanded towards the aperture; flattened on the outer margin with a larger and deeper sulcation on each side of the flat band: *aperture* oblique, orbicular, or ovate: *suture* distinct and deeply impressed. *Surface* marked with small, rounded, revolving costæ.

Length, .75; width of base, .47; length of aperture, .30. Spire above the last whorl more than half the length of the shell.

This fossil is rare in the Upper Archimedes Limestone at Chester, Illinois.

Pleurotomaria trochiformis.

Shell depressed conical, tapering rapidly. *Volutions* flattened on the outer and upper side, obtusely carinated on the outer margin ; the last one convex below ; the others, at their base projecting beyond the top of the one below : *umbilicus* deep, infundibuliform : *aperture* angular. *Surface* marked with sharp, distinct, transverse striæ, parallel to the margin of the aperture.

This shell resembles the *P. Wortheni* of Prof. Hall ; but its spire is larger, more conical, has no revolving costæ on the lower side of the body whorl, and the lower part of the upper volutions do not project so much in the *Wortheni.*

Dr. Giddings collected this fossil from the Archimedes Limestone of Cooper county, Missouri.

Bellerophon Missouriensis.

Shell subglobose ; *outer whorl* carinated, inflated at the aperture ; *aperture* very large, transverse, sinuate in front. *Surface* marked with small, rounded, longitudinal costæ and transverse striæ parallel to the aperture.

This fossil is common in the upper beds of the Archimedes Limestone, at Chester, Illinois.

Natica Chesterensis.

Shell of medium size, ellipsoidal, oblique ; *spire* small, depressed ; *volutions* five or six, convex ; *suture* depressed and filled with enamel ; *body whorl* large and convex ; *aperture* oblique, elliptical ; anterior extremity somewhat prolonged and slightly reflected. *Surface* is marked with numerous, minute, thick-set, oblique papillæ.

Length, 1.00 ; length of spire, .35 ; diameter of body whorl, .60 ; length of aperture, .60 ; breadth of aperture, .50.

This fossil is rare in the 1st Archimedes or Kaskaskia Limestone at Chester, Illinois, and near Ste. Genevieve, Missouri.

Macrocheilus Cooperensis.

Shell small, obliquely conical ; *whorls* four or five, very convex, the last very large ; *spire* one half the length of the shell, tapering rapidly ; last whorl very large, most convex near the lower margin, subflattened on the upper and outer margin ; *suture* deeply impressed.

Length, .47 ; diameter of base, .30 ; length of aperture, .25.

This fossil was discovered in the Archimedes Limestone of Cooper county, by Dr. Giddings.

NOTICE *of some* NEW *and imperfectly known* FOSSILS *from the* PRIMORDIAL ZONE (POTSDAM SANDSTONE *and* CALCIFEROUS SAND GROUP) *of Wisconsin and Missouri.**

By B. F. SHUMARD, M.D.

[May, 1862.]

CRUSTACEA (TRILOBITES).

DIKELOCEPHALUS LATIFRONS, n. sp.

Head rather large, flattened convex, having a wide border in front with a gently convex rim, within which is a strong groove, and between this and the front of the glabella a gently convex surface double the width of the marginal rim. This surface is marked with fine, slightly flexuous lines, which arise from the groove in front and converge to the front of the glabella. The width of the border is rather more than two thirds the length of the glabella. The glabella is flattened convex, truncated conical, very gently rounded at apex, sides nearly straight, and the surface marked with two or three very obscure furrows on each side of the median line. At the base is an obscure transverse furrow.

The eyes, cheeks, thorax, and pygidium, are unknown.

Length of head, 13 lines; length of glabella, $7\frac{1}{2}$ lines; width at base, $6\frac{1}{2}$ lines; width at apex, 4 lines.

This species is nearly related to *D. planifrons*, Billings, from which it differs in having a proportionally wider front margin, while the sides of the glabella converge much more rapidly from base to front. Mr. Billings finds also in the Canadian species a curved row of punctures just within the marginal rim, whence arise the striæ which converge to the front of the glabella; but in our specimen no traces of such punctures are visible.

The only specimen I have seen of this species is a cast in fine grained yellowish-gray micaceous sandstone, filled with remains of *Conocephalites* and an *Orthis* which resembles *O. Coloradoensis*, Shum.

Geol. Pos. & Loc.—Primordial Sandstone (Form. No. 1 of Owen's Geol. Surv. of Iowa, Wisconsin and Minnesota), Trempeleau, Wisconsin.

ARIONELLUS BIPUNCTATUS, n. sp.

Small, moderately elevated; glabella convex, conical, truncated or sometimes very gently arched at apex; length ex-

* Figures illustrating the species described in this paper will appear in the next number of the Transactions.

cluding the neck segment equal to the width at the base, sides gently convex, neck furrow straight, moderately deep and well defined; neck segment short, semielliptical, with the sides gently rounded; dorsal furrows distinct all around, as deeply impressed as the neck furrow, and marked opposite each angle of the glabella in front with a minute circular depression; no lateral furrows visible on any of the specimens under examination; front margin rounded and occupying about one fourth the total length of the head; movable cheeks regularly convex, margined with a narrow, rounded, raised border, genal angles prolonged into long, slender, curved spines.

Length of head, 0.22 of an inch; length of glabella, 0.16; greatest width, 0.11.

The general contour of the head of this species when deprived of the movable cheeks reminds one of the head of *Homolonatus delphinocephalus.*

Geol. Pos. & Loc.—The glabella and cheeks occur in great profusion in soft ferruginous sandstone, of the age of the Potsdam Sandstone, near the mouth of Lawrence creek, a small tributary of St. Croix river, Minnesota. I have not observed it at any other locality in the Northwest.

CONOCEPHALITES IOWENSIS, *Owen* sp.

DIKELOCEPHALUS (?) IOWENSIS, *Owen*. Geol. Rep. Iowa, Wisconsin and Minnesota, Tab. 1, fig. 4, and Tab. 1 A, fig. 13.
CREPICEPHALUS, id. ibid, Tab. 1 A, fig. 10, 16 & 18.
UNDET. TRILOBITE, id. ibid, Tab. 1 A, fig. ii.
LONCHOCEPHALUS, id. ibid, Tab. 1 A, fig. 15.

Head moderately large, flattened convex; glabella gently convex, truncated conical, length excluding neck segment equal to the width at base, front gently rounded, no traces of lateral furrows; neck furrow linear, sharply impressed and somewhat shallower in the middle than at the extremities; neck segment not elevated above the curve of the glabella, with sides converging rapidly from the neck furrow to the posterior margin, which latter is short and straight; dorsal furrows narrow and rather strongly impressed around the sides and front of the glabella; front margin forming about one fifth the total length of the head, having a deep transverse groove situated in advance of the middle, and a cord-like rostrum in front; immovable cheeks flattened convex, not as high as the glabella, palpebral lobes separated from the cheeks by a strong sigmoid furrow contracted at extremity in front.

Thorax and movable cheeks unknown.

Pygidium subquadrangular, sides converging from behind forwards at an angle of 25°; margin wide, flattened, terminating on each side posteriorly in two long, slender, slightly curved, diverging spines; axis and lateral lobes forming together nearly a semicircle—the former moderately elevated, cylindrico-conical, bluntly rounded at extremity, as wide as the lateral lobes; annulations four or five, rounded, separated by narrow furrows—the first three sharply impressed, the last nearly obsolete; lateral segments four, well defined by the lateral furrows—the first expanding a little towards the extremity, the second and third smaller and with margins nearly parallel, the fourth triangular.

Length of head, 8 lines; length of glabella, 6 lines; width of same at base, 5½ lines; width at apex, 3 lines.

This species may be readily distinguished from the *Crepicephalus Wisconsensis*, Owen, to which it is somewhat nearly allied, by its wider and more conical glabella and much narrower front margin. The pygidium (supposed by Dr. Owen to belong to the *C. Wisconsensis*) is also very distinct from that of the species under notice.

After a careful investigation of Dr. Owen's figures in his invaluable Report on the Geology of Iowa, Wisconsin and Minnesota, and a study of specimens from the localities cited by him, I am satisfied that the synonymy of this species as above given will be found correct.

The *C.* (*Dikelocephalus?*) *Iowensis* was founded by Dr. Owen upon the tail-shields of specimens from the Mississippi opposite the mouth of Black river, and I am pleased that I am able to add now to our knowledge of this interesting species a description of the head.

The genus *Crepicephalus* is not adopted, as it appears to me not to differ materially from *Conocephalites*. Dr. Owen, in his description of the genus *Crepicephalus*, refers evidently to the existence of ocular ridges when he says that "oblique plications can be traced on the cheek plate in advance of the eye converging towards the apex of the glabella"; and I can discern, also, obscure ocular ridges on one of my specimens of *C. Iowensis*.

Geol. Pos. & Loc.—From the Potsdam (Primordial) Sandstone of the Bluffs of the Mississippi near the mouth of Black river, Wisconsin.

Conocephalites Wisconsensis, *Owen* sp.

Crepicephalus (?) Wisconsensis, *Owen*. Geol. Rep. Iowa, Wisconsin and Minnesota, Tab. 1, fig. 8 & 13, and Tab. 1 A, fig. 16.

This is a well marked species, and readily distinguished from the preceding by its glabella, which is proportionally narrower and longer, while the sides are subparallel and almost as wide at apex as at base. The front border of the head is also double the width of that of *C. Iowensis*, and, according to Dr. Owen, the postero-lateral angles of the pygidium are rounded, and not prolonged into sharp, slender spines. Dr. Owen has given some excellent figures of the head and pygidium of this species, in the work above cited, under the generic title of *Crepicephalus*. This latter genus, as above stated, appears to me to differ in no essential characters from *Conocephalites;* which has been extended by Barrande and Angelin to include such genera as *Solenopleura*, *Eryx*, *Conocoryphe*, and *Harpides*. I have before me a specimen of *C. Wisconsensis* from the Potsdam Sandstone of Lawrence creek, near St. Croix river, Minnesota, which plainly exhibits an ocular ridge on either cheek, extending obliquely forward and inward from the eye to the glabella, and the facial suture has likewise the same direction as in *Conocephalites*.

CONOCEPHALITES CHIPPEWAENSIS, *Owen* sp.

LONCHOCEPHALUS CHIPPEWAENSIS, *Owen*, 1852. Geol. Rep. Iowa, Wisconsin and Minnesota, p. 576, Tab. 1, fig. 6 & 14, and Tab. 1 A, fig. 9.

This species is much smaller than the preceding. The glabella is rather strongly convex, conical, longer than wide, strongly rounded in front, and with sides slightly arched and converging very gradually from the apex posteriorly. Some specimens exhibit two or three indistinct furrows on either side, which are strongly curved backwards, while others show no traces of these furrows. The dorsal furrows are linear, deep, and distinctly separate the glabella from the cheeks and front. The neck furrow is narrow and well marked. The neck segment is not as high as the glabella, and terminates behind in a long slender spine. In some examples the margin in front is emarginate, as shown in two of Owen's figures (Tab. 1, fig. 6, and Tab. 1 A, fig. 9), while in others it is gently rounded. We have a number of specimens referable to this species, which may be regarded as the type of the genus *Lonchocephalus*, proposed by the late Dr. Owen. After a careful study of the examples before us, some of which are from the localities cited by Owen, we are led to the opinion that *Lonchocephalus* presents no features of generic importance to distinguish it from *Conocephalites ;* we therefore unite it with the latter genus, which has priority.

The *Conocephalites minutus* of Bradley appears to be very closely related to the species under consideration.

CONOCEPHALITES HAMULUS, *Owen* sp.

LONCHOCEPHALUS HAMULUS, *Owen*, 1852. Geol. Rep. Iowa, Wisconsin and Minnesota, p. 576, Tab. 1 A, fig. 12.

This species appears to be quite distinct from the preceding, but evidently belongs to the same genus. I have not access to any specimens of it. According to Dr. Owen, its position is in the greenish sandstones (Potsdam Sandstone) about two hundred feet below the base of the Lower Magnesian Limestone of the Northwest.

CONOCEPHALITES MINOR, n. sp.

Very small; glabella well defined by linear dorsal furrows, subcircular, much elevated above the cheeks, regularly convex, slightly longer than wide, marked on either side with two short, deep, lateral furrows, which are directed obliquely backwards and reach not quite one third the distance across; neck furrow linear, distinctly but not deeply impressed, sinuate, arched forward in the middle; neck segment short triangular, gently convex, not elevated, posterior angle terminating in a delicate acicular spine, which is prolonged backwards, its length unknown; front margin narrow, convex; cheeks rounded, having very delicate ocular ridges, which pass from the eyes in a short curve to reach the glabella, a short distance in advance of the anterior glabellar furrow.

Length of head, 0.10 of an inch; length of glabella, 0.08.

The glabella of this species has the form and convexity of *C.* (*Menocephalus*) *globosus* of Billings; but the latter is destitute of lateral furrows, and the neck segment is not triangular as in our species.

Geol. Pos. & Loc.—This minute species occurs in the Potsdam Sandstone of the Bluffs of the Mississippi, near the confluence of Black river, Wisconsin, where it is associated with *Obolella*, *Pugiunculus*, and *Conocephalites Chippewaensis* (Owen sp.)

AGNOSTUS ORION (?), *Billings.*

A careful examination of some slabs of sandstone from the Mississippi, opposite the mouth of Black river, has disclosed the existence of a minute species of *Agnostus*, which appears to be identical or at least very nearly related to the above species. The specimen is a cast in friable sandstone, and is the only example known to me of a species of this genus from the Potsdam Sandstone of the Northwest.

GASTEROPODA.

STRAPAROLLUS VALVATAFORMIS, n. sp.

Shell small, spire forming about one third the total height; whorls about four, flattened at the summit, angulated at upper external margin, with a shallow groove just within; sides flattened convex, under surface rounded; body whorl enlarging rapidly, bearing on its side three moderately prominent, rounded carinæ; succeeding whorl with a single obscure carina, becoming obsolete on the inner whorls; aperture subquadrangular; umbilicus deep, exhibiting all the volutions.

The diameter of the largest specimen I have seen of this species is about six lines, but usually it does not exceed four lines. In the most perfect example of this species which has come under my observation the dimensions are: height, 2 lines; width, $3\frac{1}{2}$ lines; width of umbilicus, $1\frac{1}{4}$ lines.

This little species is very abundant in the cherty beds of the 3d Magnesian Limestone at a single locality in Ozark county, Missouri. It has not been observed elsewhere in the State.

Missouri State Collection.

Murchisonia Ozarkensis, n. sp.

Shell small, slender, spiral angle about 15°; whorls about seven, moderately convex, marked with rather obscure, revolving carinæ, of which there are four or five on the body volution; suture linear, well impressed; aperture elliptical.

Length, about 5 lines; width of body whorl, $1\frac{1}{2}$ lines.

This species occurs somewhat sparingly as silicious casts in rough cellular chert, of the 3d Magnesian Limestone, in Ozark county, Missouri.

Missouri State Collection.

Murchisonia carinifera, n. sp.

Shell small, conical; whorls subangulated, and bearing a rounded, revolving central carinæ; suture distinctly impressed. Spiral angle, 17°; sutural angle, 62°.

All the specimens found are casts, and in most of them the carina is apparent only in the lower whorls.

Resembles *M. perangulata* (Hall), but the mesial band is not double as in the New-York fossil.

Occurs with the preceding species.

Missouri State Collection.

Raphistoma subplana, n. sp.

Shell depressed, turbinate; width rather more than one third the height; whorls about four, periphery of last whorl sharply angulated, inner edge obtusely angulated; upper surface subplane, with a shallow groove just within the exterior margin; under surface convex; umbilicus small; aperture transverse, subtrigonal.

Width, $4\frac{3}{4}$ lines; height, 3 lines.

This shell resembles *R. planistria*, variety *parva* (Hall), a species of the Chazy Limestone of New-York, but is more depressed, while the aperture is transverse and not longitudinal as in that species.

Occurs with the preceding species in Ozark county, Missouri.

Missouri State Collection.

CEPHALOPODA.

Orthoceras Ozarkense, n. sp.

Shell elongate, very gradually tapering to the apex; septæ very thin, deeply concave, from nine to ten in the space of a quarter of an inch; external edge plane and slightly sinuous; siphuncle marginal, transverse section reniform, surface marked with annulations, oblique to the axis, the grooves between accommodating the edges of the septæ. In some specimens the surface of the shell is marked with faint longitudinal striæ.

This species may possibly be identical with *O. primigenium* (Vanuxem) of the Calciferous Sandrock of New-York; but the published figures of that species in the New-York Reports have been drawn from such imperfect specimens that it it is impossible to institute a satisfactory comparison.

Occurs in the 3d Magnesian Limestone (Calciferous Sand Group) of Ozark county, Missouri.

Missouri State Collection.

Lituites complanata, n. sp.

Shell small, depressed discoidal; sides very gently convex; volutions about four, not embracing, sloping from the ventral to the dorsal margin, which latter is subangulated, transverse section ovate; siphuncle small dorsal; septæ thin, concave—those of the last volution near the outer chamber scarcely more than one half the width of those of the inner volutions. No surface markings are visible on any of the specimens under examination.

Dimensions.—Diameter across the volutions, 1 inch; width of aperture, 3 lines; height of same, 2½ lines.

This elegant little species occurs somewhat abundantly in the Calciferous Sandrock (3d Magnesian Limestone of Prof. Swallow) in Ozark county, Missouri. All the specimens are silicified, and they were obtained from an exceedingly rough cellular chert, interstratified with sandy-textured Magnesian Limestone.

Missouri State Collection.

Descriptions of New Palæozoic Fossils.

By B. F. Shumard, M.D.

[May, 1862.]

Spirifera Organensis, n. sp.

Shell of medium size, semielliptical, very transverse, width about double the length; thickness somewhat more than half the length; hinge line extended and terminating in acute points: lateral margins very gently arched from the cardinal angle to the front, which is excavated at the mesial elevation. *Ventral valve* gently and regularly convex; sinus moderately excavated, gradually increasing in width to the front, and marked with seven or eight small, rounded costæ, of which the median one is simple, while the others are derived from the trichotomizing of two which originate one on each side of the beak; area narrow, slightly concave, terminating at the extremities in very acute angles; deltoid opening rather large, and forming almost an equilateral triangle; beak small, moderately elevated, and overhanging that of the opposite valve. *Dorsal valve* less convex than the ventral, flattened on each side of the mesial elevation, which latter is but little elevated, rounded, expands rapidly towards the front, and is limited by curvilinear margins. Surface marked with small, rounded costæ, of which those on the sides bifurcate near the cardinal edge, and thence usually continue without further division to the front margin, where, in the specimens before us, we can count from 20–22 on each side of the mesial fold and sinus; those which originate at the beak are disposed in two fasciculi of three or four costæ each; the surface is also covered with extremely fine waved lines of growth.

Dimensions.—Length, .95 inch; width, 2.10 inches.

This species is quite unlike any species known to me from American strata. In general form and appearance it resembles *Spir. Forbesii* (Nor. & Prat.), a fossil of the Encrinital Limestone of Iowa and Missouri, but may at once be distinguished from that species by the absence of granulæ on the surface, and its wider deltidial opening. Compared with *Spir. camerata* (Mort.), our shell is much more extended at the hinge line, much less gibbous, and the costæ are not disposed in fasciculi as in that species.

Geol. Pos. & Loc.—This fine species was found in considerable abundance, by Dr. G. G. Shumard, in the Coal Measures of the Oregon Mountains, not far from Ft. Filmore, New Mexico, where it occurs with *Fusulina gibbosa*, of Meek and Hayden.

GONIATITES TEXANUS, n. sp.

Shell large, discoidal, strongly rounded on the dorsum, gently convex on the sides; umbilicus deeply excavated, exhibiting the inner volutions, and having a diameter equal to two-thirds the greatest width of the last volution; margin subangulated; transverse section of last volution semielliptical; its dorso-ventral diameter about equal to, or a little greater than, the width from side to side.

A small fragment only of the shell is preserved in one of the specimens in the Texas State Collection. It is extremely thin and the surface is marked with numerous parallel revolving lines, crossed with flexuous transverse lines, presenting a neat cancellated appearance. There are also faint indications of transverse costæ perceptible near the margin of the umbilicus. *Septæ* deeply sinuous; dorsal lobe cleft by a profound linguæform sinus with a broad base, into two narrow, elongated branches, which are not as wide as the sinus between, and which are gently expanded in the middle and narrowed to an acute point at their extremities by an oblique truncature of their inner margins; dorsal saddle linguæform, longer than wide and larger than the branches of the dorsal lobe; superior lateral lobe having nearly the same form as the branches of the lateral lobe, but larger.

Diameter, 3.35 inches.

Bluffs of Wallace creek, San Saba county, Texas, in dark Carboniferous (Coal Measures?) Limestone.

Texas State Collection.

GONIATITES CHOCTAWENSIS, n. sp.

Shell discoidal, broadly and strongly rounded on the dorsum and flattened laterally, inner volutions entirely concealed by the outer one; umbilicus small, its diameter scarcely equal to one sixth the breadth of the volution; transverse diameter of volution about equal to the breadth from dorsal to ventral side; aperture lunate, much wider than high; surface marked with fine, distinct revolving lines, less than the width of the intervals between, crossed by extremely fine, crowded, transverse striæ. *Septæ* having but one lateral lobe on either side; dorsal lobe as wide as long, divided into two lanceolate branches by an accessory saddle, which is truncated and bifid at tip and extends almost to the middle of the lobe; dorsal saddle of the same form, but wider and double the length of the branches of the dorsal lobe; superior lateral lobe wider than the dorsal saddle, and contracted at extremity to an acute point.

This shell resembles the *G. striatus* (Sowerby) both in the form and number of the lobes of the septæ and its surface markings, and for several years I have had it in my cabinet under the latter name. A closer examination, however, shows points of difference which appear to me to be of specific value. The striæ of our shell are finer and more crowded; the dorsum is more broadly rounded, and the umbilicus is proportionally smaller.

This very handsome species was found by Dr. Geo. G. Shumard in a dark compact Limestone supposed to belong to the Coal Measures, on the farm of Mr. J. Blackburn, in the Choctaw Nation.

Straparollus magnificus, n. sp.

Shell unusually large, smooth, or marked with fine striæ, discoidal; umbilicus wide, equal to about one half the diameter of the shell, and exhibiting from three to four volutions; suture deeply impressed; volutions very slightly embracing; width from dorsum to suture less than the height; dorsum broadly and somewhat deeply excavated, with the dorso-superior and inferior margins obtusely angulated; under and upper surfaces marked with a revolving series of large and somewhat prominent nodes, which are situated nearer the umbilical than the dorsal margin, and of which in the last volution about sixteen can be counted in each series; exterior to the nodes the surface is flattened; umbilical margin rather strongly rounded to the suture.

Dimensions.—Diameter, 10 inches; height of aperture, 5 inches; width of same, 3½ inches.

The specimen is composed of silex, and a portion of the matrix is so firmly attached to the shell that it is impossible to remove it so as to exhibit the spire.

This, the largest known species of the genus, is in the cabinet of Dr. A. Litton of St. Louis, by whom it has been kindly loaned to me for examination and description. It was sent to Dr. Litton from Tennessee by his brother, who obtained it from a person who stated that it was found in Kentucky. Its precise geological position is unknown, but some fossils which adhere to the matrix lead me to believe that it belongs to some one of the divisions of the Carboniferous System.

Proetus Proutii, n. sp.

Body subelliptical or subovate, length about one third greater than the width, moderately elevated; head nearly semicircular, with the genal angles produced posteriorly to a point opposite the sixth thoracic segment; border of moderate width, a little convex, and marked with a very shallow groove, internal to which is a deeper groove separating the border from the cheeks; facial suture very sinuous, and reaching the posterior border nearer the genal angle than the dorsal furrow; glabella ovate-conical, longer than wide, occupying about two thirds the total length of the head, flattened convex, front strongly and somewhat narrowly rounded, sides contracted a little in advance of the middle and rounded before and behind the contraction; no glabellar furrows; occipital furrow profoundly impressed and bifurcated near the extremities, so as to leave a small, short, subtriangular lobe between the branches; occipital ring much wider than the thoracic rings and less elevated than the glabella; dorsal furrows rather shallow but distinct; eyes of medium size, not as high as the glabella; movable cheeks rather strongly convex and bounded posteriorly by a deep furrow.

Thorax slightly decreasing in width from the head posteriorly, composed of ten segments, trilobation strongly marked; axis wider than the lateral lobes, subsemicylindrical, slightly narrowing from before backwards, rings gently rounded and separated by distinct narrow furrows; lateral lobes flattened the inner third of their width, and thence bending somewhat abruptly downwards to the exterior margin.

Pygidium nearly semicircular, depressed convex; axal lobe elevated, narrow conical, rounded at apex, not as wide as the lateral lobes; rings distinct but not prominent, separated by shallow furrows; lateral segments but little elevated, rounded, becoming obsolete before reaching the margin; border narrow and marked with a shallow depression all around. The pygidium of the specimen is slightly abraded, so that I can not count the rings and segments precisely, though their number may be estimated at from nine to twelve.

Length, 1.20 inches; width at base of head, 0.77 of an inch.

This species appears to be somewhat nearly related to the *P. Haldemani* (Hall) of the Hamilton Group of New-York and Pennsylvania, from which it seems to differ by its greater size, the absence of glabellar furrows, and other characters of more or less importance.

For the opportunity of describing this fine species I am indebted to the kindness of my friend, Dr. H. A. Prout of this city, who found it, some years ago, a short distance above the town of Davenport, Iowa, near the water-level of the Mississippi, in compact gray limestone, supposed to be of the age of the Hamilton Group of the New-York series.

It affords me much pleasure to dedicate this beautiful trilobite to its discoverer.

Genus Elæacrinus, *F. Rœmer*, 1852.

There is, in my opinion, good grounds for separating from the genus *Pentremites* those forms that have been hitherto included in the group *Elliptici* of Prof. Rœmer, and placing them in the genus *Elæacrinus* of the same author. We therefore propose now to group in the latter genus such forms as *Pentremites melo*, *P. Norwoodi*, *P. curtus*, *P. granulatus*, *P. Rœmeri*, *P. Sayi*, *P. cornutus*, and the species we are about to describe; also the *Nucleocrinus angularis* of Lyon.

Among European species, the following may be grouped in this genus: *Pentremites ellipticus*, *P. orbicularis*, *P. Derbiensis*, *P. oblongus*, and *P. angulatus*.

These form a very natural group, easily recognizable, and distinguished from the typical species of *Pentremites* by well marked characters. They are always of an elliptical or subglobular shape. The pseudo-ambulacral areas are narrow, with sides subparallel, and extend usually the entire length of the body. The basal pieces are nearly always concave, and generally situated at the bottom of a deep excavation. The tubular lamellæ, which in the interior reach from the ovarial apertures to the base of the pseudo-ambulacral fields, are more simple in structure, being much less convoluted, while the relative position of the ovarial apertures is different.

The typical species of the genus *Elæacrinus*, viz., *E. Verneuili*, long previous to the publication of Prof. Rœmer's description with figures was well known to American and also to some European palæontologists as *Olivanites Verneuili*, under which name it was designated by Prof. G. Troost in his Monograph on North American Crinoidea, which valuable memoir was completed a short time previous to the death of its author, but is not yet published. According therefore to the laws of priority, Rœmer's name, *Elæacrinus*, proposed in 1852, must be adopted, although it is to be regretted that the learned author did not adopt Troost's generic name in preference to creating a new one.

It is possible that the genus *Nucleocrinus*, proposed by Conrad in 1842, (Jour. Acad. Nat. Sci., Philad., vol. viii., p. 280, pl. xv., fig. 17,) may be identical with *Elæacrinus;* but the meagre and unsatisfactory description of Conrad ("this genus differs from *Pentremites*, Say, in having only one perforation at top, which is central") does not apply to any of the forms we propose to group in *Elæacrinus*.

The American species hitherto discovered are distributed through the Geological formations as follows: In the St. Louis Limestone two, *E. Kirkwoodensis* and *E. cornutus;* in the Warsaw Limestone one, *E. curtus;* in the Encrinital Limestone three, *E. Norwoodi*, *E. melo*, and *E. Sayi;* in the Chemung Group one, *E. Rœmeri;* and in the Devonian two, *E. Verneuili* and *E. angularis*. To these we may add an undescribed species found by the writer in the Silurian (Upper Helderburg) strata in Perry county, Missouri, and now in the Missouri State Collection.

ELÆACRINUS KIRKWOODENSIS, n. sp.

Body very small, subglobose, a little longer than wide, flattened above and below. Basal pieces very gently concave, with their edges on a level with the plane of the under side. Radial pieces (fork pieces) reaching to the base and occupying more than four fifths the entire length of the body, narrow below and widest in the middle, sides gently arched. Interradial pieces subdeltoid, very prominent towards the apex, much longer than wide, obtusely angulated below, acutely angulated above, and notched on either side a short distance below the summit. Pseudo-ambulacral areas extending from base to summit, narrow, deeply impressed; sides nearly parallel; pore pieces amounting to about fifty in each field. A longitudinal fissure or slit extends from the central summit opening downwards, separating the pore pieces of one side from their fellows of the opposite for the distance of about one fifth the length of the field, thence their inner edges are united in the median line to the base. Pseudo-ambulacral spaces lanceolate, sloping gently from their edges to the sutures. Ovarial apertures eight, very minute, situated at the notches of the interradial plates. Anal opening large, circular or very slightly elliptical. The surface markings are not plainly exhibited in any of the specimens I have collected of this species. On several of them I observe, more or less distinctly, irregular coarse rugæ or pittings, which, however, may be due to weathering.

Dimensions.—Length, 0.20 of an inch; width, 0.18.

The *Elæacrinus Kirkwoodensis* is nearly allied to *E.* (*Pentremites*) *melo*, from which it is distinguished by its much smaller size and less deeply excavated base. It also occupies a higher geological position.

Occurs in the St. Louis Limestone (Carboniferous) on the Pacific railroad near Kirkwood, St. Louis county, Missouri.

Topaz in Utah. By Henry Engelmann.

During my explorations in Utah as Geologist of the Expedition under Capt. J. H. Simpson, Top. Eng'rs. U. S. A., in 1858 and 1859, I observed some remarkably beautiful crystals of Topaz among some detritus of trachytic porphyry. They were perfectly colorless, transparent, sharply developed, and of great lustre. They were all short columnar. The largest of them measured scarcely one third of an inch in the direction of the basal cleavage, which was highly perfect. I observed ten modifications: all crystals exhibited (according to Prof. Rose's designation)

$\infty c : b : a$,	$\infty c : b : 2a$,	$c : \infty b : : \infty a$ 1 ,
$4c : b : \infty a$,	$2c : b : a$;	
most of them also	$2c : b : \infty a$,	$c : b : a$;
a few only	$2c : \infty b : a$,	and $4(?)\ c : b : a$.

As in none of the crystals were both ends developed, I could not ascertain whether they were hemihedral, as is most common with topaz. The hardness of the mineral is =8. It is infusible before the blowpipe; and when strongly heat ed is coated with small blisters, but does not show any change of color. It exhibits the reactions of fluorine, alumina, and silex. No tests were made for other elements, nor were the crystals examined in regard to pyro-electricity and polarization of light. They exhibit double refraction quite plainly.

The locality of the mineral is near lat. 39° 40′, long. 113° 30′ west of Greenwich, west of south of Salt Lake, in Thomas' range of mountains, on Capt. Simpson's return trail. Circumstances prevented me from obtaining more than a few crystals, which are now deposited in the collection of the Smithsonian Institute; a few others are also in the hands of members of the party. We were travelling at the time by forced night marches with nearly worn out animals, seeking to gain a spring of water in a distant range of mountains. This desert was then entirely unexplored. I have but little doubt that more interesting materials are to be found at the same point.

The mountains of the former Territory of Utah promise a rich yield to the mineralogist. We know already of gold and silver ores in the east, west and south part of that district; of copper and lead ores in the south, and I have discovered the latter also in the centre of it; of specular iron ores and native sulphur in the Rocky Mountains and near Little Salt Lake; of rock salt in the mountains south-east of Utah Lake; of native alum near Salt Lake; of various other salts in the deserts; and of silicates, composing the granites, porphyries, diorites, trachytes, and lavas, nearly over the whole area.

Additional Remarks on Atmospheric Electricity.

By A. Wislizenus, M.D.

The delay in the publication of this volume enables me to add to my observations of atmospheric electricity in 1861, the result of my observations in 1862. The latter observations have been made in the same manner and by means of the same fine glass thread, which, after many thousand torsions, proves as good as ever. I present herewith in tabular form the general result of my observations in 1861 and 1862.

I. *Monthly mean of Positive Atmospheric Electricity in* 1861 *and* 1862, *at St. Louis, Mo., based upon daily observations at* 6, 9, 12, 3, 6 *and* 9 *o'clock, from morning till night.*

	Jan.	Feb.	Mar.	Ap'l.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean of Year.
1861*	16.5	12.1	9.8	8.8	7.8	4.0	3.7	3.4	3.0	7.1	10.0	14.3	8.4
1862	12.1	16.0	9.4	10.6	7.5	3.0	2.2	2.3	3.0	7.7	12.6	13.9	8.4

* This table of 1861 differs in some decimals from that published on page 66 and in Diagram No. 1. Having discovered some errors, I calculated all my observations once more, and give now the present as the corrected table.

II. *Monthly mean of Temperature and of Relative Humidity in* 1861 *and* 1862, *at St. Louis, Mo., based upon daily observations, cotemporaneous with those of Atmospheric Electricity.*

TEMPERATURE.

	Jan.	Feb.	Mar.	Ap'l.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean of Year.
1861	32.2	40.4	44.8	58.1	64.1	76.9	77.5	78.6	69.1	57.9	46.0	39.7	57.1°F.
1862	28.9	30.2	43.2	55.0	69.7	75.1	81.2	80.7	72.1	57.3	42.6	41.3	56.4°F.

RELATIVE HUMIDITY.

	Jan.	Feb.	Mar.	Ap'l.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean of Year.
1861	72.2	63.3	64.5	61.5	66.3	70.8	66.3	69.6	77.3	76.6	69.0	74.3	69.5
1862	85.3	73.9	70.8	67.0	57.3	67.0	66.8	64.3	74.2	67.2	69.5	74.6	69.8

III. *Yearly mean of Positive Electricity of Temperature, and of Relative Humidity of the Atmosphere, at the hours of* 6, 9, 12, 3, 6 *and* 9, *from morning till night, based upon daily observations at these hours through the years* 1861 *and* 1862, *at St. Louis, Mo.*

ELECTRICITY.

	At 6 A.M.	At 9 A.M.	At 12 M.	At 3 P.M.	At 6 P.M.	At 9 P.M.
1861	8.6	10.0	9.2	7.9	8.7	6.9
1862	8.9	10.0	9.1	7.3	8.1	6.8

TEMPERATURE.

1861	48.9° F.	54.9	61.6	63.6	59.3	54.3
1862	48.9	55.0	60.9	62.3	58.0	53.6

RELATIVE HUMIDITY.

186'	86.4	71.3	60.3	57.2	65.1	77.3
186	5.3	70.6	60.0	57.5	67.6	78.0

IV. *Direction of Winds and number of Thunderstorms in '61 & '62.*

1861.	E.	N.	N.E.	S.W.	N.W.	S.	W.	S.E.	Prevailing Winds.	Thunder-storms.
January......	11	3	12	22	38	18	28	61	S.E.	 0
February	4	2	2	35	24	19	41	60	S.E.	 2
March.........	12	11	10	23	30	19	42	40	W. & S.E....	 3
April	16	10	9	26	21	35	34	26	S. & W.......	 2
May	26	10	23	21	8	13	49	35	W. & S.E. ...	 5
June	12	21	22	20	25	26	8	41	S.E.	 7
July	3	31	14	21	26	46	15	29	S.	 3
August	18	24	58	17	11	18	3	37	N.E.	 5
September...	6	14	18	26	30	13	21	52	S.E. & N.W.	 3
October	12	9	5	21	30	33	30	46	S.E. & S.....	 1
November....	7	15	8	22	27	20	36	44	S.E. & W. ...	 1
December ...	9	19	9	25	23	33	17	51	S.E. & S.....	 0
	136	169	190	279	293	293	324	522	S.E.	 32

1862.	E.	S.W.	N.	N.E.	W.	S.	N.W.	S.E.	Prevailing Winds.	Th. st's.
Jan.......	19	6	19	23	29	3	38	51	S.E.	1
Feb.......	14	9	18	16	22	7	39	43	S.E. & N.W.	0
March ...	9	14	3	15	59	10	34	43	W., S.E. & N.W.	4
April	12	13	18	31	18	11	34	47	S.E., N.W. & N.E..	6
May......	12	18	14	38	18	30	14	44	S.E. & N.E...........	5
June	3	29	24	16	8	36	26	23	S., S.W., N.W., N. & S.E................	6
July......	5	25	17	7	2	24	31	77	S.E.	10
August..	6	16	16	45	5	22	28	48	S.E. & N.E...........	7
Sept.	16	10	21	18	11	18	13	72	S.E.	6
Oct.......	1	15	19	4	10	40	47	46	N.W. & S.E.	1
Nov.......	14	19	21	12	43	19	34	18	W. & N.W.	0
Dec.......	11	17	21	5	34	45	13	38	S., S.E. & W.	4
	112	191	211	230	259	265	351	550	S.E.	50

V. *Positive or Negative Electricity in the Observations of* '61 & '62.

	Positive Electricity.		Negative Electricity.		No Electricity, or 0.		Highest Positive Electricity.	
	1861.	1862.	1861.	1862.	1861.	1862.	1861.	1862.
Jan.......	179	179	3	5		2	40°	40°
Feb.......	162	166	6	2			34	33
March ...	168	179	15	8			30	48
April	157	157	12	22	1	1	33	52
May......	171	180	17	5	1	3	25	32
June	162	143	5	2	8	20	16	21
July......	183	153	3	8	1	24	14	11
August..	176	143	5	4	6	40	15	19
Sept......	169	117	1	1	10	61	18	23
Oct.......	162	143	4	3	20	41	33	35
Nov... ...	172	157	2	7	6	16	42	42
Dec... ...	175	166	5	0	6	17	37	35
	2046	1883	78	67	59	225	42°	52°

VI. The appearance of negative electricity was connected in

1861. No. times.	1862. No. times.	
30	32	with thunderstorms.
23	28	with rains without thunder and lightning.
20	4	with dry storms (without rain and without thunder and lightning).
4	3	with snow.
1	0	with fog.
78	67	

VII. *Relation of Rain and Snow to Electricity.*

Rain without thunderstorm was accompanied

	By Positive Electricity.		By Negative Electricity.		By no Electricity.	
	In 1861.	In 1862.	In 1861.	In 1862.	In 1861.	In 1862.
January	7	5	3	2	......	2 ......
February	2	1	4	1	......	......
March	......	5	6	4	......	......
April	8	6	7	11	......	1 ......
May	10	7	1	1	3	1 ......
June	7	1	......	......	......	3 ......
July	2	4	......	......	......	3 ......
August	3	......	1	......	1	2 ......
September	4	......	......	1	4	8 ......
October	3	1	1	1	7	1 ......
November	2	3	......	7	......	7 ......
December	2	3	......	......	......	6 ......
	50 + el.	36 + el.	23 — el.	28 — el.	15 no el.	34 no el.

Snowing was accompanied

	By Positive Electricity.		By Negative Electricity.		By no Electricity.	
	In 1861.	In 1862	In 1861.	In 1862.	In 1861.	In 1862.
January	3	9	......	2	......	......
February	12	8	......	1	......	......
March	3	12	......	......	......	......
October	......	1	......	......	......	......
November	......	4	......	......	......	......
December	5	2	2	......	......	1 ......
	23 + el.	36 + el.	2 — el.	3 — el.	......	1 no el.

REMARKS.

The monthly mean of atmospheric electricity in 1862 was not quite so regular as that in 1861. While in 1861 an uninterrupted descent and ascent took place from January to December, we find in 1862 some interruptions in the steps of that ladder. The electricity in February, 1862, is about four degrees higher than that of January, April somewhat higher than March, and July is the lowest instead of September in 1861. These trifling irregularities may be accounted for by differences in temperature and relative humidity, and by a greater number of thunderstorms in 1862. January of 1862, for instance, was so unusually rainy, that its relative humidity too was unusually high, diminishing thus electricity. But the general features of distribution of electricity throughout the year are apparent in both years, and we may in that respect divide the twelve months of each year into two or three groups. Computing the months which give the highest electricity and those which give the lowest in each year, we find that in both years the months of January, February, March, April, November and December exhibit the highest, and the months of May, June, July, August, September and October the lowest electricity. The first group gives

The aggregate monthly mean of	71.5	degrees of electricity	in	1861
and	74.6	" "	"	1862
While the second group gives	29.0	" "	"	1861
and	25.7	" "	"	1862

The second group prevailed therefore in 1861, and the 1st in 1862.

Or we may divide the twelve months of each year into three groups. The first group with the highest electricity is formed by the months of January, February, November and December; the second with a mean electricity by the months of March, April, May and October; and the third with the lowest electricity by the months of June, July, August and September.

The aggregate monthly mean of

The first group	in 1861 is	52.9—in 1862,	54.6
The second "	"	33.5 "	35.2
The third "	"	14.1 "	10.5

Thus in 1861 the third group prevailed, and in 1862 the first and second. But these differences are so well balanced throughout the year, that the mean of the whole year in 1861 and in 1862 is exactly the same, namely, 8.4. Such an identity in the yearly result, even to decimals, is of course not to be expected every year; but it seems to prove, at least, that the yearly mean of electricity is as constant as that of temperature, of relative humidity, and of atmospheric pressure.

The third table, showing the daily periodicity of atmospheric electricity, confirms the daily two maxima and two minima of electricity as an undeniable fact.

METEOROLOGICAL TABLE FOR 1862—ST. LOUIS, MO.—BY DR. G. ENGELMANN.

Months.	Barometer, Reduced to Freezing Point. Mean of the Observations made daily at 7, 2 & 9 o'clk.	Barometer Highest.	Barometer Lowest.	Barometer Range.	Thermometer, (Fahrenheit.) Mean of the Observations made daily at 7, 2 & 9 o'clk.	Thermometer Highest.	Thermometer Lowest.	Thermometer Range.	Evaporation.*	Force of Vapor.	Relative Humidity.	Quantity of Rain and Melted Snow, in inches.	Prevailing Winds.	Proportion of Cloudiness.	No. of Thunderstorms.
Jan.	29.576	**30.216**	29.169	**1.047**	**29.5**	**46.0**	2.5	43.5	**1.4**	0.141	**85.2**	4.01	N.W. and E..	**8.7**	2
Feb.	29.579	29.946	28.954	0.992	30.1	56.5	**—1.0**	57.5	2.8	**0.118**	71.3	**0.80**	S.E. and N.W..	5.9	—
Mar.	**29.337**	29.789	**28.828**	0.961	43.3	80.0	19.0	61.0	4.7	0.175	63.2	4.11	W..	6.5	5
April	29.484	29.818	29.058	0.760	54.1	80.0	36.5	43.5	6.3	0.255	61.6	4.82	W., E., then S.E.	5.3	6
May	29.466	29.747	29.043	0.704	68.6	90.0	45.0	45.0	**9.5**	0.376	**55.3**	2.51	S.E., then W. and N.E.	3.6	4
June	29.462	29.790	29.134	0.656	73.6	95.0	52.0	43.0	7.8	0.528	64.7	2.85	S., next S.E., N.W. and S.W.	4.3	4
July	29.458	29.775	29.159	0.616	**80.0**	**100.5**	58.0	42.5	7.9	**0.681**	67.8	3.61	S.E.	4.0	**8**
Aug.	29.527	29.808	**29.287**	0.521	79.1	95.5	**60.5**	**35.0**	8.0	0.653	67.2	1.32	N.E., next E. and S.E.	**3.1**	4
Sept.	29.542	**29.738**	29.265	**0.473**	70.8	89.0	50.0	39.0	5.8	0.544	73.3	6.27	S.E.	3.6	6
Oct.	29.606	30.148	29.272	0.876	56.4	88.0	21.5	**66.5**	5.7	0.297	66.8	3.73	S.E., then S.	3.4	2
Nov.	29.604	29.964	29.085	0.879	41.9	75.5	26.0	49.5	4.2	0.171	66.2	3.59	W., then S.W. and N.W.....	5.0	—
Dec.	**29.645**	30.138	29.214	0.924	41.4	66.0	15.5	50.5	4.0	0.172	66.6	**6.38**	S.E. and S.	4.3	5
1862.	29.524	30.216	28.828	1.388	55.7	100.5	—1.0	101.5	5.7	0.343	67.4	44.00	S.E.	4.8	46

* Differences of wet and dry bulb Thermometers.

Ascent of Pike's Peak, *July 1st*, 1862, *by* Dr. C. C. Parry. *From a Letter addressed to Prof.* Torrey, *and communicated by him.*

Prof. J. Torrey, M.D.

Dear Sir: In accordance with frequent suggestions from you, recommending the examination of the memorable botanical locality known as James', or Pike's Peak, I feel gratified in being able to furnish you with a brief sketch of the results of such an exploration, accomplished on the 1st of July, 1862.

Since Dr. Edwin James, of Col. Long's expedition, first visited this alpine summit forty-two years ago, on the 14th day of July, 1820, there is no record of any professed botanist having made the ascent. For this long period, its peculiar vegetation has bloomed unheeded, and the meagre collection of plants made by Dr. James has not been duplicated in scientific herbaria.

It is true, indeed, that of late years, since the rapid settlement of the adjoining region, popularly known as Pike's Peak, various pleasure parties, intent on sight-seeing, and even *ladies*, have ventured to this snow-crowned summit, and Mr. M. S. Beach, of Colorado City, our guide on this last occasion, counted it as his third ascent; but by all these its floral treasures were only casually observed, and in no instance that I can learn have botanical collections been made.

The truthful and graphic account given by Dr. James, in Long's Expedition, of the ascent of this "*highest peak*," shows that the route then taken was substantially the same as that followed by us, and is no doubt the one most accessible, at least from the northern slope.

That remarkable and interesting stream, known by the expressive French name of *Fontaine-qui-bouit*,* which circles round the gigantic mass of rocks comprising the main peak, together with its lower range of mountains, pursues a general course east of south, and collects the waters flowing from its northern and eastern slope. This drainage is effected through numerous tributaries, coming more or less direct from the main peak, and cleaving their way through chasmed valleys and *cañons* of the most rugged character. Up one of the main forks, which enters the principal stream at the noted locality called "Soda Springs," or Boiling fountain, lies the most direct route for making the ascent. This stream, which ought to receive the historical name of *James creek*, at its junction with the *Fontaine-qui-bouit*, is about six feet in width, but soon con-

* The name, originally given to the carbonic acid spring, has been transferred to the stream into which it empties its waters, and is now used exclusively for it.

tracts its dimensions, as the valley through which it descends becomes narrow; and, farther up, is obstructed by fallen rocks. Winding among these, its swift current rushes along till a sudden descent projects it in the form of rapids and falls. Here, the scenery is wild in the extreme; the torrent, often lost entirely to view among masses of rock, shoots forth in frequent cascades, or is seen, through the vista of overhanging cliffs, boiling along its tortuous channels. The trail here is a succession of tedious clamberings from one mass of rock to another, or winding along the steep verge of precipices, and over sloping banks of decomposing granite. Among these rock crevices, grows profusely the elegant flowering shrub *Rubus deliciosus* of *James*, now just passed out of flower, and maturing its reddish purple fruit. This latter, however, will hardly be found to merit the title of *delicious*, the mass of the berry being composed of large grains, with very meagre insipid pulp. An interesting associate of this common shrub is the *Jamesia Americana*, *Torr. & Gr.*, its neat white flowers contrasting prettily with its wrinkled velvety leaves. Conspicuous among other plants, may also be noticed the *Yucca angustifolia*, now in the full glory of its globe-shaped flowers, of satiny lustre. Here and there, also, in detached localities, *Penstemon Torreyi*, *Benth.*, sends up its brilliant red spikes.

The trees include the elegant pyramidal forms of *Abies grandis*, here remarkable for the unusual length and breadth of its leaves; *Abies Douglasii* is also common, associated with *Abies Menziesii*, and *Pinus ponderosa*. Succeeding these at a higher elevation comes the Pine, which must now be undoubtedly regarded as the original *Pinus flexilis*, *James*. As such it has for several years been recognized by Dr. Engelmann, from the collection of Fendler, and others, though still doubtfully regarded in late European works on Coniferæ. Dr. James' account of this tree being quite meagre, and in some respects contradictory, it may be satisfactory to dwell at some length on its peculiar habit, as exhibited in this its original locality. In general appearance, it very closely resembles our *P. Strobus*, from which it differs mainly in its shorter and stouter entire leaves, more branching mode of growth, as well as in the yellowish brown cones, with peculiar thickened ligneous scales. The cones are inclined to be pendulous. The fertile aments occupy the extremity of the growing branch, extending in the same line with it; but in the second year the terminal bud shoots out, and by its development the growing cones, 1 to 5 together, are gradually deflected. Rarely more than two of these become fully grown, and as a general rule the mature cones fall off at the close of the second year, the opening scales having previously dropped their wingless seeds. These seeds are nearly equal in size to those of the

New Mexican nut-pine, *Pinus edulis*, of an irregular oval form, 4–5 lines long, and possess similar edible qualities. In addition to other peculiarities of this pine, may be noticed its slowness of growth; thus on a small trunk of 7¾ inches in diameter, there were 232 annual rings. Its wood is soft, of fine texture; the heart wood inclined to a yellowish cast. The flexibility of its branches, on which Dr. James founded its specific name, is partly due to the thickness of the elastic bark of the smaller twigs. The bark of the trunk is of a dark reddish-gray color, considerably furrowed, and about equal in thickness to that of our common white pine. The average height of full-grown trees is from 40 to 50 feet; they have a rounded outline, are generally low branched, and spreading; in the largest specimens observed, the trunk, a short distance from the surface of the ground, had a diameter of two feet and upwards.

The vertical range of this species, as observed between latitude 38° and 40° W., is from 7,000 to 11,000 feet above the sea. It rarely occurs in large bodies of timber, but is mostly of scattered growth, being associated, at its lowest range, with *Pinus ponderosa* and *Pinus contorta*, and at its upper limits with *Pinus aristata* and *Abies Engelmanni*. Besides *Pinus flexilis*, which alone seems to have particularly attracted the attention of Dr. James, he mentions, in a cursory way, the occurrence of *Abies balsamea*, *A. Canadensis*, *A. alba*, *A. nigra*, and *A. rubra*, these being the then recognized representatives of the fir tribe in eastern North America. In this enumeration, the very common error of confounding analogous species was committed; an error to which those who simply observe, and do not collect, specimens, are quite apt to fall into. It is sufficient to state, in this connexion, that not a single one of these species is recognized at present as occurring in this part of the Rocky Mountains; in fact, most of the species there met with, were, at that early day, unknown to science. Under the names of *Abies nigra* and *A. rubra*, there is little doubt that Dr. James had in view a very puzzling Rocky Mountain species, which, in imperfect material, has frequently turned up in collections from this region, as being usually classed under the names of *A. alba* or *A. nigra*. My attention having been particularly directed to this species by Dr. Engelmann, I became soon satisfied, in pursuing the investigation, that this was in fact a single undescribed species, appearing under different forms according to soil, altitude and exposure; to which, accordingly, I have ventured to affix the name of its actual discoverer, calling it *Abies Engelmanni*.

I continue the narrative of our ascent. On reaching an elevation of about 9,000 feet, the contracted valley, up which we were travelling, spread out into more free stretches, being on a level with the plateau of the first range of foot hills.

The surface is here covered with a rank growth of grass and scattering pine timber. Sweeping fires, which had passed over nearly this entire region of country, occasioned the destruction of the principal pine growth, which, with its dry, naked trunks, gave a somewhat forbidding aspect to the more open scenery. In the moist lower portions of the valley, the fallen timber unites with a matted growth of sub-alpine willows, rendering the passage tedious and difficult. The several valleys here converging from different directions gradually merge into a steeper, rocky slope, occupied, as before, with dead wood. On this sub-alpine inclination, few peculiar plants are met with; *Penstemon glaucus*, and *P. alpinus*, *Torr.*, being most conspicuous. From this point, the mountain slope increases quite rapidly, and the ascent is by steady and continuous climbing. The timber growth, confined almost exclusively to a more stunted form of *Abies Engelmanni*, with scattering trees of *Pinus flexilis*, soon gives place to open patches, disclosing a vegetation purely alpine. Here, for the first time, *Pinus aristata*, *Engel.*, makes its appearance; its deformed trunks, beset with withered branches, and sending off leafy tufts close to the ground, serve to give a peculiar blighted look to the landscape which it occupies. I have had frequent occasion, in my various mountain rambles, to notice the abruptness with which the alpine flora usually makes its appearance. After toiling slowly up the steep ascent, with little or nothing new to attract the attention, suddenly, on mounting some exposed knoll, a profusion of alpine flowers bursts on the view. The plants thus met with, include, almost constantly, *Primula angustifolia*, *Cymopterus alpinus*, *Eritrichium aretioides*, *Arenaria arctica*, *Silene acaulis*, *Aplopappus pygmæus*, &c. From this point, there is a constant succession of these interesting forms, varied according to the peculiar exposure, and the character of rock, or soil. Along the somewhat scanty alpine brooks of this region, (much less copious than those of the Snowy Range,) I was pleased to notice the elegant flowered *Primula Parryi*, with its very constant associate *Sedum rhodanthum*. The *Mertensia Sibirica* still maintains its position by the edges of streams, extending thence downward to the very base of the mountains. Here, also, we more or less constantly meet with *Sibbaldia procumbens*, *Saxifraga cernua*, *S. debilis*, *S. punctata*, *Caltha leptosepala*, and others. Among the plants not heretofore observed, is the neat *Androsace Chamajasme*, which exhales a pleasant odor of bitter almonds, and the beautiful red flowered *Saxifraga Jamesii*, rooting in crevices on the vertical walls of shaded rocks. These various forms continue, intermixed with patches of snow, till the limit of arborescent growth is reached, observing a well defined horizontal line along the mountain slope. According to barometric measurement, this line, at the point observed, having a north-east exposure, shows an elevation of 12,043 feet above the sea level. The last trees to maintain their position in this exposed locality, are *Abies Engelmanni*, and *Pinus aristata*, both of them dwarfed and stunted in their struggle with the elements, and exhibiting marks of decrepid age, in blasted trunks and prostrate branches. From some of these alpine *centennarians* we made huge fires to keep off the chilly night air, while spruce boughs supplied us with spring matresses.

As the setting sun passed over the western slope, the gigantic outline of Pike's Peak was projected on the plain below with wonderful distinctness, and in massive proportions.

Astir by daylight, to watch, from our mountain eyrie, the glories of an unclouded dawn, we were surprised and gratified by the faint chirp of birds, strangely contrasting with the bleak scenery by which we were surrounded. This morning carol we afterwards found to proceed from a species of mountain swallow, the nest of which we discovered still higher up on the alpine slope, at an elevation of not less than 13,000 feet above the sea. We could not but admire the taste with which the selection was made; a snug recess, scooped out amid the matted foliage of *Silene acaulis*, concealed from view by an overhanging tuft of *Dryas octopetata*, crowded with its pure white blossoms; while, in close vicinity, bloomed the beautiful *Primula angustifolia*, and fragrant *Eritrichium aretioides*. Under such circumstances, natural feelings overcame the scientific taste for collecting, and we left undisturbed the nest with its contents, consisting of five mottled, granite-colored eggs.

As the sun rose majestically above the well defined horizon of the plains, the resemblance to a wide open sea was strikingly manifested. A slight haze served to heighten the pleasant illusion, the inconsiderable elevations appearing only as ripples, or low islands, on its surface. To carry out the resemblance still farther, the rounded grassy swells, and reef-like ledges of tilted rock, at the foot of the mountains, could be readily taken for surges and breakers on this once well defined coast.

Setting our faces once more towards the gigantic peak, still towering 2,000 feet above us, we commenced the final ascent, slowly mounting over a varied surface composed of disintegrating rock, interspersed with patches of alpine sward. Conspicuous among the plants decorating this mountain sod, were the bright azure flowers of *Mertensia paniculata*, and *Eritrichium aretioides*, the latter, as one of the party significantly suggested, resembling "a piece of the sky just fallen down." Though as late in the season as the 1st of July, all the indications of vegetation were those of early spring. I looked in vain, at the foot of the snow drifts, to discover the

Chionophila, (snow-lover,) discovered here by Dr. James, and found last year on the Snowy Range, but the season was no doubt, too early; *Trifolium nanum* and *T. dasyphyllum* were, however, in full bloom, and quite conspicuous. Near the very summit, we first came upon the interesting tap-rooted *Claytonia*, observed so abundantly last season on the Snowy Range, at the head of South Clear creek. Here, it seemed dwarfed and stunted, having far less conspicuous leaves and flowers. This plant, together with an alpine *Thlaspi*, were the only flowers in bloom on the highest elevation.

The summit gained, there was opened an extensive view towards all points of the compass. To the east stretched the unlimited expanse of the great plains; while to the south could be traced the course of the upper Arkansas; north and west was a confused mass of mountains, interspersed with open valleys, including the broad basin of South Park, bounded by the sharply defined outline of the Snowy Range. From this point, I was able to detect an elevated peak, in the Snowy Range, visited a few weeks previously, having an elevation, according to barometric measurement, of 13,223 feet above the sea. I have called this peak *Mt. Guyot*, in compliment to the distinguished Swiss-American savant of that name. Other still more elevated points could be noticed, some of which are perhaps as high, or even higher, than Pike's Peak.

The summit of Pike's Peak is a somewhat level plateau, embracing several acres in extent, strewn with masses of detached rocks of a fine-grained granite, and occupied in part by extensive snow drifts. On the highest point of one of these, by the aid of a rough tripod, made from climbing staffs brought up by the ascending party, I set up my barometer, which, on adjusting the column of mercury, stood at 18,100; attached thermometer, 45° F.; detached thermometer, 37° F. Chilly gusts of wind, sweeping over the bald exposure, compelled me to change the place of observation to a more sheltered spot, about fifteen feet below the main summit. At this point, I made a series of observations for ascertaining the elevation, giving a result, as computed by Dr. Engelmann, of 14,216 feet above the sea.

Our observations finished, the more *facilis descensus* was commenced, not, however, without many weary steps, and much carefully poised balancing. We reached the timber line, to partake of our last mountain meal, and thence, by night fall, our pleasant camp ground at the *Fontaine-qui-bouit*.

Altitude of Pike's Peak *and other points in Colorado Territory.* By Dr. G. Engelmann.

Though the elevation of the Rocky Mountains from the British down to the Mexican boundary, and the configuration of that whole country, is now pretty well known through the explorations begun by Frémont, twenty years ago, and continued so extensively by the Mexican boundary survey, and principally by the different explorations of routes for a Pacific railroad, it has so happened that the Pike's Peak region has been almost entirely neglected. The then Captain Frémont had, in July, 1843, passed down eastward of the mountains, examined part of the South Platte, the Boiling Spring at the eastern base of the Peak, and other points in that district, and ascertained the altitude of several of them. On his return from California he passed, in June, 1844, through the three "Parks" to the upper headwaters of the Arkansas river and to the westward and southward of Pike's Peak. Being now left without barometers, his only means of determining elevations was by the temperature of boiling water, which in a few instances he made use of with a very good approximate result. The height of the Peak he never determined.

But we have two much older estimates (we cannot call them calculations) of the altitude of Pike's Peak. The discoverer and first chronicler of these mountain regions—the energetic and indefatigable Capt. Zebulon M. Pike, after whom the "principal peak," as he calls it in his quaint and curious "Account,"† has been named—has himself (Dec. 3,

† "An Account of Expeditions to the Sources of the Mississippi, and through the Western part of Louisiana, &c., in the years 1805, 1806 and 1807. Philadelphia. 1810."—Pike first saw the mountains from the Arkansas, Nov. 15, 1806; Nov. 24th to 28th he explored the "north fork" of the Arkansas, evidently the *Fontaine-qui-bouit,* without however discovering the famous spring itself, and ascended a chain south of the peak, from which "the summit of the grand peak, which was entirely bare of vegetation and covered with snow, appeared at a distance of 15 or 16 miles from us, and as high again as we had ascended." Pike with his few followers, during December and January, wandered about the mountains in search of the sources of Red river, and visited the headwaters of the South Platte, the Arkansas, and at last the Rio Grande, where he was taken prisoner by the Spaniards of New Mexico. The following account is now of some historical interest, since that country has acquired so much importance. In the Appendix to Part 3, p. 16, Pike relates how he met in Santa Fé one James Pursley, from Bairdstown, Ky., "the first American who ever penetrated the immense wilds of Louisiana," and who, after many adventures with the Indians, as whose captive he got into the Pike's Peak region, came to Santa Fé. "He assured me," he continues, that he "found gold on the head of La Pla te, and had carried some of the virgin mineral in his shot-pouch for months"—that "the Spaniards had frequently solicited him to go and show a detachment of cavalry the place, but that, conceiving it to be our territory, he had refused."

1806) measured it by triangulation "on the base of a mile," apparently on the Arkansas river, south of the Peak. He found it (p. 171, note) 10,581 feet above the level of "the prairie," and, supposing the prairie to be 8,000 feet above the level of the sea, he made the elevation of the Peak 18.581 ft. But as we know from Frémont's observation (Rep. 2d Exp., p. 116) that the Arkansas somewhat lower down, at the mouth of the Fontaine-qui-bouit, is only 4,880 feet, Captain Pike's base may have been about 5,500 instead of 8,000 feet, reducing the altitude of the peak to about 16,000 feet, still nearly 1,800 feet too much.

Col. S. H. Long, the second explorer of that region, on the contrary, estimated the base too low. The surgeon, botanist and historian of the expedition, Dr. E. James, says,* for Pike's 8,000 feet "we would substitute 3,000 feet." Dr. James was the first white man whose foot trod the summit of the Peak itself; its altitude was measured (Appendix, p. 37) by triangulation from camp on Boiling Spring creek, 25 miles from the Peak. A base of 1,048 feet was measured, a second base of 133,372 feet was calculated, and the height of the Peak above the "plain" where the observations were made was found to be 8,507.5 feet, which, with the 3,000 feet for the altitude of the base line, gives for the summit 11,507.5 feet above tidewater. Long's base, however, must have been somewhat lower than the Boiling Spring, say about 5,800 ft. above the Gulf, which would increase Long's result to about 14,300 feet, almost exactly the true height, as now ascertained by Dr. Parry.

This comprises the more or less precise knowledge we had of these mountains, until Dr. C. C. Parry, now of Davenport, Iowa, on his second botanical exploration of Colorado Territory during the summer of 1862, with an excellent mountain barometer, constructed by James Green of New-York, measured more than sixty stations, (and a number of them by observations continued for several days,) among them two of the principal passes and the summits of five of the highest mountains.

Entrusted by Dr. Parry with the calculation of these observations, I have thought it best to refer them to the corresponding observations made by me here in St. Louis at my station, 481 feet above the Gulf of Mexico, this being the next convenient barometrical station where regular observations are made and the altitude of which has been definitely ascertained. Though I am fully aware that the distance of 15 degrees of longitude intervening between both points must allow many disturbing influences to interfere with the per-

* Long's Expedition to the Rocky Mountains. By Dr. James. Philad. 1823. Vol. 2, p. 332.

fect accuracy of the result, the connected observations of Dr. Parry leave no doubt, that, during the summer season at least, the changes of atmospherical pressure in the region of the Rocky Mountains, or, to speak more precisely, of the eastern slope of the main chain of the mountains in Colorado, correspond in time very nearly with the changes observed here; sometimes I find them a day earlier here, and more rarely a day later,* and also that these changes are there much more moderate than they are here.

From a careful analysis of Dr. Parry's observations, I have further come to the conclusion, that the horary changes of the barometer are not very different from those noticed here, and for which I have from my long continued observations computed tables for the different months of the year, differing somewhat from the table of the Philadelphia corrections published by the Smithsonian Institution, (Table D, p. 93,) especially in the more decided rise of the mercury in the forenoon and its greater fall in the afternoon, the average difference for the whole year being here 0.076 and in Philadelphia 0.061 inches. With the assistance of these tables I have reduced Dr. Parry's observations to daily means, and have compared these with the means of the ten days, next preceding and following, at St. Louis, eliminating extraordinary and more local changes, which was done by the aid of diagrams, on which the daily means for both stations were laid down. The greatest element of error, no doubt, lies in the influence of the atmospheric temperature. Following the plan ot some computers, I have been induced to adopt, as an element in the calculation, the mean temperature of the day or days of observation instead of the actual temperature of the time of observation; but I am fearful that even thus I may have obtained a result a little too high, especially as I may have estimated the mean temperature too high, not being able to take sufficiently into account the excessive difference of the day and night temperature in those high mountains.

The altitudes of the stations where Dr. Parry was able to take observations for a number of days (Mt. Vernon, 9 days; Tarryall, 4 days; Soda Springs, 8 days; Colorado, 5 days; Empire City, 13 days, and Lindstorm's mills, 12 days) are, of course, the most reliable, and to them I have referred as much as possible other observations made in the neighborhood; thus, especially, those of Pike's Peak to the Soda Springs—Mt. Guyot to Tarryall—Mt. Flora, Gray's Peak, and Parry's Peak, to Empire City. The direct comparison of the

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* In winter these changes seem to occur from one to three days earlier there than here, as appears from the Hon. F. M. Case's observations, detailed at another place.

high peaks with the St. Louis station gave a somewhat different result, making them mostly from from 80 to 100 ft. lower.

I have for the computation made use of Delcros' Tables as prepared by Prof. Guyot and published by the Smithsonian Institution.

An important and curious, though not quite unexpected, result of Dr. Parry's measurements is the discovery, that the limit of arborescent vegetation is, in Colorado, reached only at an altitude of between 11,600 and 12,000 feet; an elevation which nearly corresponds with the same limit in the great mountain ranges of the globe nearer to the equator. Thus the Schlagintweits give the limit of the trees on the Himalaya (about lat. 31°) at 11,800 ft.; on the Andes within the tropics it is said by Humboldt not to reach over between 11,000 and 12,000 feet; only in Mexico do I find it recorded as high as 12,800 feet. On the mountains of the same or even lower latitudes it is much lower than in Colorado; thus on the Peak of Teneriffe (lat. 28°) it reaches only to 7,300 feet; on Mt. Etna (lat. 38°, nearly the same as Pike's Peak) to 6,600 feet, and in the Alps of Switzerland (about lat. 46°) on an average also to 6,500 feet. The cause of this remarkable apparent deviation from physical laws is to be found in the great elevation of the greatest plateau on the globe, which extends between the upper confluents of the Mississippi and the California coast range over from 12 to 20 degrees of longitude, and from the plateau of Mexico far into the British possessions, widest between the parallels of 40 and 42 degrees, at an elevation of between 4,000 to 7,000 feet, reaching its highest points just in Colorado Territory,* carrying the general mean temperature of the whole region far above that of smaller mountain ranges or isolated peaks of the same altitude and under the same latitude.

Another cause of this higher mean temperature will be found in the absence of large masses of perpetual snow in the Colorado mountains, which, whenever present, cannot fail to depress the temperature of the regions next below them. The snow-line proper is not reached in the Colorado mountains at all, though masses of snow are found on many high points all the year round. The only chain of the Rocky Mountains proper supposed to reach into the limits of perpetual snow are the Wind River mountains (lat. 42°), where, according to Frémont's observations, made in Aug., 1842, the arborescent vegeation attains its upper limit at 10,160 feet (1,500 to 1,800 ft. lower than in Colorado), and the snow-line commences about

* Dr. Parry is confident that a number of peaks, not yet explored, reach quite up to 15,000 feet or more; so that the palm lately awarded by Prof. T. D. Whitney to Mt. Shasta in California (14,410 feet) as the highest point in the territory of the United States, may soon have to be transferred to some peak in Colorado.

feet higher, with 12,400 feet, while the summit of Frémont's Peak reaches more than 1,100 feet into the region of eternal winter, to 13,570 feet.

Besides this, I find in the works at my disposal only the following notices about the altitude of the upper tree limits in our western mountains:

Capt. Gunnison states (Pacif. R. Rep. 2, p. 47), that pines and aspen groves occur on the mountain sides over the Cochatoopee Pass (lat. 38°), which itself is 10,000 feet high.

Capt. Whipple (ib. 4, p. 20) tells us, that *Pinus flexilis* is found on the Sandía Mountains, in eastern New Mexico (lat. 35°), at an elevation of 12,000 feet, and Dr. Bigelow, who ascended these mountains, informs me that their top is covered with that pine. Capt. Whipple further states (ib. Appendix, p. 280, note) that on the San Francisco Mountain, in western New Mexico, in the same latitude, the pine timber reaches up to 504 feet of the summit of 12,052 feet; therefore, to an elevation of 11,548 feet. In another place (vol. 3, Geol., p. 7) the summit is stated to be 13,000 feet high, which, if correct, would bring the upper limit of trees to about 12,500 feet.

My brother, Henry Engelmann, informs me, that in Capt. Simpson's expedition he found the highest growth of trees on the level, wet tops of the Uintah Mountains (lat. 41°), south of Fort Bridger, to consist of aspen, at 10,000 feet elevation; and that in August he met with snow there on the same level.

Corresponding with this observation, Dr. Newberry (Pac. R. Rep. 6, Bot., p. 44) found the line of "perpetual" snow on the Cascade Mountains, in lat. 44°, at 7,000 feet; at 6,500 feet he found good sized pine timber, and higher up, "to the snow-line itself," pines of scrubby growth. Both these observations cannot refer to a real snow-line, as that never reaches down to the limit even of the most scrubby pines.*

As everywhere else in the northern hemisphere, or rather north of the tropics, Coniferæ are in Colorado those trees which form the extreme limit of arborescent vegetation, though aspen and birches reach almost as high in suitable, moist localities.

The following tables exhibit some interesting facts in relation to the distribution of the incipient population of Colorado over different altitudes. The "cities" extend from 5,300 feet (Denver) to 8,600 feet (Empire City), and a few small towns even reach to near 10,000 feet (Jefferson and Tarryall). Ranches—i. e., farms, the upper ones only grazing farms—are found up to about the same elevation. Dr. Parry, however, informs me, that crops of wheat, maize, barley, oats, &c., are

* Mount Washington, in New Hampshire (lat. 44°), 6,285 feet high, does not reach to the snow-line, but the timber ceases at perhaps 1,000 feet below the top, say at 5,000 or 5,200 feet altitude.

raised almost exclusively along the South Platte, or near the base of the mountains, where irrigating streams can be conducted over alluvial flats. Within the mountains, at an elevation of 8,000–9,000 ft., rarely some sunny nook in a sheltered valley is planted with potatoes, turnips, and other kitchen vegetables. At an elevation of 8,500 feet potatoes become precarious, and the doctor saw a small potatoe patch, at 8,738 feet altitude, cut down by frost on August 4th. Turnips do better. These facts are curious, because it is generally assumed that cereals can be raised in mountain districts almost as high up as trees will grow. The pastures are good far up the alpine slopes, and unsurpassed in the upper part of the Middle Park, 8,000–8,700 feet high; but they are poor on the rocky slopes lower down.

1. *Route from Omaha to Denver.*

	Feet.
Omaha, library in statehouse, 211 feet above the Missouri	1,155
Baker's and Fales' Ranch, 2 miles above lower crossing of South Platte	3,161
Julesburg, upper crossing of South Platte, 8 feet above river	3,703
Mouth of Beaver Creek, 4 feet above river	4,284
Bijou Creek, on "Cut-off"	4,712
Mail Station, 12 miles from last point, now abandoned	4,963
Thirteen-mile Creek, 13 miles from Denver	5,776
Denver City, lower bottom of Platte, near mouth of Cherry creek	5,303

2. *Route from Denver southwestwardly to Tarryall,* 80 *miles.*

Mount Vernon, at the base of the mountains, 12 miles from Denver	6,421
Bergen's Ranch, 10 miles further south-west	7,752
Bear-creek Station, 15 feet above level of creek	7,198
Bradford Junction, 8 miles further	8,069
Dr. Casto's Ranch, 1½ miles from last	8,380
Elk Creek, 6 miles from Junction, 25 ft. above level of creek	8,150
Summit of hill on road leading down to the Platte	8,881
North branch of South Platte, 10 feet above water level	8,028
Same, 6 miles higher up, at Lee's Ranch, 30 ft. do. do.	8,435
Same, 3 miles higher up, at a deserted Ranch, 6 ft. do. do.	8,657
Same, 11 miles higher up, junction of the upper branches, near a deserted Ranch, 8 feet above water level	9,153
First appearance of *Pinus aristata* on the road	9,342
Lake-house, on the Divide leading down to the South Park	10,041
South Park, at Junction Ranch	9,453
Same, near the town of Jefferson	9,842
Range-house, near Georgia Pass	10,498
Georgia Pass, or Jefferson Pass, over the Snowy Range to Georgia Gulch*	11,487

* It may be this pass which Frémont crossed June 22, 1844, estimating its altitude at 11,200 feet. He had, by the boiling point, found his camp on the northern slope to be 10,430 feet high; "still the pine forests continued;" the divide itself was estimated about 800 feet higher.

	Feet.
Mount Guyot, west of the Pass	13,223
Tarryall, a deserted town	9,932

3. *Route from Tarryall eastwardly to Colorado City*, 70 *miles.*

Eastern edge of South Park, on Tarryall or Middle Branch of the South Platte	9,538
On road to Colorado City, 20 miles east of Tarryall, 20 feet above the level of Middle Branch	8,895
At the foot of a high hill, where the road leaves the Middle Branch	8,664
On the road, 40 miles from Tarryall, off the Middle Branch...	8,503
On South Branch of the South Platte, where the road crosses it at Gleason's Ranch, about 15 feet above the water level, 46 miles from Tarryall	8,151
Near the Divide between the waters of the Platte and the Arkansas, about 10 miles west of Pike's Peak	8,724
Near the western base of the Peak	9,327
Upper course of Fontaine-qui-bouit, where the road first strikes it, north of the Peak	8,273
On Fontaine-qui-bouit, 3 miles lower down	7,794
Soda Springs,* at the eastern base of the Peak	6,515
Last timber growth on the north slope of the Peak	12,043
Summit of Pike's Peak	14,216
Colorado City, on the Fontaine-qui-bouit, about 15 ft. above the water level	6,342

4. *Route from Colorado City northwardly to Denver*, 70 *miles.*

On road, 10 miles north of Colorado City	6,753
Garlick's Ranch, towards the Divide	7,105
Divide of Arkansas and Platte Rivers	7,554
Plum Creek, near its head, 8 miles north of last station	6,840
Same, 30 miles south of Denver	6,409
Denver City	5,303

5. *Route from Denver westwardly to Empire City*, 50 *miles.*

Mount Vernon, as above	6,421
Junction of North and South Fork of Clear Creek	7,086
Idaho, 12 feet above South Clear Creek	7,800
Head of Virginia Gulch, a high divide between North and South Clear Creek	9,690
Missouri City (Consolidated Ditch Office), near Central City and 600-800 feet higher than that	9,073
South Clear Creek, at mouth of Fall Creek, 3 miles above Idaho, 6 feet above water level	7,930
Level of Clear Creek, at Empire City	8,583

6. *Route from Empire City northwestwardly to Hot Springs, in Middle Park*, 50 *miles.*

Lindstrom's Mill, on Mad Creek, about 30 feet above Clear Creek, 1 mile above Empire City	8,738
Survey Station No. 50, 1½ miles above 1st station in Empire City	8,693
Deserted Ranch, 5 miles above Empire City, at base of Berthoud's Pass	9,464

* Frémont's measurement makes it 6,350 feet high.

	Feet.
Little Park, a survey station below the Pass (*Primula Parryi* abundant)	10,715
Summit of Berthoud's Pass (with large timber)*	11,349
Brush shanty, a survey station, ¾ mile from the Pass, on its western slope	10,696
Limit of trees on the range west of the Pass	11,816
Head of Middle Park, where the first open ground begins, a well marked station	8,690
Hot Springs of Grand River, 25 miles below last station	7,725

7. *Route from Empire City southwestwardly to Gray's Peak,* 20 *miles.*

Empire City, as above	8,583
Georgetown, 4 miles further south, 6 feet above level of branch of Clear Creek	8,452
Limit of trees on eastern slope of ridge leading to Gray's Peak	11,643
Summit of Gray's Peak	14,251
First heavier timber on eastern slope of Mount Engelmann	11,578

8. *Towns in Colorado Territory.*

Denver City	5,303
Colorado City	6,342
Mount Vernon	6,421
Georgetown	8,452
Empire City	8,583
Missouri City	9,072
Jefferson, in South Park	9,842
Tarryall (a deserted town!)	9,932

9. *Passes.*

Georgia Pass, from South Park to Middle Park	11,487
Berthoud's Pass, from the Clear Creek valley to the head of Middle Park	11,349

10. *Limit of Trees.*

On the Snowy Range, eastern slope of Gray's Peak	11,643
On the south slope of Mount Flora	11,807
On the range west of Berthoud's Pass, north slope	11,816
On the northern slope of Pike's Peak†	12,043

11. *Alpine summits.*

Mount Flora, a detached peak, east of Parry's Peak	12,878
Parry's Peak, (so named by Surv. Gen. F. M. Case,) a peak of the Snowy Range, north-west of Empire City	13,133
Mount Guyot, near Georgia Pass	13,223
Pike's Peak	14,216
Gray's Peak, south-west of Empire City‡	14,245

* I was gratified to learn from Dr. Parry, that the actual survey of the route from Station 50 to Berthoud's Pass has proved the approximate accuracy of our barometrical results. Gen. Case found, by levelling, the difference between both points (distance 6 miles), 2,634 feet; the barometer made it 2,656 feet, or only 22 feet higher.

† On the northern slope the trees seem to attain a higher elevation than on other exposures, here as well as in some other mountain chains.

‡ Torrey's Peak, in the same Snowy Range, is as high or a little higher.

JOURNAL OF PROCEEDINGS.

September 3, 1860.

The President, Dr. Prout, in the chair.

Eight members present.

Letters were read from Prof. Haidinger, dated Vienna, Aug. 1, 1860, acknowledging receipt of letter from the Corresponding Secretary concerning meteorites, and requesting a specimen of the meteoric iron from Nebraska for the Imperial Cabinet; from A. F. Bandelier, Jr., dated Highland, Ill., Aug. 24, 1860, communicating observations upon the Aurora Borealis of 1859–60.

The following donations to the library were received:— Catalogue of the Phænogamous and Filicoid Plants of Newcastle Co., Del., by Edward Tatnall, Wilmington, Del., 1860, *from the Author;* Eine Leitform der Meteoriten, von W. Haidinger, Wien, 1860, *from the Author;* Contributions to Compar. Anat. & Physiology—No. 1, Eye of the Alligator (*Crocodilus Mississippiensis*)—by Bennett Dowler, M.D., New Orleans, 1860, *from the Author;* Bulletin of the Wiscon. Agri. & Mech. Assoc., Aug. 1860, *from the Association.*

Mr. Holmes presented in the name of E. Holden. Esq., a trilobite (*Calymene Blumenbachii?*) from the Niagara Group of Grafton, Ill. Dr. Wislizenus presented a "Copperhead" snake from Illinois.

Prof. E. W. Hilgard, State Geologist of Mississippi; Prof. Jules Marcou, of Boston, Mass, and Mr. A. F. Bandelier, Jr., of Highland, Ill., were elected Corresponding Members.

September 17, 1860.

The President, Dr. Prout, in the chair.

Seven members present.

Letters were read from Prof. S. F. Baird, Ass. Sec. Smithson. Inst., dated Boston, Mass., Sep. 8, 1860; from Prof. Jules Marcou, Boston, Sept. 1860, and from A. F. Bandelier, Highland, Ills., acknowledging their election as Corresponding Members.

Donations to the library were received as follows: N. O. Med. & Surg. Jour., Vol. XVII., No. 5, Sept. 1860, *from the Editors;* Jour. Frank. Inst., Vol. XL., No. 3, Sept. 1860, *from the Institute;* Amer. Jour. Sci. & Arts, Jan. 1860, *purchased.*

The Corresponding Secretary laid upon the table No. 4, of Vol. I., of the Trans. of the Academy.

Dr. Alleyne presented a series of dried plants from Massachusetts, collected by Dr. Starke; Dr. Wm. M. McPheeters, a small herbarium collected from Missouri, and Dr. Prout, a beetle (*Lucanus cervus?*) from Silver Top, Obion Co., Tenn.

Dr. Engelmann exhibited *Nelumbium luteum* from the swamps in this vicinity, and made some remarks concerning its properties and peculiarities; also, specimens of *Cuscuta chlorocarpa.*

Prof. Michael O'Kinealy was elected an Associate Member.

October 1, 1860.

Vice-President WISLIZENUS in the chair.

Eight members present.

Letters were read from the Editors of Amer. Jour. Sci. & Arts, New Haven, Ct., Sept. 20, 1860, from the President of Harvard College, Cambridge, Sept. 26, 1860, and from the Chicago Acad. of Sci., Sept. 29, 1860, acknowledging the receipt of the Transactions.

Donations to the library were received as follows: Proc. Acad. Nat. Sci. Philad., Aug. 1860, *from the Academy;* Bull. Mens. de la Soc. Imp. zool. d'Acclim., T. VII., No. 8, Août, 1860, *from the Society;* The Weal Reaf, a Record of the Essex Institute Fair, Salem, 1860, *from the Institute.*

Dr. Chas. A. Pope presented a Tarantula, caught on the Pacific railroad in this State; and Mr. J. C. Reid, a specimen of schist from Erie Co., Penn.

Dr. Engelmann gave a further account of his observations on *Nelumbium luteum*, and exhibited a series of drawings in illustration of his remarks.

October 15, 1860.

Vice-President, Dr. ENGELMANN, in the chair.

Ten members present.

Letters were read from the N. Y. State Library, Albany, Sept. 28, 1860; Naturw. Verein des Harzes, Blankenburg, May 26, 1860, and Naturforsch. Gesellschaft in Basel, March 18, 1860, severally acknowledging receipt of the Trans.; from Prof. C. U. Shepard, dated New Haven, June 8, 1860, advising the Academy of the transmission of meteoric iron from Hominy Creek, N. C., Lexington District, S. C., and Bohnmilch, Bohemia, in exchange for the Nebraska Iron sent him by the Academy; from E. G. Squier, Esq., New York, Oct. 10, 1860, transmitting publications, and requesting the Transactions in exchange.

The Corresponding Secretary read a paper from Prof. G. C. Swallow, entitled "Descriptions of some New Fossils from the Carboniferous and Devonian Rocks of Missouri." Referred to the Publication Committee.

Donations to the library were received as follows: Report of Progress of the Geological Survey of Canada for 1858, Montreal, 1859, *from the Survey;* Bulletin Bibliog. de Hector Bossange et Fils, No. 9, Paris, 1860, *from the Publishers;* Journal of Education, Nos. 2–9, Vol. IV., 1860, *from Capt. L. A. Huguet-Latour;* Journal of Franklin Inst., No. 4, Oct. 1860, *from the Institute;* Collection of Rare and Original Documents and Relations concerning the Discovery and Conquest of America, chiefly from the Spanish Archives, (Carta del Dr. Don Diego Garcia Palacio, año 1576,) by E. G. Squier, *from the Author;* Catalogue of Bethany College, Va., 1859–'60, *from Prof. Mosblech;* Letters on some points of the Geology of Texas and New Mexico, &c., by Jules Marcou, Zurich, 1858,—"Reply to the Criticisms of James D. Dana, by Jules Marcou," *from the Author.*

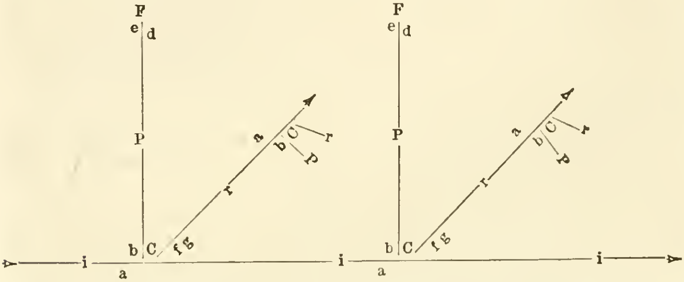
Dr. Engelmann resumed and concluded his remarks on *Nelumbium luteum*, illustrated by a great many drawings.

The *Nelumbium*, common in our stagnant waters, is not only one of our most showy plants, with the largest leaves and the largest flowers, with edible nuts and large edible tubers; but it is also one of the most curiously constructed plants, following with astonishing regularity its peculiar but very simple laws. Its morphology has attracted the attention of botanists before this, and Mr. A. Trécul has done much to develop its peculiarities; Prof. Caspary has studied the plant very intelligently, without, however, publishing as yet anything about it. The ample material at my disposal has, I believe, permitted me to add observations which may have been beyond the reach of my predecessors.

The structure of the embryo is sufficiently well known. The lower leaf (always on the side of the raphe and the periphery of the torus) of the large green plumule shows at the base of its petiole a rim, extending around the stemlet, indicative of the stipule which characterizes all the succeeding leaves. The stipule of the second much smaller leaf includes the third, and the stipule of this a fourth leaf, all of them preformed in the seed. After these distichously arranged leaves have been developed, the young stem reclines in the mud, and henceforth begins the new mode of vegetation which ever afterwards characterizes this plant. The stem, growing now horizontally in the mire at the bottom of the pond or lake, has an upper, or dorsal, and a lower, or ventral side; it (as well as the organs produced from it in a vertical direction) has an anterior and a posterior side in regard to the direction of its growth. This stem is terminated by a bud, which consists of two bud-scales (Niederblaetter), *a* and *b*, in opposite directions, with very short, confluent nodes, and one large leaf, *C*, with the stipule, *s*, in the direction of the second scale, succeeded by an elongated internode, *i*, which at its end bears a similar bud. The roots consist of numerous fleshy fibres, beset with simple fibrillæ, and originating from the node just behind the lowest scale.

Now the plant prepares for propagation, also in the simplest and most constant manner: one flower is produced from the axil of the second scale and one branch from that of the leaf; these parts are always preformed and distinctly visible even when not developed. The long and stout flower-stalk, *P*, without any foliaceous organs at its base, bears on its top the flower *F*, and just under it two opposite bracts, *d* and *e*,—the lower one, *d*, having a direction opposite to the supporting scale, *b*. The branch, *r*, has at the base of the long internode and opposite to the supporting leaf two bud-scales, *f* and *g*, one above the other; the internode is terminated by a bud exactly like the one described before; so, however, that the scale *a* has a direction opposite to that of *f* and *g*; consequently, *b* with *P* and *C* with *r* have the same direction as *f* and *g*.

The following diagram will explain the arrangement and the repetition of the different organs:



Stem.—The long internode, not quite cylindrical, but depressed and somewhat channeled above, is traversed by 6–9 principal air channels or tubes, of unequal size, arranged in a circle, with numerous smaller peripheral and one central one. The nodes are almost solid, but beyond them, in the next internode, the tubes are continued even with their irregularities and peculiarities, adding new ones when the plant becomes stouter. In both axillary productions, the peduncle and the branch, the arrangement of the tubes is reversed. In the full grown plant the internode is commonly 12–20 inches long and 5–8 or even 9 lines in diameter. I usually find a pair of small tubes above, 2 or 3 pairs of large ones on the sides, and a single middle sized tube below. In the embryo a pair, sometimes more or less confluent, occupies the side of the lowest leaf, an odd one the side of the second leaf, and 4 or sometimes 5 others the intervening spaces. The stem of smallest size has a small pair above, a large pair on the sides, and a middle sized pair below; in larger stems a seventh odd tube appears between the lowest pair, and in full grown ones an upper pair of small ones completes the circle of nine tubes. In the peduncle the same system of tubes is reproduced (not always so regular) in an inverse order, so that the small pair is found on the anterior side, or on the side opposite its supporting scale. The branch has at first always six tubes, the smallest pair on the lower side opposite to the supporting leaf. This arrangement, however, is usually only visible near the origin of the branch, because the upward tendency of the developing leaf and flower, which in the bud are directed downwards, imparts to the tender, growing shoot a rotation half around its axis, thus righting themselves, and bringing, in the anterior part of the internode, the pair of small tubes to the upper side. Where circumstances, such as hardness of soil in very dry seasons, prevent this rotation or twist, the different organs curve from under the branch upwards to the light. As the branch grows, more tubes are added in the succeeding internodes, just as in the parent stem, from which henceforth it does not differ at all, shooting up a flower and a leaf at each repetition of its simple cycle, and gradually overrunning the whole bottom of the pond with their network.

Thus the plant continues to grow until sometime in August, after the flowering period is passed, it prepares for winter by depositing in the now shortened and thickened internodes or joints a large quantity of starch as food for the young plants, which in the succeeding season spring from the terminal bud at the tip and the axillary bud at the base of the tuber. These tubers are 5–10 inches long, 1–2 inches in diameter, somewhat spindle shaped, depressed, and not rarely angled and furrowed, and weigh 2–8 ounces; they are traversed by the same system of tubes as the summer stems; the tubes, however, are mostly of a more irregular shape and more or less compressed. Our plant having no truly perennial root-stock like its relatives, the *Nymphæaceæ*, the tubers and their buds are the only parts which live through winter, much like those of the potatoe.

Leaves.—All the foliaceous organs, with the exception of those in the flower proper, are either distichously alternate, or they are superimposed in the order detailed above. The lowest scale, *a*, is about 3 inches long and envelops the whole bud; the growing stem, enveloped by the stipule, bursts through its very thin back, while the leaf and the flower-bud, wrapped in the second scale, *b*, pass out on the upper, open side, leaving its upper part, when entire, between the leaf and the stipule; at last, it usually divides into two halves, with lateral positions.

The second scale, *b*, is 3–5 or sometimes even 6–8 inches long, bears in its axil *always* the flower-bud, and originally envelops that and the leaf, but not the stipule; it remains on the back of the peduncle, or, where that remains undeveloped, of the petiole.

The peltate, orbicular leaf, *C*, has often been described. I allude here only to the 6 tubes of its stalk, arranged exactly as in the smallest branches, the smallest pair on its *posterior, grooved* side. The epidermis-cells of the upper surface are very small (0.007–0.010 lines diameter) and angular, each with a little knob, which together produce the velvety, water-repelling surface; the lower surface is formed of a single layer of much larger cells (0.020–0.025 lines) with tortuous walls, and is kept distended and separate from the parenchym of the leaf by a kind of framework built of cells, which forms a network of meshes filled with air. Only the upper surface has stomata. At the base of the leaf a stipule, in shape and texture similar to the scales, in full sized specimens 2–2½ inches long, envelops the axillary bud as well as the continuation of the stem; while the latter, growing out, leaves it on its upper side, the branch penetrates its back, thus placing it between itself and the stem, or at last splits it in two.

The first opposite leaves of the flowering branch may be classed as bracts; from the very similar exterior sepals, they may be distinguished by their position, smaller size, and persistency; they are already observed in the smallest bud, of 0.1 line diameter. The succeeding organs of the flower are arranged in much more complicated phyllotactic orders.

The lowest, superimposed scales of the leaf-branch are close between the branch and the stem; the lowest one is only 6 9 lines long, notched or unequally bifid; the second is 1¼–2 inches long, of the form and texture of the other scales, not perforated by any organ, but often at last severed in two halves.

Flower and Fruit.—A few observations must suffice here. I will only mention that the prolonged and thickened commissure of the anthers forms a hook, which in the bud is curved over the torus, that of the inner filaments much more than that of the outer ones. The pollen grains are smooth and globular, 0.04 lines in diameter. I find the number of carpels, and consequently of nuts, on the torus between 12 and 31, arranged in two or in three circles: 9-15 in the outer, 3–11 in the second, and 1–5 in the third circle, when present. The carpels, in the smallest flower-buds examined, were indicated by cellular protuberances on the receptaculum in the same plane as the smaller cellular masses destined for anthers, of 0.05 line diameter; the torus, growing up, gradually encloses them, leaving only the stigma free. The knob of the carpel is always directed towards the periphery of the torus, and the micropyle of the anatropous ovule towards the centre; the channel of the perforated stigma leads into the cavity of the carpel near the short funiculus, away from the micropyle. The cotyledons form with the edge towards the raphe, consequently in the radius of the torus, and the lowest leaf of the plumula turns its back to the rhaphe and the periphery.

Buds.—The buds, especially those which persist through winter, include the whole plant with all its organs (except the complicated parts of the flower itself) completely preformed, and repeated several times. A bud of 2 inches in length contained the primary organs *a*, *b* and *C* four times, and the branch *r* twice repeated, the first branch consisting of two internodes, thus:

$$1^{\;1\quad 2} \qquad 2^{\;1} \qquad 3 \quad 4$$

In 1 the leaf was 20 lines long; in 2, 3 lines; in 3, $\frac{2}{3}$ line, and in 4, $\frac{1}{6}$ line long; each one of the seven cycles distinctly showed the flower-bud and the branch-bud at their proper places.

Phyllotaxis.—The attempt to harmonize the very unusual disposition of the organs with the ordinary laws of phyllotaxis has produced some very odd theories. A rather specious explanation seems to be the following: the flower might be the termination of the main stem, which has five distichous foliaceous organs, *C*, *a*, *b*, *d* and *e*; the lowest leaf, *C*, bears one branch, *r*, and the second, *a*, another branch, *i*, which at last becomes the continuation of the stem; in the first the twin scales *f* and *g*, in the second the leaf *C*, stand opposite to the supporting organs. Thus all the foliaceous organs would be distichous, but the branches *r* and *i* would not harmonize, *r* being left without a leaf *C*. The principal objection, however, to this explanation is the unmistakable continuation of the structure in what I have considered the stem, while in the peduncle it is reversed just as it is in the branch.

Use.—The tubers and the seeds of *Nelumbium* are edible and highly nutritive, both being replete with amylum; but they have been eaten only by the aborigines.* The boiled seeds closely resemble chestnuts in taste. Some of the largest tubers, obtained about the end of September, I had cooked; they were not done as soon as potatoes, and retained much more firmness; baked, they were much more palatable than boiled, and had a pleasant, sweet and mealy taste, considerably resembling that of sweet potatoes, without anything reminding one of their growth in stagnant water. The decomposing tubers become gray and at last black, the inside assuming a beautiful purple color, and a very fetid odor, somewhat resembling that of rotten potatoes. The purple color is produced by deep purple globules forming in the cells, one in each, and considerably larger than the starch granules; undoubtedly some rudimentary fungoid production.

Prof. A. Winchell, Ann Arbor, Mich.; E. G. Squier, Esq., New York, N. Y.; C. H. Hitchcock, Amherst, Mass.; S. T. Wells, Cincinnati, O.; and Dr. M. Johnston, Coshocton, O., were elected Corresponding Members.

November 5, 1860.

The President, Dr. H. A. Prout, in the chair.
Nine members present.

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* The Chariton River in Missouri, after which Chariton County is named, is said to derive its name from the Indian word for *Nelumbium*, a plant very abundant there and highly esteemed by the Indians.

Letters were read from

A. F. Bandelier, Esq., Highland, Ills., Oct. 13 & 18, 1860, transmitting fossil plants from the Coal Formation of Illinois; K. Akad. Wissensch. Wien, Ap. 25 & June 25, 1860; Lit. & Philos. Soc. of Manchester, Eng., May 30, 1860; Oberhessische Gesellschaft fur Nat. und Heilkunde Giessen, June 20, 1860; K. K. zool.-bot. Gesellsch. Wien, 1860; Naturf. Gesellsch. des Osterlands zu Altenburg, May 29, 1860; K. Gesellsch. der Wiss. zu Gœttingen, June 3, 1860; Dorpater Naturforsch. Gesellsch. Dorpat, Jan. 1860; Naturforsch. Gesellsch. in Emden, May 20, 1860,—severally acknowledging receipt of No. 3, Vol. 1., of the Transactions and transmitting publications in exchange. Also, from I. R. Istituto Veneto, Ap. 6, 1860; Prof. Director Franz Fœtterle, Wien, Mar. 26, 1860; Leeds Philos. & Lit. Soc., July 13, 1860; Mr. Senoner, Vienna, June 17, 1860; E. A. Rossmässler, Leipzig, Aug. 16, 1860; K. Akad. der Wissenschaft, Munchen, June 12, 1860; K. Sächzische Gesellsch. der Wissenschaft. Leipzig, March 1, 1860; Pres't Yale College, Oct. 30, 1860,—severally acknowledging receipt of No. 3 of Transactions. Also, from the Smithson. Inst. Washington, D. C., Oct. 10, 1860, transmitting packages: and from E. Geo. Squier, Esq., New York, Oct. 22, 1860; C. H. Hitchcock, Esq., Amherst, Mass., Oct. 27, 1860; D. M. Johnson, Esq., Coshocton, O., Oct. 27, 1860; Prof. A. Winchell, Ann Arbor, Mich., and Prof. Jules Marcou, Boston, Mass., Oct. 15, 1860,—severally acknowledging their election as Correspondents.

The Corresponding Secretary read extracts from a letter addressed to him by Dr. B. F. Shumard, State Geologist of Texas, dated Austin, Oct. 2, 1860, concerning the discovery in Texas of dicotyledonous leaves in Cretaceous strata, and the existence of an extensive Miocene Formation, equivalent to the Bone beds of the Mauvaises Terres of Nebraska, as follows:

You will, perhaps, remember the statement in my paper on the Cretaceous Strata of Texas, (p. 589 of Transactions,) that although we had not succeeded in finding dicotyledonous leaves in the Lower Cretaceous marls and sandstones of Texas, as has been done by Meek and Hayden in Nebraska and Kansas, and Newberry in New Mexico, they would probably be found in this position. I have now the pleasure of informing you, that further explorations in Lamar County, near Red River, have resulted in the discovery, by Dr. G. G. Shumard, of numerous impressions of leaves in alternations of yellowish sandstones and bluish shales, which are believed to occupy a position below the marly clay or Red River Group of my section, and which we regard as being on a parallel with the lower beds of No. 1 of the Nebraska Section. The collection made by Dr. G. G. Shumard contains several species of monocotyledonous leaves, which appear to belong to the genera *Salix, Ilex, Laurus*, etc. I am unable to determine positively the generic affinities of these leaves for want of proper works of reference, but shall submit the collection to a competent fossil botanist, and think they will be found analogous to those discovered by Meek and Hayden at the base of their Nebraska Section.

Not among the least important results of the survey is the discovery, in Washington and adjoining counties, of an extensive development of Miocene Tertiary Strata, referable to the age of the Miocene deposits of the Mauvaises Terres of Nebraska, which have yielded such a wonderful profusion of extinct Mammalian and Chelonian remains. The Texan strata consist of calcareous and silicious sandstones, and white, pinkish and grayish silicious and calcareous marls. The calcareous beds are often almost wholly composed of finely comminuted and water-worn shells, chiefly derived from the destruction of Cretaceous strata, and in places abound in fossil bones and plants, usually in a fine state of preservation. The bones have been usually found in excavations for wells, at depths varying from twenty to sixty feet below the surface, and consist of genera closely allied to, or identical with *Titanotherium, Rhinoceros, Equus*, and *Crocodilus*. Among the plants are several species of palms, a fine collection of which has been made by Dr. Gideon Lincecum, of Long Point, Washington Co., and by him presented to the State cabinet.

The Miocene beds are surmounted at some localities, as at Hidalgo Falls, with a pebbly deposit cemented with ferruginous matter into a coarse pudding-stone or conglomerate. This deposit has yielded in more or less abundance the bones of *Mastodon, Elephas, Megalonyx, Equus* (*E. fossilis*), *Crocodilus*, and *Testudo*.

The collections of the Texas Survey are rapidly increasing in all the departments. The series of Cretaceous and Tertiary fossils are already very extensive, and when properly studied will throw much light on some disputed points in the Geology of Texas and New Mexico.

Donations to the library were received as follows:

Bull. Amer. Ethnolog. Soc., and Report on the Huacas or Ancient Graveyards of Chiriqui, read before the Ethnolog. Soc. by J. King Merrit, M.D., N. York, 1860,—*from the Ethnolog. Soc.;* Bull. de la Soc. Imp. zoolog. d'Acclimation, Paris, No. 9, Sept. 1860, *from the Society;* Sitzungsberichte der K. K. Akad. der Wissensch, Wien, Nos. 3–5, 7–8, 10, Band XXXIV.–XL., Jan. to Ap. 1860, *from the Imperial Academy;* Jahrb. der K. K. Geol. Reichs., Wien, 1859, X. Jahrg., Nos. 3–4, *from the Imperial Society;* Mem. Lit. & Philos. Soc. of Machester, Eng., 2d Ser., Vol. XV., Pt. 2, 1860,—Proc. of same, 1858–9, Nos. 1–16, and 1859–60, Nos. 1–11, *from the Society;* Geolog. Uebersicht der Bergbaue der Oestr. Monarchie von Franz Ritter von Hauer u. Franz Fœtterle mit einem Vorworte von Wilhelm Haidinger, Wien, 1855,—Bericht, über die erste Allgemeine Versammlung von Berg und Hüttenmännern zu Wien, (10 bis 15 Mai, 1858) Wien, 1859,—*from Dr. Franz Fœtterle;* 7–8 Bericht der Oberhessischen Gesellsch für Natur. und Heilkunde, Giessen, 1859, *from the Society;* Atti dell I. R. Istit. Veneto, Tomo V., Serie III., 1–7, 1859-60, *from the Institute;* Verhand. K. K. zool.-bot. Gesellsch. Wien, 1859, IX. Band, *from the Society;* Archiv. der Ver. d. Freunde der Naturgeschichte in Mecklenburg, 14 Jahrg., Neubrandenburg, 1860, *from the Society;* Mittheil. aus dem Osterlande, XV. Band, Heft 1–2, 1860, Altenburg, *from the Society;* Ueber die Wärme-Entwicklung in der Pflanzen, deren Gefrieren und die Schutzmittel gegen dasselbe, von H. R. Goeppert, Breslau, 1830,—Uber die Flora der Silur. Devon. und unteren Kohlen Form. oder des sogenannten Uebergangs-Gebirges, von Göppert, Dec. 1859, *from Prof. von Göppert;* Sitzungsb. der Dorpater Naturforsch. Gesel., 1853-6, Dorpat, *from the Society;* Nachrichten von der Georg. August. Univ. u. d. Königl. Gesellsch. d. Wiss. zu Gœttingen, 1859, No. 1–20, *from the Royal Society;* Verhand. u. Mittheil. des Siebenbergischen Vereins für Nat. zu Hermanstadt, Jahrg. X., No. 7–12, 1859, *from the Society;* Ueber die Wohnsitze der Brachiopoden, von Prof. Ed. Suess, Wien, 1860, *from the Author;* Annual Rep. of the Leeds Phil. & Lit. Soc. for 1859-60,—Proc. Geol. & Polytech. Soc. of the West Riding of Yorkshire for 1859, Leeds, 1860,—The Physical Condition of the People in its bearing upon their Social and Moral Welfare, by the Rt. Rev. R. Bickersteth, Leeds, 1860,—Sensorial Vision, by Sir J. F. W. Herschel, Bart., Leeds, 1858, *from the Society;* Archiv. für die Naturkunde, Ser. I. Bd. I., Lf. 1–3, Bd. II. Lf. 1–2, Ser. II. Bd. I. Lf. 1–5, 1854-59, Dorpat, *from the Dorpater Naturforsch. Gesellsch.;* Jahresbericht der Naturf. Gesellsch. in Emden, 1859, Kleine Schriften VI.–VII., 1860, *from the Society;* Mém. de l'Académie Imp. des Sciences de St. Petersbourg, 7e. Ser., T. II., No. 1–3, 1859,—Bulletin, T. I., Feuilles, 7–36, *from the Imperial Academy;* Proc. of the Histor. Soc. of New York, Oct. 1853,—Ruins of Terrampua, by E. G. Squier,—Memoir on the European Civilization of

America in Ante-historic Times, by Adolph Zestermann of Leipzic, with Critical Observations by E. G. Squier, 1851,—Volcanoes of Cent. America, by E. G. Squier, 1850, *from the Author;* Canad. Journal of Industry, Science and Art, Sept. 1860, *from the Canadian Institute;* Notes d'un Voyage dans l'Amérique Centrale,—Lettres à M. Alfred Maury, Bibliot. de l'Inst. (Ext. des Nouvelles Annales des Voyages, Paris, Août, 1855,—Lettre de M. E. G. Squier, à propos de la lettre de M. Brasseur de Bourbourg, à M. Alf. Maury, Paris, 1855, from E. G. Squier, Esq.; Proc. Acad. Nat. Sci. Philad., Sept. 1860, *from the Academy;* Observations upon the Form of the Occiput in the Various Races of Men, by J. Aitken Meigs, Philad. 1860, *from the Author;* Proc. Boston Society Nat. Hist., Sep. & Oct., 1860, *from the Society;* Original Communications from the N. Orleans Med. & Surg. Journal, Nov. 1860, *from Bennett Dowler, M.D.;* Bull. de la Soc. Imp. zool. d'Acclim. Paris, *from the Society.*

Mr. Holmes presented, in the name of A. F. Bandelier, a series of fossils from Illinois, and Mr. Reid specimens of asphaltum, petroleum, and fossils, from Canada West.

The committee to whom was referred the paper of Prof. Swallow on New Fossils from the Carboniferous and Devonian Rocks of Missouri, reported the same for publication in the Transactions.

November 19, 1860.

The President, Dr. Prout, in the chair.

Eleven members present.

Letters were read from the Essex Institute. Salem, Mass., Nov. 6, 1860, acknowledging receipt of No. 4 of Transactions; Sec. of the Smithson. Inst. Wash., D. C., Nov. 1860, enclosing list of shells presented to the Academy by the Smithsonian Institution; Soc. Roy. des Sciences, Upsal; Société Imperiale des Sciences Naturelles de Cherbourg, transmitting publications; Naturk. Verein in Augsburg, Aug. 27, 1860, —Nat. Hist. Society of Northumberland, Durham and Newcastle-upon-Tyne, Oct. 6, 1860, acknowledging receipt of Transactions; Lem. T. Wells, Cincinnati, O., acknowledging notice of his election as a Corresponding Member of the Academy.

The following donations to the library were received:

The Rock and Coal Oils of Ohio, by J. S. Newberry, M.D., 1829, *from the Author;* Der Zool. Garten, Organ der Zool. Gesellsch. in Frankfurt a M., Herausg. von Dr. D. F. Weinland, No. 7–12, 1860, *from the Editor;* N. Orl. Med. & Surg. Jour., No. 6, Nov. 1860, *from the Editors;* Journal Frank. Inst., No. 5, Nov. 1860, *from the Institute;* Nova Acta, Roy. Soc. Sci. Uspal Ser. III., Vol. I. & II.,—Arsskrift of same, 1, *from the Royal Society;* Dritter Jahres-bericht des naturf. Vereins in Passau, for 1859, 1860, *from the Society;* Mém. Soc. Imp. Sci. Nat. Cherbourg, T. VI. & VII., 1858-9, *from the Society;* Tab. Method. et Descrip. des Mollusques terrestres et d'eau douce de l'Agenais, par M. J. B. Gassies, Paris, 1849,—Catalog. raisonné des Mollusques terrestres et d'eau douce de la Gironde, par M. J. B. Gassies, Paris, 1859, *from the Author;* XIII. Jahresb. des Naturhist. Vereins in Augsburg, 1860, *from the Society;* Actes de la Société Linn. de Bordeaux, Tome XXII., 3e. Ser., T. II., Paris, 1860, *from the Society;* List of Shells collected in the Grand River Valley, Michigan, by A. O. Currier, 1860, *from the Author;* Amerika, Geograph. und Naturgesch. von Brückner, *from C. Witter*; Med. Statistics of U. S. Army during the years 1855–59, *from Dr. Leigh.* Dr. Engelmann laid on the table a Latin translation of his monograph on *Cuscuta* (Trans. Acad. Sci. St Louis, Vol. I., p. 453,) *presented* by the translator, Dr. Acherson, of Berlin.

Mr. Holmes presented, in the name of Mr. Bandelier, several slabs of coal shale with fossil plants from Illinois.

Prof. Holtzman, of Heidelberg, Germ., was elected a Corresponding Member.

December 3, 1860.

The President, Dr. PROUT, in the chair.

Nine members present.

Letters were read from Wm. W. Jeffries, dated West Chester, Penn., proposing exchange of minerals, and from Prof. E. W. Hilgard, State Geologist, Oxford, Miss., acknowledging his election as a Corresponding Member.

Additions to the library were received as follows:

Observations upon the Geology and Palæontology of Burlington, Iowa, and its vicinity, by Chas. A. White, 1860, *from the Author;* Report on the Economical Geology of the Route of the Ashtabula and New Lisbon Railroad,—Catalogue of Flowering Plants and Ferns of Ohio, by J. S. Newberry, M.D., *from the Author;* Amer. Jour. Sci. & Arts, Nov. 1860, *purchased.*

Dr. Prout presented, in the name of S. S. Lyon, Esq., a collection of Devonian and Upper Silurian fossils from the Falls of the Ohio and vicinity.

December 18, 1860.

The President, Dr. PROUT, in the chair.

Seven members present.

Letters were read from L'Acad. Roy. des Sciences de Lisbonne, Mai, 1860, transmitting publications; and from Prof. Wm. Haidinger, dated Vienna, Aug. 1, 1860.

Donations to the library were received from the following Societies:

Bull. Soc. Imp. zool. d'Acclim. Paris, Oct. 1860,—Proc. Acad. Nat. Sci. Phil., Oct. 1860,—Mem. Acad. Real Sci. Lisboa, Classe Math. Phys. e N t., 2d Ser., T. I., Pt. 1, 1843,—Nov. Ser., T. I. p. 1–2, T. II. p. 1, 185 –7, *from the Royal Academy;* Neuere Nachrichten über Meteoriten, namentlich die von Bokkeveld, New Concord, Trenzano; die Meteoreisen von Nebraska, Brazos, Oregon, von W. Haidinger, July, 1860,—Neuere Untersuchungen über die Bestandtheile des Meteorsteines von Copland, schreiben von R. Wöhler an W. Haidinger, July, 1860,—Die Calcutta

Meteoriten von Shalka, Futtehpore, Pegu, Assam, und Segowlee in dem K. K. Hof. Min.-Cab. von W. Haidinger,—Der Meteorit von Shalka in Bancoorah u. der Piddingtonit, von W. Haidinger, *from the Author;* Jour. Frank. Inst, Dec. 1860, *from the Institute;* Canadian Journal, Nov. 1860, *from the Canadian Inst;* Proc. Acad. Nat. Sci. Philad., Nov. 1860, *from the Academy;* Jour. of Education, Nos. 10 & 11, Montreal, 1860, *from Capt. Huguet-L*[illegible]*our.*

Dr. E. R. Morerod, of Silver Top, Tenn., was elected a Corresponding Member.

January 7, 1861.

Vice-President Engelmann in the chair.

Thirteen members present.

Letters were read from I. A. Lapham, Milwaukie, Wis., Dec. 17, 1860, acknowledging receipt of Transactions; Smithson. Inst. Washington, D. C., Dec. 3, 1860, transmitting publications; E. R. Morerod, M.D., Silver Top, Tenn., acknowledging receipt of notice of his election as a Corresponding Member.

The following letter was read from Lieut. G. K. Warren, dated West Point, Dec. 19, 1860:

Nathaniel Holmes, A.M.,
Cor. Sec. Acad. Science St. Louis.

Dear Sir: In looking carefully over the table given by Dr. Engelmann, p. 666, Vol. I., No. 4, calculated from Nicollet's data, I see one rather important error, and that is in taking the low water elevation of the Mississippi at New Orleans at 10 feet above the Gulf. *This is the level of the pavement in front of the Cathedral.* A note in Mr. Nicollet's table, taken from Albert Stein, gives this low water elevation 5·10ths of a foot, and consequently a slope of only about 5-1000ths of a foot thence to the mouth; and not 9-10ths, as in Dr. Engelmann's table. This very slight fall in so long a distance could scarcely be credited were it not a well established fact. Respectfully, your ob't serv't,

G. K. Warren, Lieut. Top. Eng'rs.

The following publications were received:

Beobacht. u. Betracht. über *Scotophis Lindheimeri, S. Alleghaniensis* und andere Schlangen von Dr. Benno Matthes, Dresden, *from the Author;* Smithsonian Report for 1859, *from the Smithson. Inst.;* Catalogue of Lepidoptera of North America, prepared for the Smithson. Instit. by John G. Morris, Washington, 1860,—Catalogue of Diptera of North America, prepared for Smithson. Inst. by R. Osten-Sacken, Washington, 1860,—Catalogue of Publications of Societies (Foreign Works) in the Library of the Smithson. Inst. Washington, 1859,—Instructions in reference to Nests and Eggs of North American Birds,—Directions for Collecting and Preserving Specimens in Natural History, *from the Smithson. Inst.;* Acad. Roy. Sci. à Amsterdam, Verlsagen en Med. Afd. Naturk. Dl. X. Letterk. Dl. V., 1860,—Catalogus Dl. I. St. 2,—Jaarboek, 1859, *from the Royal Academy;* Erster Bericht des Offenbacher Vereins für Naturk. 1860, *from the Society;* Ergebnisse Meteorol. Beob.—Sternschuppen und Feuerkugeln von Dr. Rudolph Wolf—Jahresbericht über die Konigliche Blinden-Anstalt zu Dresden, 1859,—Nachrichten von dem Taubstummen-Inst. zu

Leipzig, 1855,—Gleichgewichtsbe Singungen ungen von Erdmassen von Prof. C. Culmann, Zurich, 1836, *from Dr. Flügel;* Proc. Boston Soc. Nat. Hist., Nov. & Dec., 1860, *from the Soc.;* Descrip. of New Species of Tertiary and Cretaceous Fossils, by Wm. M. Gabb, 1860, *from the Author;* The Primordial Fauna and Taconic System of J. Barrande, with Additional Notes by Jules Marcou, Boston, 1860, *from the Author;* Report on State-house Artesian Well, Columbus, Ohio, by Dr. J. S. Newberry, *from the Author.*

Dr. Engelmann stated that the quantity of rain which had fallen the past year amounted only to 29.79 inches, being considerably less than that of any year since 1839; the average annual fall during the last twenty years had been about 45 inches.

Dr. Wislizenus stated the results of his observations on atmospheric electricity, and gave a minute description of Dellmann's Apparatus for measuring the same.

Dr. Engelmann exhibited a germinating cocoa-nut, and described the peculiar mode of growth of this genus of plants.

Wm. T. Woodruff, Esq., of Marshall, Mich.; Chas. Robin, M.D., of Paris, and Geo. Vasey, M.D, of Ringwood, Ill., were elected Corresponding Members.

The Annual Report of the President, Dr. Hiram A. Prout, was then read, as follows:

ANNUAL ADDRESS.

Time in its ceaseless course has brought us to the close of another year and to the close of the fifth anniversary of our Academy. It becomes us to pause here, and pass in review the events and circumstances which have marked our progress, in order that we may determine how far we have advanced in the accomplishment of the noble and praiseworthy objects which form the basis of our association.

It gives me the highest gratification to be able to state, that the past year furnishes sufficient evidence of our continued prosperity, and a substantial earnest of the success and perpetuity of our labors in the future. Surrounded by difficulties and embarrassments, without means and without patronage, we have struggled on, and struggled successfully. We had hoped that ere the present moment some friend or friends of science, with enlarged and liberal views, would have extended to us a helping hand and placed us in a condition to give to the world a more ample exhibition of the fruits of our labors. But for the generous liberality of one of our members we should not now have a place to hold our meetings, or to garner up the treasures which have been so liberally contributed to our museum; and, again, these objects lose a part of their interest for the want of appropriate casings in which they could be systematically arranged or classified.

We have been compelled to make a publication of our transactions from the limited funds annually paid by the Associate Members, aided by their private subscriptions. The fourth number of our Transactions, completing one large volume, has been published and sent abroad to scientific associations, and everywhere it has met with the most cheering welcome, and the expression of the hope that our humble labors may be continued. We have sent out our publications to one hundred and fifty-three societies, universities, and authors, in foreign lands, and seventy-three in our own country. For these we have received in return many memoirs and transactions, which, if continued, as doubtless they will be, will form a most valuable collection of the current literature of the science of the present day, and the nucleus of a library which will be resorted to by the lovers of natural history and the cultivators of the natural sciences in this great valley. But in order to secure to it more fully this prominence and utility, and furnish our own members all the advantages possessed by the older institutions of Europe and this country, it is essentially requisite that we should add to these contributions an extensive library embracing an extended series of works upon all the branches of natural history and the natural sciences, each as complete as possible in its connections. Such a library would soon form a shrine at which many a Parian would bow in humble adoration in his search for more light. But such a library would cost several thousand dollars, and in our present condition it can scarcely be hoped that by our united labors we shall be able to secure a fund adequate to the purpose. The cause of science is the cause of humanity, and it was in this relation that we fondly expected that some philanthropic benefactor, capable of tracing out how far the aid of science contributes to the progress, the refinement, the well-being and the happiness of our race, seeing our necessity, would come to our relief. Such a mind could readily appreciate the difficulties and embarrassments under which we labor in these comparative wilds of the West.

Remote as we are from the well stocked libraries of the old world, or those of our own country, which form the storehouses of the treasured experience and wisdom of the past, with no Ariadne threads to lead us through the tangled labyrinths into which our desire to advance the progress of human knowledge, or innate love or devotion to science, too often lead us, how are we to give efficiency to our labors, or render them available to the great cause of human progress? Is it not obvious that in these fresh and comparatively untrodden wilds, where the advance of civilization has not yet blotted out the diversified manifestations or the beautiful forms of Creative Wisdom, that much could be accomplished? Would not our labors be more cheerful, more energized, and our work more successful, had we but such advantages? In their absence, I hope, however, that we will not relax our efforts and become discouraged. We can even without them gather a few pebbles from the great sea shore to aid in the construction of the great temple.

In this connection, I must be permitted to say, that I had earnestly hoped that some of our younger members would have ere this become deeply imbued with a desire to aid us in our labors by studying thoroughly some specialities in science. The want of a complete library and a well arranged museum have no doubt, with many, constituted prominent causes of discouragement. A noble ambition, a cultivation of a taste for such pursuits, and untiring industry, would in a measure overcome these difficulties, and endow them with power to win many a laurel and to enshrine themselves in the grateful memory of the world. Many of the older members, who take an active part in the labors before us, must before many years pass away and give place to those who are more fresh and vigorous. What then shall become of the interests of our flourishing Institution if their successors are not ready to buckle their whole armor on, and do battle in so glorious and so noble a cause? What occupation in life can yield a purer, a more elevating or refining influence than the unfolding of the mysteries of nature in all its beauty, in all its glory, and in all its sublimity? and what can more dignify and ennoble human nature than scanning with subdued reverence the well written lessons of wisdom which lead from nature up to nature's God?

The following summary will exhibit the number of memoirs presented and referred to the Publishing Committee, and the contributions to the museum, for the past year:

Report on the Meteorology of 1859; by George Engelmann, M.D.

A new species of *Platycrinus* and other fossils from the mountain limestone of Illinois and Iowa; by A. H. Worthen, State Geologist of Illinois.

A Review of some points in Dr. B. F. Shumard's Report of the Geology of Ste. Genevieve County, Mo.; by A. H. Worthen, State Geologist of Illinois.

On a method of obtaining Water, for Railroad purposes, on the high Prairies of Missouri; by E. Miller, C. E.

Descriptions of new species of *Bryozoa* from the Palæozoic Rocks of the Western Sates and Territories; 4th series; by H. A. Prout, M.D.

On a Meteorite found in Texas; by B. F. Shumard, M.D.

Description of new Cretaceous Fossils from Texas; by B. F. Shumard, M.D., State Geologist of Texas.

Observations upon the Cretaceous Strata of Texas; by B. F. Shumard, M.D., State Geologist of Texas.

Description of four new species of *Blastoidea* from the Subcarboniferous Rocks of Kentucky; by Sydney S. Lyon.

Description of five new species of *Gasteropoda* from the Coal Measures, and a *Brachiopod* from the Potsdam Sandstone of Texas; by B. F. Shumard, M.D., State Geologist of Texas.

Descriptions of new Fossils from the Carboniferous and Devonian Rocks of Missouri; by G. C. Swallow, State Geologist of Missouri. (Three papers.)

Notes on the Grape Vines of Missouri; by Geo. Engelmann, M.D.

On the Elevation of St. Louis above the Gulf of Mexico; by George Engelmann, M.D.

On hybrid *Verbenæ*; by Geo. Engelmann, M.D.

On the Peculiarities of the Spring of 1860; by Geo. Engelmann, M. D.

Description of the Nebraska Meteorite; by N. Holmes, Esq.

Stratigraphical Arrangement of the Rocks of Kentucky; by Sydney S. Lyon.

Remarks on a Fossil Tooth from King's Salt Works, near Abingdon, Va.; by H. A. Prout, M.D.

On the Big Mound of St. Louis; by N. Holmes, Esq.

On some new Fossils from the Carboniferous and Devonian Rocks of Missouri; by G. C. Swallow, State Geologist of Missouri.

Geological Survey of the State of Michigan; by A. Winchell, State Geologist of Michigan.

Measurements of Elevations on the Missouri; by G. C. Broadhead, of the Geological Survey of Missouri.

The principal contributions to the museum have been as follows:

Palæontology and Mineralogy. — By E. A. Filley, H. W. Leffingwell, Esq., Dr. M. A. Pallen, Dr. Pope, Mr. Reed, and A. F. Bandelier.

Collection of H. Engelmann, Geologist to U. States Expedition to the Rocky Mountains in 1856, under Lieut. F. T. Bryan, U. S. A., presented in the name of Lieut. Bryan; a large and valuable collection of fossils and minerals.

C. A. White, of Burlington, presented several new species of fossils from the Devonian Rocks of Burlington, Iowa.

A valuable collection of fossils and minerals, donated by the Academy of Natural Sciences of Philadelphia, and Wm. S. Vaux, Esq.

Herpetology.—By Dr. Pope, Dr. Baumgarten, and Dr. Wislizenus.

Entomology.—By Dr. Pope and Dr. Prout.

Ornithology.—A collection of bird skins from the Smithsonian Institution, collected by Capt. John Pope, U. S. A., from Texas and New Mexico.

Embryology.—By Dr. Forbes.

Malacology.—A collection of marine shells from the U. S. Exploring Expedition, from the Smithsonian Institution.

Indian Antiquities —By N. Holmes. Esq.

Botany.—By Dr. Alleyne and Dr. McPheeters.

The present number of Associate Members is 151; Corresponding Members, 109.

By the report of the Corresponding Secretary, it appears that the number of foreign societies and persons from whom we have already received exchanges is 102, and the home list reaches the number of 73.

Relations of correspondence and exchange have been established with twenty new foreign societies and individuals during the past year, and nine have been added to the home list.

The disbursements of the Corresponding Secretary for the year 1860 have amounted to $72.45, and his receipts to $73.38, leaving a balance in hand of 93 cents.

By the report of the Treasurer, it appears the total Receipts of the Treasurer for the year 1860 were	$888 67
And the total Expenditures......	850 53
Leaving a balance of........	$38 14

H. A. Prout, *President.*

The Reports of the Corresponding Secretary and Treasurer for the year 1860 were submitted, examined, and accepted.

The following gentlemen were elected officers for the ensuing year, 1861:

President, ...	George Engelmann, M.D.
1*st Vice-President,* . .	Charles A. Pope, M.D.
2*d Vice-President,* . .	Hon. Samuel Reber.
Corresponding Secretary,	Nathaniel Holmes, Esq.
Recording Secretary, .	Enno Sander, Esq.
Treasurer, ...	J. S. B. Alleyne, M.D.
Librarian, ...	G. H. E. Baumgarten, M.D.
Curators, ...	Chas. W. Stevens, M.D., Theo. C. Hilgard, M.D., Hiram A. Prout, M.D., A. Wislizenus, M.D.
Com. on Publication,	N. Holmes, A. Wislizenus, Geo. Engelmann.
Com. on Library, . .	J. S. B. Alleyne, H. A. Prout, G. H. E. Baumgarten.
Com. on Finance, . .	Britton A. Hill, James B. Eads, M. A. Pallen.

Chairmen of the Standing Committees were appointed as follows:

Ethnology, ...	N. Holmes.
Comparative Anatomy, .	Chas. A. Pope.
Embryology, ...	J. S. B. Alleyne.
Mammalogy, ...	Chas. W. Stevens.
Ornithology, ...	M. L. Clark.
Ichthyology and Herpetology,	T. C. Hilgard.
Entomology, ...	Wm. M. McPheeters.
Botany, ...	Geo. Engelmann.
Geology and Palæontology,	Hiram A. Prout.
Chemistry, ...	A. Litton.
Meteorology, ...	A. Wislizenus.
Mineralogy, ...	Hiram A. Prout.

Britton A. Hill, Esq., authorized the Treasurer to call upon him for $50 as a contribution towards the publication of the Transactions; for which liberal donation the Academy, on motion, passed a vote of thanks.

January 21, 1861.

The President, Dr. ENGELMANN, in the chair.

Six members present.

Letters were read from the Verein für Naturk. in Würtemberg, dated Sept. 1, 1860, and Soc. Italiana Sci. Nat., dated Milan, June 28, 1860, acknowledging receipt of Transactions and transmitting publications in exchange; and Naturf. Verein zu Riga, dated April 28, 1860, sending publications.

The following donations to the library were received:

Proc. Amer. Antiq. Soc. Worcester, Mass., Oct. 1860, *from the Society;* Mém. Acad. Imp. Sci. St. Petersburg, 7e. Ser., T. II. No. 4–7, T. III. No. 1, 1860,—Bulletin of same, T. II. No. 1–3, *from the Imperial Academy;* Sitzungsberichte der K. K. Akad. Wiss. math. naturw. Classe XL.–XLI. Bd. 11–17, XXXIX. Bd. 6, Wien, 1860, *from the Imperial Acad.;* Jahrb. K. K. Geol. Reichs. Jahrg. VI. No. I, Wien, 1860, *from the Imperial Soc.;* Atti della Soc. Geol. Milano, Vol. I., fasc. 1–8, 1855-9, *from the Soc.;* Atti della Soc. Ital. Sci. Nat. Milano, Vol. II., fasc. 1, 1859-60, *from the Soc.;* Correspondenzblatt des Naturf. Ver. zu Riga Jahrg. XI. 1859, *from the Society;* Atti del. Imp. Reg. Inst. Veneto, T. V., Ser. III., Disp. 8, 1859 60, *from the Imperial Inst.;* Würtemb. naturw. Jahreshefte, 2–3 Heft, 1860, *from the Society;* Jour. Frank. Inst., January, 1861, *from the Institute.*

Prof. Charles Rau was elected an Associated Member, and Prof. Adolph Weiss, of the Imperial University of Vienna, a Corresponding Member.

February 4, 1861.

Dr. H. A. PROUT in the chair.

Five members present.

The following donations were received for the library:

Mémoires et Documents publiés par la Soc. Historique de Montreal, 3e. Liv., 1860, *from Capt. L. A. Huguet-Latour;* Jour. of Education, Montreal, Dec. 1860, *from the Publishers;* Notice of the Origin and Present Condition of the Acad. Nat. Sci. Philad., by W. S. W. Ruschenberger, M.D., Philad., 1860,—Proc. Acad. Nat. Sci. Phil., Dec. 1860, *from the Academy.*

A paper presented for publication by B. F. Shumard, M.D., State Geologist of Texas, entitled "Descriptions of New Cretaceous Fossils from Texas," was read by the Corresponding Secretary. Referred to a committee.

Mr. Holmes read an extract from a newspaper giving an account of the fall, on the 11th January last, of a meteorite in Northern Illinois.

Dr. Prout called the attention of the Academy to the Nebraska mass of Meteoric Iron on the table which had been placed in his hands for examination. He had submitted a polished portion of its surface to the action of nitric acid, which had developed the Widmannstättian Figures in beautiful relief.

On motion of Dr. Baumgarten, the following amendments to Art. II. of the By-laws were adopted:

Substitute for Section 5. — Members may borrow books, the property of the Academy, from the Librarian, on signing a receipt for the same in the following words: "Received of the Academy of Science of St. Louis [title and description of the work], to be returned five weeks after date in good order and condition"—which receipt shall be returned to the signer on the return of the book.

Section 6 *shall read* — But no works marked in the catalogue with an asterisk (*) shall be loaned from the library on any account whatever, unless by an affirmative vote of three-fourths of the members present.

Substitute for Section 7.—No book shall be kept from the library longer than five weeks. A fine of 25 cents shall be imposed for each week that any book is kept over the time laid down in this section. Any fines thus imposed shall be reported by the Librarian to the Treasurer, to be collected with the semi-annual contribution of members.

February 18, 1861.

The President, Dr. Engelmann, in the chair.

Seven members present.

Letters were read as follows: from E. G. Squier, Esq., N. York, dated Feb. 4, 1861, acknowledging receipt of Transactions and transmitting publications in exchange; N. Orl. Acad. of Sci., dated Jan. 22, 1861, acknowledging receipt of Transactions.

The following publications were received:

Trans. Royal Scottish Soc. of Arts, Vol. V., Pt. IV., Edinburg, 1860, *from the Society;* Jour. Frank. Inst., No. 2, Feb. 1861, *from the Institute;* Canad. Jour. Toronto, No. XXXI., Jan. 1861, *from the Institute;* Proc. Amer. Philos. Soc. Philad., No. 61, Dec. 1860 *from the Society;* Geology of the Island of Aquidneck, by C. H. Hitchcock,—Synchronism of Coal Beds in New England and the U. S. Coal Basin, by C. H. Hitchcock, *from the Author;* On Roberts' Test-Plate and Striæ of Diatoms, by W. S. Sullivant and T. G. Wormley, *from Dr. G. Engelmann.*

March 4, 1861.

The President, Dr. ENGELMANN, in the chair.

Eleven members present.

Letters were read from Dr. A. Holtzmann, of Heidelberg, Germany, acknowledging receipt of notice of his election as a Correspondent; and from Dr. Behr, San Francisco, Cal., communicating observations on the geographical distribution of *Lepidoptera*.

Dr. T. C. Hilgard exhibited numerous specimens illustrative of his preliminary remarks on the nature of certain vegetations forming an originally white efflorescence on humid ground in summer, different phases of whose development he had been tracing, and which were formerly thought to be so many *Algæ*, under the names of *Chlorococcum*, *Lepraria*, *Kermesina*, *Protococcus*, etc., with digressions on the production of leprous and byssous brooding phases or so-called degenerations observed in *Cryptogamia;* of the probable serial connection between the zonarious Algæ and collematous Lichens, and likewise in the proliferous cells of fermentation and putrefaction, which Schwann, the founder of microscopi cal anatomy, had previously argued to be always absolutely dependent on the formation of these vegetable organisms. Dr. Hilgard has also made investigations on the growth of fungous plants such as mould and wood-rot, of which he exhibited interesting examples confirmatory of Schwann's views.

Mr. Holmes made some remarks on the discovery of an ancient Semitic language in arrow-head inscriptions older than the known Semitic languages, the Chaldean, etc., and holding a similar relation to the latter which the Gothic language had to the modern Germanic and Scandinavian. This language is also syllabic. The discovery is mentioned in Bunsen's Philosophy of Universal History as applied to languages and religion.

March 18, 1861.

The President, Dr. ENGELMANN, in the chair.

Nine members present.

Donations were made to the library as follows: Texas Almanac for 1861, *from Dr. B. F. Shumard;* Descrip. of New Species of Crinoidea, from the Iowa Geological Survey, by James Hall, Albany, 1861, *from the Author.*

The following donations to the museum were received: A box containing skulls and eggs of birds from Missouri, *from J. T. Irwin, Esq., Ravenna, Mo.;* a specimen of *Inoceramus Sagensis*(?), and part of the lower jaw and teeth of *Rhinoceros occidentalis*, from Nebraska, *from Gen. Harney.*

Dr. Wislizenus read a continuation of his paper on Atmospheric Electricity. Referred to the Publication Committee.

Dr. B. F. Shumard communicated some of the results of his investigations upon the Cretaceous Formation of Texas. He stated, that, aided by his brother, Dr. Geo. G. Shumard, Dr. W. P. Riddell, and other members of the Geological Survey, he had made an extensive collection of fossils from beds not previously recognized in that State, and which appear to correspond in age with the Ripley Group of Tippah Co., Miss., and Enfaula, Ala. The fossils were found in *Septariæ*, embedded in blue and grayish-yellow arenaceous clays, and occur in an elegant state of preservation. The iridescent hues of the nacre being as perfectly retained as in recent shells. Dr. Shumard had been able to recognize in the Texan beds about twenty species of the Ripley Group of Alabama and Mississippi; among these, he mentioned *Nautilus Dekayi, Baculites Tippaensis, B. Spillmani, Purpura cancellaria, Rapa supraplicata, Ficus subdensatus, Pleurotoma Tippana, Cardium Spillmani, Legumen ellipticum*, and *Exogyra costata.* Among the new fossils of the Navarro beds, the *Cephalapoda* preponderate over other genera; but while *Nautilus, Ptychoceras, Helicoceras, Turrilites*, and *Baculites*, are abundant, not a single species of *Ammonites* or *Scaphites* has been found.

Dr. C. C. Parry, of Davenport, Iowa, and Dr. James Blake, of San Francisco, Cal., were elected Corresponding Members.

April 1, 1861.

The President, Dr. Engelmann, in the chair.

Nine members present.

Letters were read as follows; from Dr. C. C. Parry, Davenport, Iowa, March 22, 1861, acknowledging notice of his election as a Corresponding Member; Smithson. Inst., Mar. 1861, respecting exchanges.

The following donations to the library were received:

Jour. Frank. Inst., No. 3, March, 1861, *from the Institute;* On the supposed identity of the *Paradoxides Harlani*, Green, with *P. spinosus*, Bœck, by Albert Ordway, *from the Author;* Proc. Acad. Nat. Sciences Philad., Jan. 1861, *from the Academy;* Bull. de la Soc. Imp. Zool. d'Acclimation, Paris, T. VIII., No 1, 1861, *from the Society;* Jour. Canad. Inst., March, 1861, *from the Institute;* Synopsis of Amer. Cretaceous Brachiopoda, by

W. M. Gabb, *from the Author;* Notice sur les travaux d'Anatomie et de Zoologie,—Specimen Charact. Typograph. S. Concil. Christ. nom. Propag., *from Dr. S. Pollak.*

Dr. Shumard read a paper, entitled "The Primordial Zone of Texas, with Descriptions of New Fossils." Referred to a committee.

Dr. Shumard exhibited his geological map of Texas prepared from investigations made by the Geological Survey. He stated that the geological maps of Texas that had been published were necessarily quite imperfect. Upon the map exhibited this evening he had endeavored to lay down, so far as determined, the general boundaries of the Primordial, Lower Silurian, Carboniferous, Coal Measures, Cretaceous, Eocene and Miocene Tertiaries, and Post Tertiary Formations. He had not been able to recognize any Jurassic or Triassic beds in Texas, though he did not wish to be understood as saying that such rocks were altogether absent there. He had examined fossils from a number of localities claimed to be of Jurassic age, and found them to be of unequivocally Cretaceous species.

Dr. Engelmann gave an account of the singular series of thunderstorms which occurred yesterday, March 31st.

After a thunderstorm on the 29th, between 7 and 8 o'clock A. M., with south wind and a little rain, the barometer continued to fall till 12¾ P.M., when the wind suddenly veered to the west, blowing quite hard, and precipitating 0.73 inches of rain, the barometer rising. On the morning of the 30th the thermometer marked 36°, a fall of 30° since noon of the previous day; the barometer rose, the sky was clearing off with N.W. and then N.E. wind. On the morning of the 31st the sky was clear, the temperature 45°, wind E. After 9 o'clock the scene changed, and a succession of thunderstorms ensued, continuing from 10 A.M. till 10 P.M., with a fall of 2.34 inches of rain; the wind veering around suddenly from west to east, north, west, again east and south-east; the barometer rising and falling most extraordinarily, especially between 2 and 2¼ o'clock P. M., when the rain poured down in torrents. The temperature remained all the time steadily between 42° and 43°.

At 2 P.M.	the barometer	indicated	29.485,	wind	E.,	force	3.
" 2.5 min.	"	"	29.605,	"	W.	"	7.
" 2.10 "	"	"	29.500,	"	N.E.	"	5.
" 2.15 "	"	"	29.470,	"	E.	"	4.
" 2.20 "	"	"	29.575,	"	N.	"	4.
" 2.25 "	"	"	29.660,	"	W.	"	6.
" 2.28 "	"	"	29.680,	"	W.	"	5.
" 2.30 "	"	"	29.570,	"	N.	"	6.
" 2.40 "	"	"	29.530,	"	E.	"	4.

Such rapid fluctuations of the barometer Dr. Engelmann had never before observed.

Mr. Holmes presented from M. Conrad, Esq., a mass of *Lithostrotion Canadense* from St. Louis Co., Mo.

April 15, 1861.

The President, Dr. ENGELMANN, in the chair.

Twelve members present.

Letters were read as follows:

Hon. Samuel D. Bell, Manchester, N. H., March 29, 1861, concerning Transactions; Royal Geograph. Soc. London, Jan. 15, 1861,—Geological Soc. of London, Nov. 7, 1860,—British Museum, Oct. 26, 1860, acknowledging receipt of the Transactions of the Academy; A. F. Bandelier, Jr., Highland, Ill., April 3, 1861, communicating meteorological observations at Highland.

The following publications were received:

Report on the Geology and Agriculture of Mississippi, by E. W. Hilgard, State Geologist, *from the Author;* Ueber die Spuren eigenth. Eruptionserzes des Dachsteingeb. Wien, 1860, von Prof. Ed. Suess, *from the Author;* Bulletin of the Amer. Ethnol. Soc. New York, Vol. I., Sept. to Jan. 1861, *from the Society;* Bull. de la Soc. Imp. Zool. d'Acclimatation, Paris, T. VIII., No. 2, 1861, *from the Society;* Proc. Boston Soc. Nat. Hist., Vol. VIII., March, 1861, and Index to Vol. VII., *from the Society.*

Dr. Shumard presented a series of land shells from the Quaternary deposits of Washington Co., Texas.

Dr. Engelmann spoke about the dimorphism of *Draba brachycarpa*, and exhibited living specimens of this plant illustrated by drawings.

This humble white flower is at this season very abundant on the grassy hills about town, associated with *Draba Caroliniana*, the pretty *Houstonia minima*, with *Androsace occidentalis, Plantago pusilla, Ranunculus fascicularis, Myosurus minimus*, and the completely naturalized *Capsella.* In ordinary or in wet springs the flowers are all regularly formed and comparatively large, having a diameter of about 2 lines; in very dry springs, however, such as the present one, a form with very inconspicuous flowers becomes common, which in isolated specimens in the herbarium might be taken for a distinct species, but, studied on its native hills in thousands of specimens, clearly proves to be nothing but a depauperate or abortive state and not even a clearly defined variety.

During a late excursion to our commons in company with Dr. Hilgard, he ascertained that on the northern slopes of hills and sinkholes, and near the edge of ponds, the plant had the ordinary appearance, but on the sunny and dry or even arid southern slopes not a single one among the thousands of specimens could be found the flowers of which were not quite inconspicuous; in intermediate situations the size and organization of the flowers were also intermediate.

These incomplete flowers are smaller in all their parts than the regular ones; the sepals are erect and rather persistent; the petals always shorter than the sepals, but variable in size, shape and number, or even entirely absent; the stamens always abortive and often reduced in number; the ovary shorter but fertile.

The petals ordinarily broadly obovate-spatulate, retuse, over 1 line long, are here linear-spatulate, entire, emarginate or bilobed, $\frac{1}{6}$-$\frac{1}{3}$ line long, 2 or 4 in a flower, often of unequal size in the same flower, or entirely absent. The slender filaments bear a bilobed cellular head, often not more than 0.05 line long, representing the anther, but without any regular structure. He found in single flowers 4, and often 5 or 6 of them, without petals, or associated with 2 or 4 rudimentary petals. It appears that in some incomplete tetrandrous flowers the pairs of stamens adhere to the base of the corresponding exterior, and the pairs of petals to that of the interior sepals; the 8 organs forming rather one than two cycles.

How these female plants, as they must be called, which, this spring at least, form the immeasurably largest part of the whole crop, can be fertilized by the few complete ones growing in the neighborhood, is not easy to understand.

Does not this dimorphism obtain in other species of this genus, in *Lepedium* and other *Cruciferæ*, and would not several so-called species fall, if correctly understood, under other fully developed ones as incomplete forms?

Dr. Shumard submitted the subjoined vertical section of the Silurian Strata of Cape Girardeau County, Mo.,* constructed from observations made by him while connected with the Geological Survey of the State, the same being an abstract from his Report made to Prof. G. C. Swallow, State Geologist. He remarked that in the adjoining county of Perry the rocks of the section were surmounted by beds, of the age of the Onondaga Limestone, containing *Favosites hemisphærica*, *F. basaltica*, *Acervularia rugosa*, *Zaphrentis gigantea*, *Spirifera undulata*, *Atrypa reticularis*, *Phacops*, *Dalmania*, etc., and which lithologically correspond very closely with the Shell beds of the Falls of the Ohio.

May 6, 1861.

The President, Dr. ENGELMANN, in the chair.

Eleven members present.

Letters were read from J. T. Irwin, Ravenna, Mo., April 8, 1861, sending list of trees in Mercer Co., Mo., and offering exchange of specimens of fossil shells; Mr. Senoner, Wien, Nov. 8, 1860, concerning receipt and distribution of Transactions of the Academy; Acad. Royale des Sciences, Stockholm, Nov. 18, 1860,—Roy. Pruss. Acad. of Sciences, Berlin, Oct. 18, 1860,—Naturf. Gesellschaft, Bamberg, Dec. 15, 1860; Accad. delle Scienze dell' Istituto, Bologna, Feb. 4, 1860,—Königl. physik.-ökonom. Gesellschaft, Königsberg, Nov. 19, 1860,—Dr. D. F. Weinland, Frankfurt a. M., Nov. 7, 1860,—Senkenbergische naturf. Gesellschaft, Frankfurt a. M., 9 Oct. 1860,—Physikalisch-med. Gesellschaft, Würzburg, 23 Jan. 1861, & Nov. 5, 1860,—Royal Danish Society of Scien., June 1, 1860,—K. K. Akad. der Wissenschaften, Wien, Nov. 28, 1860, acknowledging receipt of the Transactions of the Academy and sending publications in exchange; Hon. Samuel D. Bell, Manchester, N. H., April 23, 1861, ordering Vol. I. of Trans. of the Academy for the city library.

The following publications were received:

Bulletin of the Wisconsin Agricul. & Mechan. Association, Milwaukie, Wis., 1860,—2d Ann. Exhib. of same, 1861, *from the Association*; Jour. Franklin Instit., Philad., Vol. XLI.. No. 4, 1861, *from the Institute;* Proc. Acad. Nat. Scien., Philad., March, 1861, *from the Academy;* Fr. Ambrosii Flora Tiroliæ Australis, Vol. I. Pt. 1–5, Vol. II. Pt. 1–3, *from Mr. Senoner, Vienna;* Royal Soc. of Sciences, Handlingar, Band II. 2, 1858, Stockholm,—Fregatten Eugenies Resa, 1851-53, H. 7, Zoologi IV.,—Meteor. Iakttagelser i Sverige, af Er. Edlund, Bd. I., 1859,—Ofversigt, 16 Aug.

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* For Vertical Section of Silurian Strata, see next page.

Vertical Section of Silurian Strata of Cape Girardeau County.

BY B. F. SHUMARD.

				FT.	FOSSILS.	
UPPER SILURIAN SYSTEM.	LOWER HELDERBERG.		Delthyris Shaly Limestone.	350	Dalmania tridentifera, Phacops, Cheirurus, Pentremites, Platyostoma (several species), Strophomena depressa, Orthoceras, etc.	Neily's Landing. Vancil's Landing. Devil's Tea-table. Shepherd's Landing. McLane's Creek. Indian Creek.
	NIAGARA GROUP.		Variegated gray and yellow Argillaceous Limestone.	40	Contains nodules of Pyrites, Platyostoma, Dalmania, etc.	Near Shepherd's Landing. Mouth of Bainbridge Cr.
			Dark Shale.	10½	Abounds in Graptolites.	Bainbridge, Shepherd's Landing.
			Gray Limestone and Variegated Shale.	8		2 miles N. of Cape Girardeau.
			Red Argillaceous Limestone.	26	Orthoceras, Dalmania, Crinoids.	2 miles N. of Cape Girardeau.
			Variegated Limestone.	32		2 miles N. of Cape Girardeau.
			Gray Limestone.	12	Halysites escharoides.	Mouth of Cape Creek.
			Cape Girardeau Limestone.	60	Acidaspis Halli, Cyphaspis Girardeauensis, Prœtus depressus, Glyptocrinus fimbriatus, etc.	Mouth of Cape Creek.
LOWER SILURIAN SYSTEM.	HUDSON RIVER GROUP.		Yellow Shale. Blue Shale.	25 25	No fossils discovered.	Head of Caney Creek.
			Cape Girardeau Sandstone.	80 to 100	No fossils discovered.	Cape Girardeau, Caney Cr Head of Shawnee Cr.
			Dark Shale.	60	Isotelus gigas, Rhynconella capax, Orthis occidentalis, Chætetes, etc.	Near Cape Girardeau.
	TRENTON GROUP.		Receptaculite Limestone.	100	Receptaculites Oweni (?) Illænus, Cheirurus, Asaphus Iowensis, Strophomena filitexta, S. alternata, Leptæna sericea, etc.	Cape Girardeau. Sources of Caney Creek. Mississippi River, 5 miles below Cape Girardeau.
			Trenton Limestone.	250	Strophomena filitexta, S. deltoidea, Leptæna sericea, Orthis tricenaria, O. disparilis, O. subæquata, Chætetes lycoperdon, etc.	Cape Girardeau. Jackson. Cap. La Cruche Creek. Appleton.
			Black River Limestone.		Cythere (?) sublævis.	Near Jackson.
	MAGNESIAN LIMESTONE SERIES.	CALCIFEROUS SAND ROCK AND CHAZY LIMESTONE.	1st Magnesian Limestone.	150	No fossils found.	Hubble's Creek. Head of Byrd's Creek. Near Jackson.
			Saccharoid Limestone.	80	No fossils found.	Byrd's Creek.
			2d Magnesian Limestone.	150	Conocephalus, Murchisonia, Loxonema, etc.	Central portion of the County.
			2d Sandstone.	60		Head of Craney Creek. Fork of White-water Riv.
			3d Magnesian Limestone.	200 to 300	Conocephalus, Arionellus, Pleurotomaria, Murchisonia, etc.	Western tier of Townships.

1859, *from the Royal Society of Stockholm;* Phys. Abhandl. der Kön. Akad. der Wissenschaften, Berlin, 1859,—Math. Adhandl., 1859, 4to, Berlin, 1860, *from the Royal Academy;* Bericht der Naturf. Gesellschaft, Bamberg, 1-4, 1852-9, *from the Society;* Aus der Heimath, von E. A. Rossmässler, Jahrg. II., 1860, Glogau, *from the Editor;* Accad. delle Scienze dell' Istituto di Bologna, Rend. 1857 60,—Memoria di Antonio Cima, Bologna, 1858, *from the Academy;* Edinb. New Phil. Jour., No. 21-24, 1860, *from the Editors;* Führer durch den zool. Garten in Frankfurt a. M., von Dr. D. F. Weinland, 1860, *from the Author;* Bull. de la Société des Sciences Nat. de Neufchatel, T. V. c. 1, 1859, c. 2, 1860, *from the Society;* Jahresbericht über die Verwaltung des Medicinalwesens, etc., der freien Stadt Frankfurt, Jahrg. II., 1858, *from the Senkenb. Naturf. Gesellschaft;* Verhandl. der Naturf Gesellschaft, Basel, Theil II., Heft 4, 1860, *from the Society;* Würzburger Medicinische Zeitschrift, Band I., Heft 2--6, *from the Society;* Oversigt over det Kongelige danske Videnskabernes Selskab, 1 Aaret, 1859,—Questiones, 1850, *from the Royal Society;* Atti dell' I. R. Istituto Veneto, T. IV., Ser. iii., Disp. 9, 1859--60, *from the Ins.;* Verhandl. u. Mittheil. des Siebenbü gisch. Vereins für Naturw., Hermannstadt, Jahrg. XI., No. 1--6, 1860, *from the Society;* Sitzungsb. der K. K. Akad. der Wissensch., Wien, Band XL., No. 9, 1860—Band XLI., Nos. 18--20—Band XLII., No. 21, 1860, *from the Academy;* Notes upon the Mound Structures of Southern Illinois, Ohio, and Newark, by T. C. Walbridge, 1861, *from the Author;* Smithson. Contrib. to Knowl., Vol. XII., 4to, 1860, *from the Institution;* Amer. Jour. of Sci. & Arts, No. 93, May, 1861,—Schriften der Königl. physik.-ökon. Gesellsch., Konigsberg, Jahrg. I., Abth. 1, 1860.,—Die Metamorphose des Caryoborus (Bruehns) gonagra, Fbr , von H. L. Eldith, 1860, *from the Society;* Jahrbucher der K. Akad. der Wissenchaften, Erfurt, Heft 1, 1860, *from the Society.*

Dr. Engelmann presented from his brother, Henry Engelmann, a series of rocks and fossils collected by him while acting as Geologist of the Expedition under Lieut. Bryan, U. S. Top. Eng. for the survey of a wagon route from Kansas to Utah.

Dr. Engelmann gave an account of the unusually violent storm which prevailed yesterday, May 5th, accompanied by a fall of the barometer, such as he had, with one exception, not observed in the course of twenty-four years.* The lowest and most extraordinary stage of the barometer he had noticed here was 28.516 inches, at 4½ P. M., March 28th, 1859, during a violent thunderstorm, with hard rain and north-west wind; yesterday the lowest was 28.611 inches, nearly 0.10 inch higher.

During the 1st and 2nd of the month the barometer was high, with easterly winds and a clear sky. On the evening of the 2d it began to fall; vacillated on the 3d during storms from the west and north; fell still more with easterly winds and a clouded sky on the 4th, till in the morning of the 5th, during a thunderstorm from 6–8 o'clock A. M., with high eastern winds and a fall of 0.40 inches of rain, it fell at 7 A. M. to 28.774, and continued to fall till 2 P. M., during a most violent storm, approaching a hurricane, from the south-west, as the following table shows:

Hour of Observation.	Barometer corr. for temp.	Temp. of air.	Wet bulb temp.	Wind. Direction.	Force.	Cloudiness.
7 A. M.	28.774	56.5	55.0	E.	3	10
12 M.	28.678	72.0	64.0	S.	3	4
1.45 P. M.	28.616	76.0	60.0	S.W.	5	8
2 "	28.611	77.0	60.0	S.W.	7	7
2.30 "	28.661	75.0	57.0	S.W.	8	3
3 "	28.703	72.0	53.5	W.	7	2

* Nor now, April, 1863, in more than twenty-six years.

Norman J. Coleman, Esq., was elected an Associate Member, and Mr. J. T. Irwin, of Ravenna, Missouri, a Correspondent.

May 20, 1861.

The President, Dr. Engelmann, in the chair.

Six members present.

Letters were read from Prof. J. Lawrence Smith, Louisville, Ky., requesting exchange of specimens of Meteoric Iron; Prof. Jas. Hall, Albany, N.Y., May 9, 1861, concerning Transactions.

The following donation to the library was received: Jour. Franklin Inst., No. 5, May, 1861, *from the Institute.*

Dr. Hilgard deposited a series of about one hundred and fifty specimens of Fungi from various localities.

June 3, 1861.

The President, Dr. Engelmann, in the chair.

Six members present.

A letter was read from J. T. Irwin, Ravenna, Mo., acknowledging his election as a Corresponding Member.

The following publications were received:

Proc. Amer. Antiq. Soc., Worcester, 1861, *from the Society;* Jour. Canadian Institute, May, 1861 *from the Institute;* Proc. Acad. Nat. Sciences, Philad., March, 1861, *from the Academy.*

Dr. Engelmann presented two plates of Lichens, by G. F. W. Meyer.

Dr. Shumard announced the death, at Washington City, D. C., on the 16th May, of Dr. John Evans, U. S. Geologist of Oregon and Washington Territories, a Correspondent of the Academy.

On motion of Mr. Holmes, Dr. Shumard was appointed to prepare a sketch of the life and scientific labors of the deceased for publication in the Proceedings of the Academy.

June 17, 1861.

The President, Dr. Engelmann, in the chair.

Six members present.

A letter was read from A. F. Bandelier, of Highland, Ill., communicating meteorological observations at Highland.

The following publications were received:

Rep. Pacific Railroad Surveys, Vol. XII., Pts. I. & II., 4to, 1860, *from the Hon. Trusten Polk;* Bull. de la Soc. Imp. zool. d'Acclimatation, Paris, T. VIII., No. 4, April, 1861, *from the Society;* Proc. Entomological Soc., Philad., Mar.–May, 1861, *from the Society;* Proc. Boston Soc. Nat. Hist., April & May, 1861, *from the Society.*

Dr. H. A. Prout presented a paper for publication, entitled "New Species of *Bryozoa*, 5th series, containing descriptions of *Fenestella nodosa*, *F. dilatata*, *F. bifurcata*, and *Retepora Hamiltonensis*.

July 1, 1861.

The President, Dr. Engelmann, in the chair.

Seven members present.

Dr. Wislizenus communicated the following remarks on the so-called "army worm:"

This insect now devastating our fields is, properly speaking, a caterpillar, described in works on Natural History as *Bombyx graminis* or *grass caterpillar.* Its destruction of grass fields is dreaded as much in the North of Europe as in this country. In Sweden and Norway these insects in some years eat off the grass so thoroughly that not a blade is to be seen It made its appearance in St. Louis county in the early part of May, and is now gradually leaving us. On a farm near the city, where I observed its mode of life, it showed a decided predilection for timothy, of which it left only the lower part of the bare stem, giving it the appearance of a field of rushes. Timothy growing on high ground was less attacked by them than that growing on low ground. In lack of timothy, they devour Hungarian and blue grass, and the young shoots of all cereals, even Indian corn.

Their numbers seem to diminish, not because they die, as many suppose, but because their time has come to be changed into the chrysalis state. For this transformation the caterpillar hides itself superficially under the ground, and lies there for awhile, in a torpid, contracted state, until it is changed into a small brownish pupa, from which in a couple of weeks a butterfly is developed, a dark brownish moth. This moth, during its short life, lays numerous eggs on and below the ground, to preserve the grass-caterpillar for the next spring, when the young army-worms will, as by magic, come forth in a new generation. From the millions of eggs which the moths will lay this summer, it is feared by some that we may be overrun next spring by a still larger levy of the army-worm. But this is by no means certain. Experience, on the contrary, has proved that such a year of warfare upon our fields is generally followed by a peace of many years, since it requires peculiar climatic influences to develop these insects so freely. Their development is favored by a dry and warm summer, followed by a mild winter. In such years two generations of those insects will sometimes be procreated in one year; at any rate they thrive better, and millions of eggs that would otherwise perish are preserved in such years. The insect, with its regular transformation from the egg into the caterpillar, the pupa and the butterfly, or moth, exists always, but in some years they are nearly all killed; in others they are preserved and developed by climatic influences. Such influences, favorable to their preservation, existed last year and this spring. After a warm and dry summer and a mild winter we had a fine spring, with gradual development of heat and frequent warm rains, influences that not only aid vegetation, but also the existence of insects and lower animals generally. But since the exact repetition of such a climatic year is not very likely, it is also unlikely that the State of Missouri will have to suffer another year's warfare from *that worm*. However, as the insect has its residence on or just below the ground, the free use of the plough over such ground must certainly be useful. Digging ditches around and driving hogs and fowls into the meadows, etc., no doubt produce some good; but in case a timothy field were invaded, I would, after digging ditches, mow it down at once, in the expectation of seeing the army move off for fresh food, or die.

If any one wishes to observe the development of this insect in its three stages, let him put some of the caterpillars in a box with some ground on the bottom and covered on the top with a thin cloth; feed them daily with fresh grass until they hide in the ground and become pupa, and in a couple of weeks he may see the moth emerge from them; or by removing the ground superficially on a timothy field where they have been feeding, he may find now plenty of the pupa; put them also in a box, and in due time he may witness their last change—the moth.

Dr. Engelmann made some remarks on the comet then to be seen in the north-western sky, which from cloudiness of the sky had become visible in St. Louis only on the previous evening.

Dr. T. C. Hilgard gave an account of his researches on the history and development of the so-called fresh-water *Algæ* of St. Louis—the observed forms of such desultory brooding-phases, *leprous*, *oscillarious*, *desmidiaceo-confervaceous*, *nostochine*, *protococcous*, *hydrodictyine*, all forming one and the same "CIRCUIT OF GENERATIONS" *of the thallus of* BRYUM ARGENTEUM.

July 15, 1861.

The President, Dr. ENGELMANN, in the chair.

Seven members present.

Letters were read from Dr. Haidinger, Wien, June 12, 1861, on the Nebraska Meteorite, and sending publications; A. J. Bandelier, Jr., Highland, Ill., containing meterological observations for June, 1861, at Highland; Werner Verein, Brünn, April 15, 1861.—Roy. Society of London, Mar. 19, 1861,—Mr. Senoner, Wien, Feb. 28, 1861,—Societa Ital. di Scienze Nat., 1860; Naturk. Verein, Bonn, Jan. 22, 1861,—K. K. Gesellsch. der Wissensch. Göttingen, Feb. 22, 1861,—Verein für Naturk. im Herzogthum Nassau, Feb. 5, 1861,—K. böhmische Gesellsch. der Wissensch., Prag Heft. 3, 1860,—Physikalisch-med. Gesellschaft, Würzburg, April 17, 1861,—Museum Francisco-Carolinum, Linz, Feb. 25, 1861,—K. Preuss Akad. der Wissensch., Berlin, Feb. 28, 1861,—K. bayer. Akad. des Wissenschaften, München, Dec. 20, 1860, acknowledging receipt of Transactions of the Academy and sending publications in exchange.

Donations to the library were received as follows:

Notiz über das Meteoreisen von Nebraska, von W. Haidinger, Wien,—Die Meteoriten des K. K. Hof. Mineralien-Cabinets, am 30 Mai, 1861, *from Dr. W Haidinger;* Jour. Franklin Inst., Philad., July, 1861, *from the Institute;* X. Jahresb. des Werner-Vereins, Brünn, 1861, *from the Society;* Proc. Roy. Soc. London, Vol. X., 1859–60, 8vo—Vol. XI., No. 42 & 43, 1860–61, *from the Royal Society;* Verhandl. der K. K. zool.-bot. Gesellschaft, Wien, Band X., 1860, *from the Society;* Wochenschrift des Vereins zur Beförderung des Gartenbaues, 1860, Nos. 1–52—1861, Nos. 1–6, Berlin, *from the Society;* Atti della Societa Ital. di Scienze Nat., Milano, Vol. II., Fasc. 2, 1860, *from the Society;* Atti dell I. R. Istituto Veneto, T. V., Ser. iii., Disp. 10—T. VI., Ser. iii., Disp. 1–3, 1860–1, *from the Society;* Visir-und Recheninstrumente von Ernst Sedlaczeh, Wien, 1856,—Rechenschieber, von E. Sedlaczeh, Wien, 1856,—Kompendium der ebenen und stärischen Trigonometrie von E. Sedlaczeh, Wien, 1856, *from Mr. Senoner;* L'Ortolano, Giornale Popolare d'Orticultura, Trieste, Anno I. 1–12, III. 1–9, 1859–60,—Allocuzione da Prof. Adolfo Stopice, Trieste, 1860, *from the Society;* Fr. Ambrosii Flora Tiroliæ Australis, Vol. II., Pt. 4, *from the Author;* Verhandl. des Naturh. Vereins, Bonn, Jahrg. XVII., 1–2, 1860, *from the Society;* Sitzungsb. der K. K. Akad. der Wissenchaften, Wien, Band XLII., No. 22–28, 1860, *from the Society;* Nachrichten von der Georg-Augusts-Univ. u. der K. Gesellsch. der Wissensch., Göttingen, 1860, No. 1–29, *from the Society;* Bull. de la Société Linnéenne de Normandie, Vol. V., 1859–60, Caen, 1861, *from the Society;* Mém. de l'Acad. Imperiale de Metz, Ann. XLI., 1859–60, *from the Academy;* Jahrbücher des Vereins für Naturk. in Nassau, XIV. Heft, Wiesbaden, 1859, *from the Society;* Dr. J. C. Ed. Hoser's Rückblicke, Prag, 1848, von Dr. Weitenweber,—Sitzungsb. der K. böhm. Gesellsch. der Wissenschaften, Prag, 1859, Juli–Dec.—1860, Jan.–Juni, *from the Society;* I. Bericht des Offenbacher Vereins für Naturk, 1860, *from the Society;* Würzburger Medicin. Zeitschrift, II. Band, 1–2 Heft, 1861, *from the Society;* Der Zoologische Garten, von Dr. D. F. Weinland, Jahrg. II., No. 1–6, 1860–61, *from the Editor;* XX. Bericht über das Museum Francisco-Carolinum, Linz, 1860, *from the Institution;* Monatsb. der K. Preuss. Akad. der Wissenschaften, 1860, Berlin,—General Register, 1836-58, Berlin 1860, *from the Academy;* Gelehrte Anzeigen, Vol. 49 & 50,—Sitzungsb. des K. bayer. Akad. des Wissenschaften, 1860, Heft 1–3, München,—Verzeichniss der Mitglieder, 1860,—Bedeutung der Sanskritstudien, von Dr. Wilh. Christ, 1860,—Denkrede auf. Alex. von Humboldt, von C. F. P. von Martius, 1860,—Grenzen und Grenzgebiete der physikalischen Forschung, von Dr. C. Harless, 1860, *from the Royal Academy;* Proc. Acad. Nat. Sciences, Philad., May, 1861, *from the Academy;* 43d Ann. Rep. of the Trustees of the New York State Library, Albany, 1861, *from the Trustees.*

August 5, 1861.

The President, Dr. Engelmann, in the chair.

Seven members present.

The following publications were received:

The Great Comet of 1861, New Haven, 1861, (Extr. from Amer. Jour. of Sci. & Arts,) *from the Editors;* Catalogue of the Mammals, Reptiles, Birds, and Mollusks, of Michigan, by M. Miles, M.D., State Geologist, Lansing, *from the Author;* Rep. on the Fossil Flora of the Kentucky Coal Field, by Leo Lesquereux, 1861, *from the Author;* Synopsis of the Mollusca of the Cretaceous Formation, by W. M. Gabb, 1861, *from the Author.*

A letter was read from Dr. E. W. Hilgard, State Geologist of Mississippi, on the existence of gold in the conglomerate of Madison County, Mo. The writer stated that the occurrence of gold in that region had been doubted, but that a number of assays made by him showed this conglomerate to contain in a quantity of 7½ lbs., taken promiscuously from 150 lbs., 2½ grains of pure gold, corresponding to $22 per ton.

Dr. Koch presented specimens of quartz and of the silicious conglomerate from Madison County mentioned in Dr. Hilgard's letter.

Dr. Engelmann stated that the mean temperature of July (77.°5) had been lower than the usual mean of that month, and that the fall of rain during the same month (2.04 inches) was about one-half less than usual.

Dr. Wislizenus stated that the mean of atmospheric electricity of July had been 3.5° less than that of the month previous, and that the amount had been gradually decreasing since winter.

August 19, 1861.

The President, Dr. Engelmann, in the chair.

Six members present.

A letter was read from A. F. Bandelier, Jr., Highland, Ill., Aug. 1, 1861, communicating meteorological observations at Highland.

The following donations to the library were received:

Bull. de la Société Géologique de France, Ser. ii., T. XVIII., Feuilles 13–14, 22–31, Paris, 1861, *from the Society;* Proc. Amer. Phil. Society, Philad., Vol. XVIII., No. 65, 1861, *from the Society;* Jour. Franklin Inst., Philad., Aug. 1861, *from the Institute;* Proc. Acad. Nat. Sciences, Philad., June, 1861, *from the Academy;* Maximilian I. König von Bayern oder der Oberstpostmeister Napoleon's, von Prof. Dr. Joh. Gistel, München, 1854,—Statuten des Münchener Vereins für Naturk., 1849, von G. Tilesius,—Isis No. 2, 1850, *from the Society;* Bull. de la Soc. Imp. zool. d'Acclimatation, Paris, T. VIII., No. 6, 1861, *from the Society.*

Mr. Holmes read from Dr. B. F. Shumard the following sketch of the life and scientific labors of the late Dr. John Evans:

Dr. John Evans.—The subject of the present sketch, whose death was announced at a former meeting of the Academy, was the son of Hon. Richard Evans, Judge of the Supreme Court of Massachusetts. He was born at Portsmouth, Feb. 14, 1812, and educated at Andover, Massachusetts. Early in life he entered a commercial house in the latter State, and for several years devoted himself assiduously to mercantile pursuits. He then removed to Washington City, and for many years acted as clerk in the Post Office Department and Auditor's Office. In 1835, he married a daughter of Robert Mills, Esq., Engineer and Government Architect of Washington.

Dr. Evans commenced active Geological pursuits during the year 1847, as a member of the Geological Corps sent out by the U. S. Government, under the direction of the late Dr. David Dale Owen, to explore the North-west Territory. While connected with that survey Dr. Evans rendered efficient service, and so much confidence was had in his ability, that in the autumn of 1849 he was detailed to make some important observations in the Upper Missouri country. During this tour Dr. Evans made an excursion to the celebrated Mauvaises Terres of Nebraska, and he has the credit of having been the first scientific explorer who visited those vast cemeteries of extinct animals which have excited so much interest among scientific men.* And such was his energy that, almost unaided, he gathered in a few weeks the extensive collection of fossil bones which furnished to Dr. Leidy the materials for his splendid memoir on the "Extinct Fossil Fauna of Nebraska." At the same time he collected a large and elegant series of Cretaceous fossils, some of which were described and figured by Dr. Owen in his final report on the Geology of Iowa, Wisconsin and Minnesota. The notes made by Dr. Evans on the geological features of that remarkable region were likewise of the highest interest, and from these Dr. Owen has compiled one of the most instructive and beautiful chapters to be found in his valuable report. In addition to his scientific duties, Dr. Evans had almost exclusive control of the business department of Dr. Owen's survey, which of itself involved an immense deal of labor. The satisfactory manner in which he discharged these onerous duties, often in the midst of disheartening privations and even danger, commanded the highest esteem and confidence of Dr. Owen and his associates, while his goodness of heart, uniform courtesy, and self-sacrificing disposition, secured to him their warmest friendship.

After the completion of the field work of the North-west Survey, (1850,) Dr. Evans received the appointment of U. S. Geologist for Oregon, which he accepted, and immediately entered upon the duties of his new office with his usual energy and zeal. The survey was organized by the appointment of Dr. B. F. Shumard to the position of Principal Assistant, who shortly after embarked for Oregon, by way of the Isthmus of Panama. Dr. Evans determined to revisit Nebraska, and thence proceed overland to Oregon by an unexplored route, with the view of determining the general geological and topographical features of a vast region, then almost unknown to science, and of ascertaining if there existed a nearer way from the Upper Missouri to the Oregon coast than that usually travelled. He proceeded to St. Louis, and there spent a few days in making preparations for his journey. He then took passage for Fort Pierre Chouteau, on board a steamer belonging to the American Fur Company. During this passage, which occupied nearly a month, cholera to an alarming extent prevailed among the passengers and employees of the Fur Company on board, several of whom died, and the mortality would have been far greater but for the kind attention of Dr. Evans, who, though himself laboring under an exhausting diarrhœa, allowed himself no rest, but in the triple capacity of physician, nurse and companion, was ever at the bed-side of the sick, administering to their wants, and encouraging them by his cheering words.

From Fort Pierre, Dr. Evans again visited the Mauvaises Terres, where in a short time he succeeded in obtaining a large collection of the fossil fauna of that region, even more extensive than his former one, and embracing a considerable number of new and interesting species. On his return to the Fort he set about preparing for his long journey, which from the hostility of the Blackfeet and other Indian tribes, together with the difficulties incident to the route, was regarded by the Indian traders as extremely hazardous; hence it was exceedingly difficult to find either guides or hunters willing to accompany him. After much persuasion, however, he succeeded in procuring the services of two hunters and a half-breed guide, they agreeing to go with him as far as the Flathead Village. With this meagre escort he started from Fort Pierre, but scarcely had he reached the borders of the Blackfeet country ere his hunters became alarmed, and unceremoniously left his camp during the night and returned to the Fort. Under these discouraging circumstances a person less courageous than Dr. Evans would have turned back; but difficulties served only to develope the indomitable

* To Dr. Hiram A. Prout is justly due the credit of having first called attention to the existence of such remains in that region by his excellent memoirs of Palæotheroid and other bones, published in Silliman's Journal.

energy of his character, and with but a single man as his escort, and no other guide than his compass, he determined to continue on his course. After a wearisome travel of many days, and having encountered many privations and dangers, he and his companion, Cadotte, arrived safely, but in almost a starving condition, at the Flathead Village, situate on the western slope of the Rocky Mountains. In accomplishing this part of his arduous task, Dr. Evans passed directly through the heart of the Blackfeet country, and travelled a distance of more than two hundred miles in the main chain of the Rocky Mountains before he succeeded in finding a passage to the valley beyond. It is much to be regretted that the credit of the discovery of this important pass, which unquestionably belongs to the subject of the present sketch, has been unjustly transferred to another. It should have been named in honor of Dr. Evans instead of Cadotte, since it is well known that the latter person had no knowledge of such a passage, and, in fact, had not even been in that region before he went there under the guidance of Dr. Evans. After a few days' rest at the Flathead Village our traveller resumed his journey, and without encountering further difficulties, reached Oregon city with much valuable information concerning the extensive district of country through which he had passed.

In the prosecution of the geological survey of Oregon and Washington, Dr. Evans was actively engaged for nearly five years, during which period his travels extended over a large portion of those Territories. The results of his important labors, embracing a large amount of information relating to the geology, topography, geography and natural history of that interesting portion of the American continent, are embodied in his large report submitted to, and ordered to be printed by Congress at its last session. It was placed in the hands of the Public Printer only a few days previous to the death of its lamented author, and it is a matter of deep regret, that, owing to some informality, its publication must be delayed to await the further action of Congress. It is earnestly hoped that Congress will, at an early period, make the necessary provision for the printing of this important document, the preparation of which has cost such a large expenditure of labor and money, and which promises to be of the highest value to science and the people for whose benefit the survey was ordered.

September 2, 1861.

The President, Dr. Engelmann, in the chair.

Seven members present.

The following donation to the library was received: Bull. de la Soc. Imper. zool. d'Acclimatation, Paris, No. 7, Juillet, 1861, *from the Society*.

Mr. Holmes presented from Dr. B. F. Shumard the following skulls from Texas: *Felis pardalis*, Linn. (Tiger-cat), from Travis Co.; *Felis onza*, Linn. (Jaguar), from Hays Co., and *Dicotyles torquatus* (Peccary), from Travis Co.

Dr. Engelmann made some remarks on the temperature and humidity of the past three summer months. June and August were by more than two degrees warmer than the averages for these months, while July was cooler. The quantity of rain for each of these months was below the average altogether 10.44 inches (average 14.06). From July 21 to August 8 no rain fell, while the heat was excessive, especially from July 29 to Aug. 7, when in the afternoon of every day but one it reached 99° to 101.5°.

September 16, 1861.

The President, Dr. Engelmann, in the chair.

Six members present.

The following publications were received:

Canadian Naturalist and Geologist, and Proc. Nat. Hist. Soc. of Montreal, Vol. VI., Nos. 1–4, 1861, *from the Society;* Jour. Franklin Institute, Philad., No. 3, 1861, *from the Institute;* Proc. Entomol. Society, Philad., June–Aug. 1861, *from the Society.*

Dr. Engelmann exhibited specimens and numerous drawings of two species of *fungi,* which infest our vineyards to such an extent as to materially diminish the crop and influence the culture of the grape, at least that of the Catawba, in our region. The first is a species of *Botrytis,* and perhaps the same as Berkeley's *B. viticola,* (very near *B. acinorum,* Pers.?) It makes its appearance in the latter part of June, on the lower downy surface of the leaves of the Catawba variety of *Vitis Labrusca,* (the only one extensively cultivated here,) forming irregular confluent spots. The horizontal fibres of the mycelium have a diameter of 0.005 line, finer and whiter than the hair of the down with which they are interwoven; the erect fructiferous stems, about 0.3–0.4 line high, and a little thicker than the horizontal fibres, bear numerous horizontal branches, upwards gradually shorter, the last divisions of which form very short pedicels, always 2 or 3 together, bearing oblong or oval, very deciduous spores, 0.008–0.011 lines in the longer diameter. About the same time the mildew appears on the pedicels, and often also on the young berries when they are of the size of small peas or smaller; Dr. E. never saw it on full grown berries. Those attacked on their surface or on their pedicels soon fall off; but the most material damage is done by the mildew infesting the leaves, whereupon the greater part of the berries will gradually turn yellowish-brown at their base, shrivel from that point, assume a club shape, and at last dry up entirely, usually remaining adherent to the withered racemes. This he designated as the *brown rot.*

The second kind of rot—the *black rot*—is brought on by a very different fungus, which he believed was undescribed by botanists. It evidently belonged near Ehrenberg's genus *Næmaspora,* and ought to bear the name *ampelicida.* It makes its appearance only on nearly full grown berries, exhibiting in the first stage a discolored spot on the side, but never at the base of the berry, about 2 lines in diameter, with a dark dot in the centre. This spot soon becomes light-brown and remains so, while the surrounding part of the berry gets darker, and exhibits a rough or (under a magnifier) pustulous surface; gradually, now, the berry shrivels up and turns black. The individual fungi are little spherical bodies, (0.07–0.10 line in diameter,) formed under the surface in large numbers, which, growing, elevate, and at last burst the epidermis, then open at their apex by a small jagged hole, and, shrivelling with the berry, eject a more or less curled or twisted thread, which, moistened, becomes gelatinous, and shows the innumerable oval sporules, (0.004–0.005 line long,) each imbedded in its coat of mucilage.

These kinds of fungi are found either on distinct vines, or sometimes also on the same; they are very rarely seen on grapes cultivated in yards and on houses, but are very common, not to say universal, in our gardens and vineyards, in some seasons more so than in others. It is said that vineyards further north, e. g. in Northern Illinois, are free from these pests.

Whether other diseases assist in the destruction of the grape, as wine-growers will have it, he cannot, from his own experience, determine. He has never seen the *Erysiphe*, which is so destructive to the gooseberry, and to vines in graperies, on grapes cultivated in the open ground.

Dr. Hilgard presented a series of mounted specimens of Algæ.

October 7, 1861.

The President, Dr. ENGELMANN, in the chair.

Six members present.

A letter was read from A. F. Bandelier, Oct. 4, 1861, communicating meteorological observations for September, at Highland, Ill.

The Proc. Boston Soc. Nat. Hist., May–August, 1861, was received as a donation to the library.

Dr. Shumard presented a small piece of meteoric iron from Denton Co., Texas.

Dr. Engelmann communicated the results of his investigations on the nature of the pulp of the Cactus fruit, illustrated by many drawings. Zuccarini, than whom none better understood the morphology, as well as the systematic characters of the Cactaceæ, had already in the year 1845 (Plant. nov., fasc. 5, pag. 34) expressed the opinion that in Cactaceæ, as well as in Cucurbitaceæ, the *funiculi* assisted in forming the pulp of the fruit. Schleiden (Grundzüge, ed. 3, p. 408) ascribes the pulp of Mamillaria to an *arillus*, dissolving into single juicy cells. Gasparrini, in his extended but rather odd description of the Opuntiæ fruit, (Osservazioni, 1853, p. 20,) also considers the pulp as a peculiar sort of an arillus. I had long since come to the conclusion, especially after examining the somewhat dry fruits of *Cereus cæspitosus* and *Echinocactus setispinus*, that the *funiculi* alone constitute the pulp, and in Cact. Mex. Bound., T. 20, fig. 12, I had figured the enlarged funiculi of the latter plant.

The Cactus fruit is usually succulent; only some Echinocacti and some Opuntiæ are known to bear dry fruits. The succulent fruit consists of the fleshy walls of the fruit itself, originating from the carpel and the adhering calyx, (or part of the stem, as Zuccarini will have it,) coalescing and forming a homogeneous mass, and of the juicy pulp, in which latter the seeds are imbedded. In some species the parenchyma of the walls, in others the mass of the pulp, prevails. *The pulp is always the product of the funiculus or its appendages.* The funiculus, even at the flowering period, bears on its inner side a beard of transparent fibres, 0.01–0.10 line in length; the fruit maturing, these fibres are enlarged, and the whole cellular tissue of the funiculus becomes, as it were, hypertrophic, every cell swelling up, filling with a sweetish, mostly red-colored juice; at last the cells in most species separate from one another, and leave the seeds floating in the pulp attached only to the slender spiral vessels. The mass of the funiculi and their proportion to the mass of the seed is very different in different species; in *Lepismium Myosurus* it constitutes only ⅓ or ½ of the seed; in *Mamillaria Nuttallii* it bears, perhaps, a still smaller proportion; while in other Mamillariæ, e. g. *M. polythele* and

M. pusilla, it is 2–4 times as large as the seed. In the large edible fruits of *Cerei*, such as *C. triangularis*, *C. grandiflorus*, *C. giganteus*, etc., it constitutes by far the largest part of the fruit. The cells are globular, oval, or variously compressed; in some species I find them extremely small, 0.01-0.03 l. long, while in others they are 0.1–0.2 and even 0.3 l. long.

The genus *Opuntia* apparently differs in having the whole seed covered with juicy cells, which, in size and quantity, vastly predominate over the cells of the rather insignificant funiculus proper. But the whole bony coating of the seed being but an arillary enlargement of the funiculus, (Cact. Mex. Bound., p. 76,) this peculiar case entirely falls into the analogy of the other *Cactaceæ*. The real difference is caused by the nature of the arillus, which, getting extremely hard, leaves the cells of the epidermis only to grow out, and finally to form the pulp of the fruit. Soon after fecundation these cells gradually become elongated, cylindrical, and disconnected among one another, rising perpendicularly from the surface of the seed; they are shorter, of nearly equal length, and perfectly straight, on the faces of the young seed, and longer, hair-like, and twisting in different directions on and near the rim. In *O. glaucophylla*, which I take to be a mere variety of *O. Ficus Indica*, I find them at their first appearance on a seed of less than one line in diameter only about 0.004 l. long and wide; on the rim they soon grow to twice the diameter and ten times the length, till at maturity the larger ones are 0.3–0.5 l. long. These cells, at first simple and cylindrical, become at last jointed and clavate, the terminal cells being many times larger than the basal ones, thus properly filling the interstices between the seeds. During winter, the fruit and seeds having reached their full growth, these cells contain a colorless, viscous, insipid fluid; in the following spring, when the fruit has assumed a deep purple colour, and attained full maturity, they contain a sweetish, purple liquid, and soon separate, forming what is properly called the pulp. The single cells are mostly oval or oblong, 0.02–0.20 l. in length. I find the same structure in *O. Engelmanni*, which, however, ripens its fruit, with us, in autumn, and it undoubtedly obtains in all Opuntiæ with large and juicy fruit.

In *O. Rafinesquii*, and probably in all species with less juicy fruit, the cells on the face of the seed are not developed, only those on the rim producing the pulp, which in this species as well as in *O. vulgaris* and *O. Pes Corvi*, remains, even at full maturity, insipid and viscous and of pale red colour. In this condition the fruit adheres to the plant, without any change, until it falls off in the following spring.

In *O. Brasiliensis* and *O. monacantha* these epidermis-cells are greatly elongated, forming, in fact, a matted, tough beard, 2–3 lines long, analogous to that of the unripe cottonseed; each hair consists of several slender joints, 0.01–0.02 l. in diameter, the terminal one often thickly clavate or otherwise variously inflated. I have found them thus in the unripe fruit late in autumn; how they may change at maturity I have been unable to ascertain.

No such development of the epidermis-cells seems to take place in the Opuntiæ with dry fruit, such as *O. Missouriensis*, *O. clavata*, etc.; the seed, consequently, has a whiter, polished, ivory-like surface, while that of the juicy Opuntiæ fruits is dull and almost rough, and not so white.

The cells of the parenchyma of the fruit, as well as those of the bony seed-coat, are full of aggregations of crystals; those of the funiculus proper contain fewer and smaller clusters; but in the pulp itself I have never seen them; neither could I discover any in the parenchyma, or in the pulp of the fruits of Mamillariæ.

Dr. J. S. Newberry, of Cleveland, O., and Prof. Chas. T. Jackson, of Boston, Mass., were elected Corresponding Members.

October 21, 1861.

The President, Dr. ENGELMANN, in the chair.

Seven members present.

A letter was read from Dr. Charles T. Jackson, of Boston, acknowledging his election as a Corresponding Member.

The following donations to the library were received:

Rep. on the Economical Geology of the Route of the Ashtabula & New Lisbon Railroad, by J. S. Newberry, M.D., Cleveland, 1857,—Report on State-house Well, by J. S. Newberry,—Catalogue of Flowering Plants and Ferns of Ohio, by J. S. Newberry, M.D., 1860, *from the Author;* Proc. Boston Society Natural History, Sept. 1861, *from the Society;* Journal of the Franklin Institute, October, 1861, *from the Institute;* Bull. de la Soc. Imp. zool. d'Acclimatation, Paris, No. 9, 1861, *from the Society;* Canadian Nat. & Geologist, and Proc. Nat. Hist. Soc., Montreal, Vol. VI., No. 5, Oct. 1861, *from the Society;* Proc. Acad. Nat. Sciences, Philad., Aug. 1861, *from the Academy;* Faune Primordiale dans la Chaine Cantabrique, par Casiano de Prado, Ed. de Verneuil, et J. Barrande, Paris,—Dépôt organique dans les loges aériennes des Orthocerés, par J. Barrande,—Obs. sur quelques genres de Céphalapodes Siluriens, par J. Barrande,—Extension de la Faune Primordiale de Bohémie, par J. Barrande,—Colonies dans le basin Silurien de la Bohémie, par J. Barrande,—Troncation normale ou periodique de la coquille dans certains Céphalapodes paléozoiques, par J. Barrande,—Notes sur quelques nouveaux Fossiles dans le basin Silurien du centre de la Bohémie, 1855, par J. Barrande,—Le Système Taconique en Amérique, par J. Barrande, 1861,—Graptolites de Bohémie, par J. Barrande, 1850,— Analyse du travail de M. Ed. Suess sur les Brachiopodes de la Collection de Vienne, par M. Deshayes,— Notice biographique sur Mercier de Boissy, par M. D'Archiac, 1856,—Notice sur la vie et les travaux de Jules Haime, par M. D'Archiac, 1856,—Notes on the Cretaceous and Carboniferous Rocks of Texas, by Jules Marcou, Boston, 1861,—Lettres sur les Roches de Jura, par Jules Marcou, Liv. 2, Paris, 1860,—Parallèle entre les Dépôts Siluriens de Bohémie et de Scandinavie, par J. Barrande, Prague, 1856, *from Prof. Jules Marcou;* Primordial Zone of Texas, with Descriptions of New Fossils, by B. F. Shumard, 1861, *from the Author.*

Dr. Shumard presented *Exogyra arietina* from the Cretaceous of Texas, and several *Naiades* from the Ohio River.

Dr. Shumard called the attention of the Academy to a new Crustacean from the Cretaceous of Hempstead Co., Ark., presented to the museum by Dr. Koch. Dr. Shumard proposed for it the name *Mesostylus Americanus.*

Dr. Shumard exhibited a series of specimens of his *Ostrea subovata* (*O. Marshii, Marcou*) from the Washita Limestone of Fort Washita and Austin, Texas, and among them the original specimen described by him in Marcy's Report.

Prof. Joachim Barrande, of Prague, Bohemia, was elected a Corresponding Member.

November 4, 1861.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

A letter was read from the Secretary of the Smithsonian Inst., Washington, D. C., concerning exchanges.

Mr. G. C. Broadhead presented a specimen of *Megistocrinus latus*, Hall, from St. Charles Co., Mo.

Dr. Shumard presented specimens of the supposed gold-bearing quartz from the region of Pike's Peak, C. T.

Mr. Broadhead exhibited a map showing the boundaries of forest trees and shrubs in North-west Missouri.

November 18, 1861.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

Letters were read from the Literary and Phil. Soc., Manchester, Eng., Aug. 15, 1861,—Librarian of Board of Trade, London, March 21, 1861,—Overysseche Vereenigung, Zwolle, July 8, 1861,—Sec'y of the Smithsonian Inst., Washington, Nov. 15, 1860,—Bataafsch Genootschap der Prœfond. Wisbegeerte, Rotterdam, Dec. 29, 1860,—Dr. Moritz Hornes, Wien, Nov. 22, 1860,—Soc. Imp. des Naturalistes de Moscou, Dec. 27, 1860,—K. K. zool.-botan. Gesellschaft, Wien, Dec. 5, 1860, acknowledging receipt of Transactions of the Academy and transmitting publications in exchange.

The following publications were received:

Smithsonian Report for 1860, *from the Institution;* Jour. Franklin Inst., Philad., Nov. 1861, *from the Institute;* Proc. Entomological Soc., Philad., Sept.--Oct. 1861, *from the Society.*

Dr. Hilgard presented the fruit of *Asimina triloba*, *Liriodendron tulipifera*, and a cast of fruit of *Anona cherimolia;* also, a series of specimens illustrating the development of Fungi.

December 2, 1861.

The President, Dr. ENGELMANN, in the chair.

Seven members present.

The following work was received: New Species of Lower Silurian Fossils, by E. Billings, *from the Author.*

Dr. Hilgard presented bones of mammals, birds, and fishes.

December 16, 1861.

The President, Dr. ENGELMANN, in the chair.

Six members present.

A letter was read from A. F. Bandelier. Jr., Highland, Ill., Dec. 3, 1861, containing meteorological observations.

The following donations to the library were received:

Descriptions of New Cretaceous Fossils from Texas, by Dr. B. F. Shumard, *from the Author;* Proc. Acad. Nat. Sciences, Philad., Oct. 1861, *from the Academy;* On some Questions concerning the Coal Formations in the U. States, by Leo Lesquereux, 1861,—Fossil Footprints found in connection with the Lignites of Brandon, Vt., by Leo Lesquereux, 1861, *from the Author;* 1st Bienn. Rep. of the Progress of the Geological Survey of Michigan, by A. Winchell, State Geologist, Lansing, 1860, *from the Author;* Bull. de la Soc. Imp zool. d'Acclimatation, Paris, Tom. VIII., No. 10, Oct. 1861, *from the Society.*

January 6, 1862.

The President, Dr. ENGELMANN, in the chair.

Fourteen members present.

Letters were read from the Verein für vaterl. Naturk., Stuttgart, July 1, 1861; K. K. Akad. der Wissensch, Wien, June 25, 1861; Naturf. Gesellsch. Freiburg i. B., July 10, 1861; Naturh. Verein, Augsburg, Aug. 4, 1861; Naturf. Gesellschaft, Dorpat, April 17, 1860; Naturw. Verein, Hamburg, Oct. 2, 1860; Naturf. Gesellschaft, Halle, Aug. 8, 1861; Gesellsch. zur Beförd. des gesammten Naturw., Marburg, Aug. 14, 1861; Naturf. Gesellschaft, Zurich, July 17, 1861,—acknowledging receipt of Transactions of the Academy and announcing publications in exchange.

Donations to the library were received as follows:

Jour. Franklin Inst., Philad., Vol. XLII., No. 6, Dec. 1861, *from the Institute.* Proc. Acad. Nat. Sciences, Philad., Nov. 1861, *from the Academy.* Notes on Cretaceous Fossils, by W. M Gabb, *from the Author.* Bull. de la Soc. Géol. de France, série 2, T. XVIII., Feuill. 1–6, 1860; 7-12, 1861, Paris, *from the Society.* Zeitschrift für die gesammten Naturw., Halle, Bd. XIII.--XVI., 1859-60, *from the Society.* Würtemb. naturw. Jahreshefte, Jahrg XVII., Heft 1--3, Stuttgart, 1861, *from the Society.* Sitzungsb. der K. K. Akad. des Wissensch., Wien, 1861, I. Abth. 1--2, II. 1--2, *from the Academy.* Bericht über die Verhandl. des naturf. Gesellschaft, Freiburg i. B., Bd. II., Heft 3, 1861, *from the Society.* XIV. Bericht des naturh. Vereins, Augsburg, 1861, *from the Society.* Algemeene Grondtrekken des Volks-huishondkunde von Dr. Arndt, Kampen, 1858; Een Geldersch Reisje van Amsterdam, Arnheim, 1848; Redevœring von Matthys Siegenbeek, Leiden, 1818; Landbouwkolonie Nederlandsch, 1857; Handelingen der Nederl., Bijbelgenootschap, 1857; Verslag van der Directie des Overyss. Vereen. tot Ontw. van Prov. Welvaart, Kampen, 1860, *from the Society.* Mémoires de l'Acad. Imp. des Sciences, Arts, et Belles-lettres de Caen, 1861, *from the Academy.* Mém. de l'Acad. Imp. de Dijon, Ann. 1860, Dijon, 1861, *from the Acad.* Archiv. für Naturk. Liv.-Ehst.-und Kurlands, Bd. II., III., 1860, Dorpat, *from the Soc.* Abhandl. v. d. naturw. Verein, Hamburg, Band IV., Abth. 2, 1860, *from the Society.* Abhandl. der Naturf. Gesellschaft, Halle, Bd. II., Heft 1, 1861, *from the Society.* Bull. de l'Acad. Imp. des Sciences, St. Petersbourg, T. II. 4--8, T. III. 1--5; Mémoires, 7e. Série, T. III. 2--9, 1860, *from the Academy*. Schriften der Gesellsch. zur Beförderung des gesammten Naturw., Marburg, Band VIII. 1857, Band VI.--VII. 1848--9; Theorie der Curven, von Dr. W. Schell, Leipzig, 1859; Acht Tafeln zur Physisch-med. Topographie, von C. F, Danz und C. F. Fuchs, Marburg, 1848; Wetterauer Gesellschaft für Naturk., 1858; Beitrag zur Geschich. der Fœtus im Fœtus, von Schwartz, Marburg, 1860, *from the Society*. Vierteljahrschrift der naturf. Gesellsch Zurich, Jahrg. III. Heft 3--4, IV. 1--4, V. 1--4, 1858--60, *from the Society*. Amer. Jour. Sci. & Arts, Nov. 1861, *purchased*.

Dr. Hilgard presented a colored engraving of the Mont Blanc chain from La Flegère, by Prof. Redtenbacher.

The Reports of the Corresponding Secretary and Treasurer for 1861 were read, referred, and accepted.

The President read the following Annual Report of the Progress of the Academy for the year 1861:

The Sixth Anniversary of our Academy imposes upon me the duty of laying before the members an abstract of our condition and our progress during the past year. And an extraordinary year it was! Our hitherto happy and prosperous country thrown into a civil war, and no part of it, perhaps, more torn and lacerated than our own State; a State which, more than any other had an interest and a desire to remain at peace!

How could Science prosper in this distracted state of public as well as private affairs? Nevertheless, I am happy to bear witness that those members of our Academy who, since their joining our Institution, had always proved its most zealous and most reliable supporters, did not abate in their zeal. The attractions of Science proved more powerful than the distractions of our public affairs.

Our semi-monthly meetings were regularly attended, and were made interesting as well as instructive, by the exhibition of numerous scientific objects, and by the reading of essays, and by scientific communications and discussions.

But our finances, as the Treasurer's Report shows, did not keep pace with our scientific wants, and thus we were prevented from issuing another number of our Transactions, in regular course, and not for a want of material, for we have a number of valuable scientific communications on hand, with which we might enrich and extend the domain of Science, and gratify our numerous correspondents in this and other lands, but for the want of the comparatively small sum of a few hundred dollars to pay for their publication.

We have, however—and I believe I do not use too strong a term—entered into a sacred engagement with the world of Science, and especially with more than 200 scientific bodies in this country, in Europe, and in more distant continents, which have honored us with their correspondence, and which are, in the most liberal manner, loading the shelves of our library with their publications in exchange for ours, although in most instances much more extensive and costly than our modest Transactions. We owe it to them, we owe it to ourselves, to continue the publication of at least one annual number of our proceedings. And permit me here to remind the citizens of this great metropolis, usually so open-handed, that the stamp of Science, the support of a scientific Institution, known and appreciated among other peoples and in other climes, would not be among the least valuable ornaments in their civic crown. Do not let the invidious taunt us with the ruin of our city, and instance, among other proofs, the downfall, the silence at least, of our scientific institutions. No! It will be considered as a proof of the vitality of St. Louis—a proof of the energy of her citizens, if, even in this dire period of her history, we shall continue, or rather resume our publications. And, indeed, it is understood, as I am permitted to inform you, that through the liberality of some friends of our Academy, it will probably be made possible soon to commence the publication of a fifth number of our Transactions.

The Smithsonian Institution has continued to act as agent for the transmission of our foreign exchanges, with but trifling expense to us.

Our last, or fourth number, published in October, 1860, was sent to them in May last, and is now, it is presumed, in the hands of the individuals and societies abroad to whom it was directed.

The total number of our home list is now sixty-nine, and of our foreign list one hundred and sixty, nine of which have been added within the last year; and from several societies, and among others the Royal Society of London, and the Geological Society of France, we have now for the first time received their proceedings in exchange for ours.

Our library has increased principally through these exchanges, having received from this source an addition of 266 volumes, numbers or pamphlets. Different Congressional publications have been presented by the Hon. Trusten Polk and the Hon. Frank P. Blair. Prof. E. W. Hilgard, of Mississippi, Prof. A. Winchell, of Michigan, Prof. Guyot, Dr. Pollak, and Dr. Engelmann, donated several valuable works to our library, and a most important acquisition was the great work of Goldfuss on Petrefactions, which the Academy bought from our member, Mr. C. Witter, on easy terms.

The additions to our Museum consisted in donations by members and correspondents in the following departments:

Comparative Anatomy.—Skulls of some rare Texan quadrupeds, by Dr. B. F. Shumard. Skulls of Missouri animals, by Mr. I. T. Irwin, of Ravenna, Mo.

Zoology.—Eggs of Birds, by the same gentleman; specimens of Reptiles and Insects, by Drs. Pope, Wislizenus, and Shumard.

Botany.—A large series of Algæ, Fungi and Lichens, by Dr. Theo. C. Hilgard; Fruits by Dr. Pope.

Mineralogy.—Specimens presented by Dr. Hilgard, Dr. Leigh, Dr. Shumard, and Dr. A. Koch. From the latter we obtained a suite of the gold-bearing rocks of Southwestern Missouri.

Geology.—Fossils by Mr. Irwin, Mr. G. C. Broadhead, and General Harney.

It is proper to state here, that our former President, Dr. B. F. Shumard, has, since his return from Texas, resumed the arduous duties of arranging part of our collection, commenced at an earlier period by Dr. H. Prout, and has thus greatly enhanced the value and the favorable appearance of our Museum, while our Library was kept in complete order by Dr. G. H. E. Baumgarten. While the former gentleman will henceforth, it is expected, devote his leisure to the Academy as a permanent citizen of our town, the latter, who had just begun to study and arrange our herpetological collection, has sought a wider field of usefulness, in the naval service of the United States, where, it is hoped, he will not forget our institution.

The following papers were read during the past year, most of them intended for publication:

From Prof. G. C. Swallow—On New Fossils of the Carboniferous and Devonian Formation.

Dr. B. F. Shumard—Cretaceous Fossils of Texas; on the Geology of Texas in general; on the Geology of Cape Girardeau County, Mo.

Dr. A. Wislizenus—On Dellmann's Apparatus to measure Atmospherical Electricity, and his own Observations with this instrument; on the Army Worm, *Bombyx graminis.*

Dr. H. Behr, of San Francisco, Cal.—On the Geographical Distribution of the Lepidoptera.

Dr. T. C. Hilgard—Abstracts of his Investigations of the Development and Transformation of the lowest vegetations of Fungi, Algæ and Mosses.

Dr. H. A. Prout—New Species of Bryozoa; fifth series.

Prof. E. W. Hilgard, of Oxford, Mi.—On the Gold-bearing Formation of Missouri.

Mr. G. C. Broadhead, of St. Louis—On the distribution of Trees and Shrubs in Northern Missouri.

Dr. Rau—On some ancient Indian Graves in Monroe and St. Clair Counties, Illinois.

Mr. A. F. Bandelier, Jr.—Meteorological Observations made at Highland, Illinois.

Dr. G. Engelmann—Meteorological Table for 1860; Comparative Meteorological Table for the last twenty-five years; On some Mildews and Moulds, and especially on two Fungi destructive to the Catawba Grape; On the structure of the pulp of the Cactus Fruit.

In conclusion, I have to state that two new Associate Members have joined our society, while several have left us, principally by removal from our city. Our list of Correspondents has received an addition of ten new names.

The Treasurer reports the number of Associate Members to be one hundred and two, of which, I am constrained to say, about two-thirds are in arrears with him. Our debts are principally one of about $70 to Mr. Witter, and one of a little over $400 to the *Republican* office; these we expect to liquidate as soon as our members pay their contributions.

It is needless, in these times, to speak of hopes and wishes for the future of our Academy; but let us hope and pray for peace, and peace will bring prosperity to the people, and so to the prosecution of science.

The following gentlemen were elected officers of the Academy for the year 1862:

President, ...	George Engelmann, M.D.
1st Vice-President, . .	Charles A. Pope, M.D.
2d Vice-President, . .	Adolphus Wislizenus, M.D.
Corresponding Secretary,	Nathaniel Holmes, Esq.
Recording Secretary, .	Benjamin F. Shumard, M.D.
Treasurer, ...	Enno Sander, Esq.
Librarian, ...	F. E. Baumgarten, M. D.
Curators, ...	B. F. Shumard, M.D., Hiram A. Prout, M.D., Geo. Engelmann, M.D., Theo. C. Hilgard, M.D.
Com. on Library, . .	Benj. F. Shumard, Enno Sander, F. E. Baumgarten.
Com. on Finance, . .	James B. Eads, Chas. A. Pope, Britton A. Hill.
Com. on Publication,	N. Holmes, B. F. Shumard, Ad. Wislizenus.

January 20, 1862.

The President, Dr. ENGELMANN, in the chair.

Nine members present.

The following donations to the library were received:

Proc. Califor. Acad. Nat. Sciences, 1860--1, *from the Academy.* Proc. Amer. Antiq. Soc., Worcester, 1861, *from the Society.* Proc. Entomol. Soc., Philad., Nov. & Dec. 1861, *from the Society.* Circular of the Editor of Dr. T. W. Harris' Work on Insects destructive to Vegetation.

Wm. H. Clark, Esq., presented a "Diamond Beetle" from Brazil, and deposited a series of specimens obtained by him from the celebrated Porcelain Tower of Nankin, China, destroyed in 1854. The specimens consist of three bricks, with their exterior surfaces highly glazed, and the inner ones coated with the original cementing material; an ornamental slab, which formed a part of the facings; and a section from the grand arch, representing in beautiful relief a part of the five-toed Dragon.

Dr. Engelmann presented a collection of several hundred marine shells, from various localities.

Dr. Stevens exhibited some curious silicio-calcareous concretions from Macoupin Co., Ill.

Dr. Engelmann presented a Report of his Meteorological Observations for 1861; also, a Table showing the amount of fall of Rain at St. Louis from 1839 to 1861 inclusive, embracing a period of twenty-three years, with a profile exhibiting the maximum and minimum of rain during that period. Referred to Publication Committee.

Prof. H. A. Warriner, of Antioch College, Ohio, was elected a Corresponding Member.

February 3, 1862.

The President, Dr. ENGELMANN, in the chair.

Eleven members present.

Letters were read from Prof. H. A. Warriner, Jan. 22, acknowledging his election as a Corresponding Member; Col. S. H. Long, Bureau of Top. Eng'rs, U. S. A., Washington, Jan. 20, 1861, sending publications; Prof. Jules Marcou, Boston, Jan. 25, 1862, announcing publications sent.

The following publications were received:

Trans. Ills. Nat. Hist. Soc, 2d ed., Bloomington, 1862, *from the Society.* Report upon the Physics & Hydraulics of the Mississippi River, by Capt. A. A. Humphreys & Lieut. H. L. Abbot, Top Engrs. U. S.A., 4to, 1861, *from the Bureau of Top Engineers.* New species of Lower Silurian Fossils, by E. Billings, F.G.S., Montreal, 1862. *from the Author.* Proc. Boston Soc. Nat. Hist., Nov. & Dec. 1861, *from the Society.* Taconic & Lower

Silurian Rocks of Vermont & Canada, by Jules Marcou, 1861, *from the Author.* Revision of the Species of *Baculites* described in Dr. Morton's Synopsis of the Cretaceous Group of the U. States, by W. M. Gabb, 1861, *from the Author.*

Dr. Wislizenus read a paper containing a synopsis of his observations on Atmospheric Electricity. Referred to Publication Committee.

Chairmen of Committees for the year 1862 were appointed as follows:

Ethnology, ...	N. Holmes.
Comparative Anatomy, .	Chas. A. Pope.
Mammalogy, ...	Chas. W. Stevens.
Ornithology, ...	G. C. Broadhead.
Ichthyology and Herpetology,	T. C. Hilgard.
Botany, ...	Geo. Engelmann.
Entomology, ...	T. C. Hilgard.
Conchology, ...	G. C. Broadhead.
Geology and Palæontology,	B. F. Shumard.
Meteorology, ...	A. Wislizenus.
Mineralogy, ...	Hiram A. Prout.

February 17, 1862.

Vice-President Dr. WISLIZENUS in the chair.

Six members present.

Letters were received from the Royal Acad. of Sciences, Madrid, Jan. 1862, acknowledging receipt of Trans. No. 4; Dr. Felix Flügel, Leipzig, Jan. 1862, announcing exchanges; A. F. Bandelier, Highland, Ill., Feb. 6, 1862, communicating meteorological observations at Highland, for Dec. 1861 & Jan. 1862; C. A. White, Burlington, Iowa, Feb. 10, 1862, concerning publication of papers; B. Westerman & Co., N. York, Feb. 13, 1862, ordering copies of the Transactions of the Academy.

Donations to the Library were received as follows:

Bull. de la Soc. Imp. zool. d'Acclimatation, Paris, T. VIII., No. 12, 1861, *from the Society.* 13th Ann. Rep. Regents of the Univ. of N. York, Albany, 1860, *from Dr. Wislizenus.*

March 3, 1862.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

The following publications were received:

Canadian Nat. & Geol. & Proc. Nat. Hist. Soc., Montreal, Vol. VI., No. 6, 1861, *from the Society.* Atti della Societa di Acclimazione e di Agricoltura in Sicilia, T. I., No. 1–5, 1860–1, Palermo, *from the Society.* Kentucky Geol. Survey, Vol. IV., 1861, *from Prof. Robert Peter.* Il Primo libro d'Architettura di M. Sebastiano, Venice, 1551, *from Dr. Behr.*

March 17, 1862.

The President, Dr. Engelmann, in the chair.

Five members present.

The following letters were received:

From Prof. Jos. Henry, Sec'y Smithson. Inst., Feb. 20 & 27, 1862, concerning exchanges; A. F. Bandelier, Jr., Highland, Ill., containing meteorological observations at Highland; Société Roy. des Sciences, Upsal, Sept. 2 & 9, 1861; K. K. Akad. der Wissensch., Wien, Oct. 4 & 28, 1861; Roy. Danish Soc. of Sciences, Copenhagen, July 1, 1861; Naturw. Verein des Hartzes, Blankenburg, Oct. 23, 1861; Dr. Robert Peter, Lexington, Ky., March 8, 1861; A. F. Bandelier, Jr., Highland, Ill., March 7, 1862, containing meteorological observations for Feb. 1862; Reale Accademia delle Scienze, Naples, Ap. 16, 1860, & Mar. 13, 1861; Naturh. Gesellsch., Nürnberg, Feb. 25, 1861; Naturf. Gesellsch., Altenburg, Sept. 24, 1861: Naturf. Gesellsch, Danzig, 1861; Verein für Naturk. im Herzogthum Nassau, Wiesbaden, Oct 1, 1861; K. K geograph. Gesellsch., Wien, Oct. 20, 1861; Director W. Haidinger, Wien, Sept. 23, 1861; K. bayer. Akad. der Wissensch., München, Dec. 2, 1861; L. Sheffler, Oct. 23, 1861.

Additions to the library were received as follows:

Wochenschrift des Vereins z. Beförd. des Gartenbaues, No. 7--49, 1861, Berlin, *from the Society*; Nova Acta R. Soc. Scientiarum, Upsal, Ser. 3, Vol. III., 1861; Arskrift, II., 1861, *from the Society.* Sitzungsb. d. math.-naturw. Classe. der K. K. Akad. der Wissensch., Wien, 1860, No. 29; 1861, I. Abth. 3--8, II. Abth, 3--7, *from the Academy.* 2r Bericht des Offenbacher Vereins für Naturk. 1860--1, *from the Society.* K. danske Videnskabernes Selskab, Obersigt, 1860; Questiones, 1861, *from the Society.* Aus der Heimath, von Dr. E. A. Rossmässler, No. 26--49, 1861, Leipzig, *from the Editor.* Report of Geol. Survey of Kentucky, Vols. I.--III., by D. D. Owen, 1856--7,—Maps & Plates, 1857; Geol. Reconnoissance of State of Indiana, 1837, by D. D. Owen, *from Dr. Robert Peter.* Jour. Acad. Nat. Sciences, Philad., Vol. V., Pt. 1. 1862; Proc. of same, Dec. 1861, *from the Academy.* Canadian Nat. & Geolog. & Proc. Nat. Hist. Soc., Montreal, Vol. VII., No. 1, 1862, *from the Society.*

Papers were read by Dr. George Engelmann as follows:

"On the difference of Temperature, Evaporation and Relative Humidity of the Atmosphere in the City of St. Louis and surrounding country."

"On *Pinus aristata*, a new species of Pine discovered by Dr. C. C. Parry in the Alpine Regions of the Rocky Mountains."

"On some new species of *Gentiana* from the Alpine Regions of the Rocky Mountains."

"Additions to the Cactus Flora of the Territory of the United States."

These papers were referred to the Publication Committee.

Mr. Holmes called the attention of members to a very interesting article in the "*Sitzungsbericht*" of the Imperial Academy of Sciences of Vienna, for March, 1861 (Bd. XLIII., Heft 3, pp. 389–426), by Prof. W. Haidinger, on the Nature of Meteorites, their Origin and Composition, (*über die Natur der Meteoriten in ihrer Zusammensetzung und Erscheinung*), in which the learned author considers the bodies, first, in reference to the phenomena attending their arrival upon our Earth; and, second, in reference to their original formation and composition. As it appeared to him to present this curious and mysterious phenomenon in nature in a more clear and satisfactory light than anything he had hitherto seen upon the subject, he had ventured to give a translation of the few brief positions into which the distinguished author sums up his conclusions, as follows:

"I.

"1. Through the Almighty Word (*Werde*) there comes out of nothing into (world-)space (as it is now known to us) matter indued with the manifold properties which we are now able to discover in it, in the most divided elementary condition in the *status nascens*.

"2. The material world consists of cosmic matter, gathered into globular masses, after the manner of the (fiery) molten spheres of the nebular theory of La Place.

"3. The pressure of the outermost upon the deeper lying strata, and the pressing of like and unlike particles against one another, raises the temperature, and there begins 'a reaction of the interior of the body against the rind and surface.'*

"4. For a solid rind is formed, whilst the innermost parts are yet only in progress of solidification.

"5. Difference of expansive power in the inner and outer portions may cause an explosion of the celestial body. The fragments would be scattered in all directions and thrown off into the regions of the fixed stars.

"II.

"1. A fragment in its course reaches the atmosphere of our Earth.

"2. Its cosmic velocity meets here with resistance which checks it.

"3. During this time, in consequence of the pressure, light and heat are developed; the meteor rotates and acquires a fused rind.

"4. The stratum of heated air is rolled back behind the meteor into a 'fireball.'

"5. Coming to a stop, the meteor ends its cosmic course.

"6. The development of light and heat ceases; and the vacuum of the fireball is suddenly filled up, with the noise of a powerful explosion.

"7. The cold of the inner kernel equalizes itself with the heat of the outer rind.

"8. The meteorite falls down as a heavy body belonging to the Earth, so much the warmer, the better its material conducts the heat."

He would only observe, with regard to the first proposition, that he presumed we were to understand the author as meaning to say no more than that something comes into existence, in that manner, as particular forms of matter, where no such particular things existed before, and not that something could be created absolutely out of nothing. Lord Bacon thought it belonged to one and the same Omnipotence to make nothing of somewhat as to make somewhat of nothing; and, in one sense, this may be true. Berkeley conceived of the Creator as a "thinking essence," and he denied the existence of any other matter. This, too, may be true. Newton, also, spoke of the "thinking substance of God," whom he considered to be "omnipresent not *virtually* only, but also *substantially*; for virtue cannot subsist without substance."† According to Plato, "the beginning of motion is that which moves itself;" and this he took to be "the very essence and true notion of soul." It being once admitted that the Almighty Being exists as a thinking essence, it then becomes easier to conceive how new forms of matter may be continually created out of, and returned into, this one substance of all created things.

* Humboldt, Kosmos. † Principia.

Prof. Robert Peter, of Lexington, Ky.; Prof. J. Bosquet, of Maestricht, and Prof. Richard Owen, of New Harmony, Ind., were elected Corresponding Members.

April 7, 1862.

The President, Dr. Engelmann, in the chair.

Ten members present.

The following publications were received:

Rep. of Overseers of Harvard College on Library for 1861, *from the Librarian.* Rep. upon the Colorado River of the West, by Lieut. J. C. Ives, U. S. Top. Engrs., 4to, 1861, *from Dr. J. S. Newberry.* Proc. Entomol. Soc., Philad., Jan. & Feb. 1862, *from the Society.*

Dr. Wislizenus presented the oviduct of a Gasteropod from Staten Island, and Dr. Hilgard, a large collection of Lichens from Europe.

April 21, 1862.

The President, Dr. Engelmann, in the chair.

Seven members present.

The following was received: Observ. on the Rocks of the Mississippi Valley, by C. A. White & R. P. Whitfield, 1862, *from the Authors.*

Dr. Engelmann presented *Placodium Yusuffii*, Link, (*Lichen esculentus*,) from the Desert of Sahara, and stated that it was found somewhat abundantly in the arid sands of the desert, and possessed much historic interest, as being probably the manna of the Jews.

Dr. Engelmann presented from his brother, Mr. Henry Engelmann, a paper entitled Topaz in Utah. Referred to the Publication Committee.

Mr. Holmes announced the death of Dr. Hiram A. Prout, an Associate Member, one of the founders and formerly President of the Academy; and offered the following resolutions, which were unanimously adopted:

Resolved, That with extreme regret we have heard of the death, this morning, of our Associate Member, Hiram A. Prout, M.D., late President of the Academy, at his residence in this city.

Resolved, That, in life, our departed Associate was especially endeared to us by an active and courteous coöperation with us in the objects and aims of our institution, since its foundation, and by his devotion to scientific studies, to which he gave the leisure which could be spared from the duties of a profession in which he also held a distinguished place, and which had gained for him an eminent reputation, not merely with us, but among men of kindred studies in other countries, as well as by his acknowledged worth and usefulness in all the relations of life, as a man, as a husband and father—as citizen, physician, philosopher, friend, and benefactor.

Resolved, That, in testimony of our respect for the memory of the deceased, we will attend the funeral in a body, and wear the usual badge of mourning for thirty days; and that one of our members shall be designated by the President, whose duty it shall be to prepare a sketch of the life and scientific labors of the deceased, to be read at a future meeting.

Resolved, That the Corresponding Secretary be directed to communicate a copy of these resolutions to the family of the deceased, in token of our sympathy with them in a loss which none but they can know.

Dr. William Carr Lane was elected an Associate Member.

May 5, 1862.

The President, Dr. Engelmann, in the chair.

Six members present.

Letters were received from the Royal Academy of Sciences, Amsterdam, Oct. 16, 29, & Nov. 15, 1861; Soc Roy. de Zoologie, Amsterdam, August & Sept. 1860; Physikalisch-med. Gesellsch., Würzburg, Jan. 6, 1862; Université de Louvain, Oct. 16, 1861; Schweitzerische Gesellsch., Bern, Nov. 1861; Naturf. Gesellschaft, Bern, Nov. 1861; Secretary of the Smithson. Instit., Washington, May, 1862, acknowledging receipt of the Transactions of the Academy and announcing publications sent.

The following donations to the library were received:

Verhand. der K. Akad. von Wetenschappen, Dl. IX., 4to, Amsterdam, 1861; Verslagen an Med. Naturk., Dl. 11 & 12, 1861; Jaarbock von 1860, *from the Royal Academy.* Mém. de la Socié é Roy. de Zoologie, Liv. 7 & 8, 1858–9. Amsterdam, *from the Royal Society.* Proc. Roy. Soc. of London, Vol. VI., Nos. 44 & 46, 1861, *from the Royal Society.* Jahrbücher der K. Akad. der Wissensch, Erfurt, N. F., Heft II., 1861, *from the Society* Bericht der St. Gallischen naturw. Gesellschaft, 1858–61, *from the Society.* Würzburger Med. Zeitschrift, Bd II., Heft 4–6, 1861, *from the Society.* Université de Louvain—Annuaire 1861: Theses, 244--252 Theol., 54--55 Med., 4--11 Droit; Programme de Cours, 1861--62, *from the University.* Mittheil. der naturf. Gesellsch., Bern, 1858--60, *from the Society.* Rocks lying between the Carboniferous and Hamilton Group in Lower Peninsula of Michigan, with descriptions of Cephalapods, by Alex. Winchell, State Geologist, *from the Author.* Bull. de la Soc. Imper. zool. d'Acclimatation, Paris, T. IX., No 1--2, 1862, *from the Society.*

Dr. Engelmann presented a skeleton of *Pelicanus carbo.*

Dr. Engelmann detailed some of the results of his observations on the fruit of Opuntia Rafinesquii, a species of the Western United States.

Dr. Shumard presented from Mr. G. C. Broadhead a paper on the Coal Measures of Missouri. Referred to the Publication Committee.

May 19, 1862.

The President, Dr. ENGELMANN, in the chair.

Five members present.

Letters were read from the Royal Hort. Soc. London, Sept. 12, 1861; Sächsische Gesellsch. d. Wiss., Leipzig, Aug. 1, 1861; British Museum, London, Nov. 28, 1861; Schweizer. Polytech. Schule, Zurich, Oct. 1, 1861; Bataafsch. Genootts. Prœf. Wis., Rotterdam; Dr. Fred. Von Hagenow, ——, 1861; Nat. Hist. Soc. Northumberland, Durham, &c., Newcastle, Eng., Oct. 15, 1861; Naturhist. Verein in Augsburg, Nov. 30, 1861; Geolog. Soc. London, Nov. 6, 1861; Naturf. Gesellsch. Basel, Nov. 8, 1861; Soc. Geogr. Imp. de Russie, Jan. 12 & 22, 1862; Eds. N. Edinburg Philos. Journal, Nov. 25, 1861, severally acknowledging receipt of No. 4 of Vol. I. of Transactions; also, from C. H. Hitchcock, transmitting his Geolog. Report of Maine.

The following publications were received:

Sixth Ann. Rep. Maine Board Agri., with Scientific Reports, *from C. H. Hitchcock*. Amer. Jour. Science, May, 1862, *purchased*. Canad. Nat. & Geol., Montreal, Vol. VII., No. 2, *from the Montreal N. Hist. Society*. Geol. Survey of California; Address by the Superintendent, J. D. Whitney, Mar. 12, 1862; Lect. on Geology, deliv. before Leg. Calif., Feb. 27, 1862, by J. D. Whitney; Report of Prog. Geol. Survey, San Francisco, 1862, *from the Author*. Atti della Soc. Acclim., Palermo, T. I., No. 6--7, 1861, *from the Society*. Meteorology of Storms, Espy, 1850, *from Mr. G. C. Broadhead*.

June 2, 1862.

The President, Dr. ENGELMANN, in the chair.

Five members present.

A letter was read from Director W. Haidinger, Vienna, acknowledging receipt of publications sent.

The following donations to the library were received:

Proc. Boston Soc. Nat. History, April & May, 1862, *from the Society*. Bull. de la Soc. Imp. zool. d'Acclimatation, Paris, No. 3, 1862, *from the Society*.

Dr. Engelmann exhibited several drawings illustrating the structure of the fruit and seed of the genus *Ribes*. His investigation of what constituted the pulp of the Cactus fruit (see p. 166) had induced him to examine the juicy fruits of allied families. It seemed strange that the structure of the gooseberries and currants, so common everywhere, had not, as far as he could ascertain, attracted the attention of vegetable anatomists. The only allusion he found to it was in Schleiden's Grundzüge (ed. 3, p. 408), where it is said, that the pulp of the berry of *Ribes* seemed to be formed by the dissolution of the cells which originally constituted the testa itself. Dr. E. found this pulp to consist of the arillus and of the modified epidermis of the testa.

The arillus of Ribes is a fleshy or juicy dilatation of the funiculus; in the currants, at least in *R. rubrum*, it is very short, cup-shaped, lobed, often obcordate, and embraces the base of the seed; in the gooseberries (*R. grossularia* and *R. hirtellum* were examined) it is much larger, as high and sometimes as large as the seed itself, entire, and attached to the funiculus, all along the raphe. The substance of this arillus is rather firm and consists of very small cells, in the common gooseberry between 0.01 and 0.05 l. in diameter. The arilli of different seeds are apt to coalesce.

The epidermis appears as a seemingly gelatinous transparent coating of the seed. It consists of simple, prismatic, 5 or mostly 6 angled, connate cells, each, in the different species examined, 0.06–0.10 l. in diameter, and 0.03–0.05 l. high, near the raphe much shorter. The contents of the cells are very pale red or colorless, the green or buff color of the seed appertaining to the testa itself. In some cultivated varieties these cells may finally become detached, forming a true pulp; but in the fruits examined by him such was not the case. If that part of the funiculus which forms the raphe at last becomes detached from the seed, as has been stated, it must be after a separation of these epidermis cells.

Dr. E. noticed that the inner coating of the carpellary cavity of *R. rubrum* consisted of a singular deposit of crustaceous and brittle, striated cells or cell-walls, which he had not observed in any other species examined by him.

June 16, 1862.

The President, Dr. Engelmann, in the chair.

Five members present.

Letters were read from the Royal Society of Sciences, Göttingen, Feb. 12, 1862; Smithsonian Institution, Washington, May 31, 1862; Zool.-mineral. Verein, Regensburg, 1862; I. R. Instituto Veneto, Venice, Oct. 25, 1861; Naturh. Verein, Bonn, Jan. 22, 1862; K. Akad. der Wissenschaften, Berlin, Feb. 18, 1862; Université Catholique de Louvain, Nov. 26, 1860; K. K. Akad. der Wissensch. Wien, Dec. 28, 1861; RoyalHorticultural Soc., S. Kensington W., Sept. 25, 1861; Phil. & Lit. Soc. Leeds, Oct. 21, 1861; Naturf. Gesellschaft, Bern, Feb. 1862; Smithsonian Instit., Washington, June, 1862; Academia Real das Sciencias de Lisboa, Mar. 22, 1862, acknowledging receipt of the Transactions of the Academy and announcing publications sent. From M. J. Bosquet, Maestricht, May 20, 1862, acknowledging his election as a Corresponding Member, and from Dr. William Carr Lane, acknowledging his election as an Associate Member.

The following donations to the library were received:

Jahrbuch der K. K. geol. Reichsanstalt, Wien, Bd. VII., No. 1, 1861--2, *from the Society*. Schriften der K. Phys.-ökonom. Gesellschaft, Königsberg, Jahrg. II. 1861, Abth. I., *from the Society*. Nachrichten von der George-Augusts-Universität u. der K. Gesellsch. der Wissensch., Göttingen, No. 1--22, 1861, *from the Society*. Bull. de la Soc. des Sciences Naturelles de Neufchatel, T. V., cah. 3, 1861, *from the Society*. Flora, No. 38--48, Regensburg, 1861, *from Dr. Flügel*. Correspondenz-Blatt des zool.-mineral. Vereins, Regensburg, Jahrg. XV., 1861, *from the Society*. Atti dell' I. R. Istituto Veneto, T. VI., Ser. iii., Disp. 10, 1860--1; T. VII., Disp. 1--2, 1861--2, *from the Institute*. Verhandl. des naturw. Vereins, Bonn, Jahrg. XVIII., Heft 1--2, 1861, *from the Society*. Archiv. des Vereins der Freunde der Naturg., Meklenburg, 1861, *from the Society*. Monatsb. der K. Akad. der Wissenschaften, Berlin, 1 Hälfte, 1861, *from the Academy*. Université Catholique de Louvain—Annuaire 1860: Theses, 232--243 Theol., 52--53 Med., 13 Phil., 1--3 Droit; Programme des Cours 1860--1,—De Ram, Discours Delfortrie,—*from the University*. Sitzungsb. der K. K. Akad. der Wissenschaften, Wien, 1861, Abth. 6--8, II. 8, math.-naturw. Classe, *from the Academy*. Proc. Roy. Horticultural Soc. London, Vol. I., Nos. 5--31, 1859--61; List of Fellows, 1861, *from the Society.* Proc Royal Soc. of London, Vol. XI., No. 45, *from the Society.* Ann. Rep. Leeds Phil. & Lit. Soc., 1860--1; Proc. Geol. & Polytechnic Soc. W. Riding of Yorkshire, 1860, Leeds, 1861, *from the Society.* Mittheil. der naturf. Gesellschaft, Bern, No. 469--496, 1861, *from the Society.* Lungenfäule u. Lungenseuche der Rinder, von J. Swaton, Linz, 1834; Jahrhundert der K. Ober-Realschule, Ofen, 1860--1; Denkschrift der K. K. Karl-Franzens-Universität, Grätz; Protokoll 1861; Bericht 1860--1, *from Dr. Felix Flügel.* Der zoologische Garten, Frankfurt a M., No. 8--13, von Dr. D. F. Weinland. 1861, *from the Editor.*

July 7, 1862.

The President, Dr. ENGELMANN, in the chair.

Four members present.

Letters were read from Prof. J. D. Whitney, State Geologist of California, San Francisco, April 2, 1862, acknowledging receipt of Transactions of the Academy; Prof. B. Silliman, Jr., July, 1862, requesting exchange of specimens of meteoric iron; Smithsonian Instit., Washington, June 17, 1862, concerning transmission of exchanges; L'Acad. Roy. des Sciences de Lisbonne, sending Memoirs.

The following publications were received:

Bull. de la Soc. Imp. zool. d'Acclimatation, Paris, No. 4, 1862, *from the Society.* Proc. Amer. Antiq. Soc., Boston, 1862, *from the Society.* Smithsonian Miscellaneous Collections, Vols. I.--III., Pt. 4, 8vo; Meteorol. Observations from 1854 to 1859, 4to, Washington, *from the Institution.* Memorias da Acad. das Sciencias de Lisboa, (Classe de Sci. math.-phys. e Nat.) Nova Ser., T. II., Parte ii., 4to, 1861. *from the Academy.* Atti della Societa di Acclimazione e di Agric., Palermo, T. I., No. 8, *from the Society.* Trans. of the Wisconsin State Agricultural Society, 1860, *from I. A. Lapham, Esq.*

Dr. Shumard stated that he had devoted some of his leisure hours to the preparation of a Catalogue of American Crinoidea, of which a vast number of genera and species had been described from the Palæozoic Rocks of the U. States, and he thought the list would be greatly extended by future researches. He had already catalogued seven hundred and fifty species, but it was probable the list included a consider able number of synonyms.

July 21, 1862.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

Letters were read from the K. K. Akad. d. Wiss. Vienna, April, 1862; Phys.-med. Gesellsch. Würzburg, April 8, 1862; Naturf. Gesellsch., Freiburg, May 8, 1860; K. K. Patriot.-ökonom. Gesellsch., Prague, Nov. 16, 1861.

Donations to the library were received as follows:

Centralblatt für die Gesammte Landskult. von der K. K. Patr.-ökonom. Gesellsch., Prague, 1859--61; Com'e Rend. Soc. Imp. Geogr. Russie pour l'Année 1861, St. Petersbourg, 1862; Sitzungsb. der K. K. Akad. Wiss., Heft IV., Wien, 1862; Proc. Roy. Soc., London, Vol. XI., No. 47, 1861, *from the Society*. Verhand. d. Naturf. Gesellsch. Freiburg, 1862, *from the Society*. List of Fellows of Royal Hort. Society, London; Proc. Royal Hort. Soc. London, Jan. 1862, *from the Society*. Würzburger Med. Zeitschrift der phys.-med. Gesellsch., Bd. III., Heft 1, 1862, *from the Society*.

Dr. Engelmann gave the results of his calculations of barometrical observations made by Dr. C. C. Parry to determine the altitude of Pike's Peak and other elevations in Colorado Territory.

Dr. Shumard presented, from Mr. Eugene Riggin of this city, a small piece of iron supposed to be meteoric.

He remarked that the members of the Academy might have seen recently in the daily papers an account of the phenomena attending the fall of this specimen in the city of St. Louis. It consists of remarkably compact malleable iron, weighs 25,375 milligrammes, is of an irregular quadrangular shape, and measures one inch and a half in length, about ten lines in width and about half an inch in thickness. It is stated to have come from a southwestwardly direction, passing over some houses on Chesnut street between Second and Third streets, striking the window of John Riggin, Esq., real estate broker, on the north side of Chesnut street, shattering a large pane of glass about three feet above the ground floor, and then bounding obliquely backwards several feet. Mr. Eugene Riggin states that he was in the office at the time of the fall, and immediately ran out and picked up the specimen.

Capt. Cozzins, Chief of Police, and several other persons on the street, witnessed the fall; all of whom state, that, in its passage through the air, they heard a noise resembling that produced by a minnie rifle ball, or a body discharged from an air-gun.

August 4, 1862.

The President, Dr. Engelmann, in the chair.

Six members present.

The following publications were received:

Canad. Nat. & Geol., Vol. VII., No. 3, *from the Nat. Hist. Soc.* Proc. Boston Soc. Nat. Hist., Vol. IX., May and July, 1862, *from the Society*. Atti della Soc. Acclim. e Agric., Palermo, Sicily, 1862, *from the Society*. Descriptions of New Cretaceous Fossils from Texas, by B. F. Shumard; Guide to the Pronunciation of Scientific Terms; Notes sur le Parallelisme entre les Dépôts Palæozoiques de l'Am. Sept. avec ceux de l'Europe, par Ed. de Verneuil, *from Dr. Shumard*. Humboldt's Cosmos, English translation, in 5 vols., *from Dr. Baumgarten*.

Dr. Hilgard presented specimens of recent Spongiæ, *Cylindrothecium Sullivanti*, and skull of a fœtal calf; and Mr. Holmes, a specimen of Gneiss from New England.

Dr. Hilgard presented a large series of mounted, microscopic fresh-water Algæ.

August 18, 1862.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

The following donation to the library was received: Bull. de la Soc. Imp. d'Acclim., T. IX., Paris, May, 1862, *from the Society.*

Dr. Shumard deposited in the name of Dr. J. J. McDowell a collection of specimens in Natural History, consisting of birds, reptiles, bones of Mastodon, etc.

Dr. Hilgard exhibited specimens of *Vernonia*, which he referred to different forms of *V. Noveboracensis* and *V. fastigiata*, and explained their distinctive characters and their variability.

Mr. Gustavus Adolphus Kœnig was elected an Associate Member.

September 1, 1862.

The President, Dr. ENGELMANN, in the chair.

Ten members present.

Dr. Pollak presented a Report of the West. Sanitary Commission on Gen. Military Hospital, St. Louis.

September 20, 1862.

The President, Dr. ENGELMANN, in the chair.

Six members present.

The following publications were received: Bull. de la Soc. Imp. zool. d'Acclimatation, Paris, No. 7, Juillet, 1862, *from the Society;* Proc. Boston Soc. Nat. Hist., July & Aug, 1862, *from the Society.*

Mr. Buehler presented through Dr. Hilgard a colored engraving of Baron Von Humboldt.

Dr. Engelmann read a letter from Dr. C. C. Parry to Prof. J. Torrey, communicated by the latter gentleman, giving a detailed account of his ascent of Pike's Peak. Referred to Publication Committee.

October 6, 1862.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

A letter was read from Secretary of Smithson. Inst., transmitting donations to the library.

The following publications were received: Canadian Nat. & Geol. & Proc. Nat. Hist. Soc., Montreal, Aug. 1862, *from the Society*; Bull. de la Société Imp. zool. d'Acclimatation, Paris, No. 8, Août, 1862, *from the Society*.

Dr. Engelmann exhibited diagrams of comparison of simultaneous observations in Colorado Territory and St. Louis showing the relative correspondence in the fluctuations of the atmospheric pressure at these two stations.

Dr. Engelmann stated that the quantity of rain for September, 1862, was larger than he had ever before observed during that month, which is generally, with the exception of January and February, the dryest month of the year, furnishing not quite 3 inches (2.93) of rain. The quantity of rain last September was 6.27 inches; the next largest quantity was observed in September, 1849, amounting to 5.81 inches.

October 20, 1862.

The President, Dr. ENGELMANN, in the chair.

Six members present.

The following publications were received: Smithsonian Report for 1861, 8vo, 1862, *from the Institution*; Proc. Boston Soc. Nat. Hist., Sept. 1862, *from the Society*.

Dr. J. M. Bigelow, of the Northern Lake Survey, read a paper "On the waves of Atmospheric Pressure and their progress from West to East along the Great Northern Lakes," from which he furnished an extract, as follows:

If it is possible to foretell the advent of a storm, by observations upon the barometer 12 to 24 hours beforehand, at St. Louis, or the stations near Lake Huron, with absolute certainty, there can be no doubt of its practical importance to the Atlantic coasts, and the more eastern portions of navigation on the Lakes.

Early foreseeing the essential consequence to be realized from the collection of a connected series of reliable meterological data, at various points of the five great Northern and North-western Lakes, upon this fundamental question, Capt. Geo. G. Meade of the Topographical Engineers, then the Superintendent of the Survey, with the sagacity and promptness peculiar to his character, adopted, in 1859, a series of stations, commencing at the most extreme western point of Lake Superior, and ending with the most eastern extremity of Lake Ontario. Within these topographical limits there are fourteen stations, where tri-daily observations have been uninterruptedly kept up with the best instruments this country can afford, viz., those adopted by the Smithsonian Institution, and constructed by Mr. James Green of New York.

Three of these stations, Superior City, Ontonagon, and Marquette, are situated on Lake Superior; two, Milwaukie and Grand Haven, on Lake Michigan; two, Thunder Bay and Ottawa Point, on Lake Huron; one, Detroit, on Detroit River; three, Monroe Piers, Cleveland, and Buffalo, on Lake Erie; and three, Fort Niagara, Charlotte, and Sackett's Harbor, on Lake Ontario.

The observations here recorded with such excellent instruments, if continued in a sufficiently lengthy series, will constitute a mass of trustworthy data, upon which, not only the present question can be satisfactorily settled, but a great many others of much magnitude in scientific aspects, as well as practical utility, may be scrutinized in a spirit presaging perfect success in the establishment of the most important truths connected with the subject, in its widest range. Not only are these valuable observations kept up, but all the improvements of modern science are added to the efficiency of the instruments, by that accomplished officer the successor to Capt. Meade in the Superintendency of the Lake Survey, Col. J. D. Graham, of the same Corps. In addition to the fact established by the late Prof. Espy, Prof. Loomis, and others, in their studies of the great storms of the United States, that the minimum wave of the barometer which usually precedes and accompanies them—especially those of the winter, which are known to pervade that portion of the United States embraced between the Rocky Mountains and the eastern coasts of the Atlantic Ocean—proceeds in an easterly direction; it is further developed by the comparisons of the barometer at Superior City with those at Thunder Bay and Sackett's Harbor, that nearly all the motions of the barometer are re-produced, or succeed each other in a regular order of time within the limits of about 7 to 48 hours between those places, always beginning at the western station, showing themselves next at Thunder Bay, thence in the same apparent order, on to Sackett's Harbor. For want of a more expressive term we call this a wave of the barometer. Not only this wave, whether it be a minimum or a maximum, but also the intermediate motions of the barometer, appear to observe the same rule of progression from west to east.

Out of one hundred and fifty great culminations of the barometer, when it rises considerably above the monthly mean, from the sudden fall of which rain or wind storms may be predicted, besides many others near or but slightly above the mean, there are in two years but three exceptions where the changes take place, first at Sackett's Harbor, and the wave appears to travel from east to west. There are, moreover, in this time, two other exceptions which show the motions at all the places simultaneously. Here, it appears, that whatever cause influences the movements of the barometer, it is so pervading and extensive as to reach from Superior City to Sackett's Harbor, a distance of some 16° of longitude.

Before the regular establishment of the Lake Survey meteorological stations, a series of observations were kept at Forrestville and Thunder Bay, two contiguous stations, commencing June, 1858, and ending May, 1860, which, by comparison with simultaneous observations at Toronto and Providence, kept at the first place by Prof. Kingston, and at the latter by Prof. Caswell, shows almost exactly the same motion of the wave of the barometer from west to east, as those developed by the regular observations of the Survey for the two succeeding years. In these observations, the exceptions of the wave moving westward are also three, in two years; but there appears in this time to have been no pervading wave, reaching from one end of the line of stations to the other, as shown on the curves of the barometer from 1860 to 1862.

If, instead of the tri-daily, hourly observations could be substituted at the extreme and middle stations, much fairer results, both with regard to the range of the barometer and the more exact time and rapidity of the waves, could evidently be secured. A knowledge and application of the hourly variations being so important an element in the corrections of isolated observations, for the determination of elevations and mountain heights in distant regions, a series of hourly observations for these regions, a sufficient length of time to insure a good approximation, is an additional inducement for filling up so important a chasm in meteorological science.

Dr. Hilgard presented Fungi from the vicinity of St. Louis.

November 3, 1862.

The President, Dr. Engelmann, in the chair.

Seven members present.

Letters were read from the Amer. Philos. Society, Philad., Oct. 27, transmitting publications; A. F. Bandelier, of Highland, Ill., sending his meteorological observations made at Highland during the months of May, June, July and August, 1862.

The following donation to the library was received: Salt Manufacture of the Saginaw Valley, Mich., by A. Winchell, *from the Author.*

Dr. Enno Sander presented a beetle from St. Louis.

Dr. Engelmann presented a copy of his paper on the *Euphorbiæ* of De Candolle's Prodromus.

Dr. Engelmann spoke about the snowstorm of October 25th. This was the third time in 27 years that he had observed in St. Louis a fall of snow in October. The first occurred Oct. 26, 1843, when between 9 A.M. and 2.30 P.M. a very light snow (melted, 0.03 inch) fell, almost immediately disappearing. The second took place Oct. 5, 1855, between 3.30 and 5 P.M., precipitating 0.17 inch: being preceded and followed by drizzling rain, it disappeared very soon: as long as it lasted it oddly contrasted with the still fresh vegetation of field and forest, but only injured some tender exotics, such as the *Paulownia*. In his meteorological journal he found a memorandum, that on the 4th a snowstorm, undoubtedly the same, extended over New Mexico, and was observed on the Upper Platte River from the evening of the 4th to the 5th at noon.

The weather had been unusually warm from the morning of October 23d last till the forenoon of the next day, the temperature varying between 50 and 64 degrees, with southeasterly and southerly winds, and a fall of the hitherto very high barometer. On the 24th, at 10 o'clock A.M., the wind suddenly veered to the west, blowing a gale from the west and northwest for about 48 hours, the barometer rising rapidly and reaching a very high point next morning at 7 o'clock. During this storm the sky was very dark, until about 1 A.M. on the 25th it began to snow and continued till 9 A.M.; in the evening the sky cleared off, both barometer and thermometer fell slowly, the latter reaching 21.5° on the morning of the 26th, which is lower than he had observed it in October. The snow, 0.30 inch when melted, partially disappeared during the day.

This snowstorm is remarkable for its extent through the middle portions of the Mississippi valley from west to east, extending far south, but scarcely north of Milwaukie and Detroit, nor, in our latitude, east of the Alleghanies.

He could trace it as far west as the plains of Kansas, where, in the afternoon of October 23d, after a very pleasant morning, a most violent gale from the west or northwest sprang up and snow fell in the following night. On the Upper Missouri, at Omaha, the snowstorm commenced, as the papers stated, on the 24th, at 8 A.M.; and on the Upper Mississippi, at Dubuque, it was observed scarcely a little later. On Lake Michigan, at Milwaukie, a very light fall of snow commenced at noon of the same day; further east, at Detroit, a very light snow fell at 12.30 P.M., and a little more in the following night. At Sackett's Harbor, at the eastern end of Lake Ontario, the barometer indicated the acme of the wave on the 25th, at 9 P.M, and the snowfall commenced on the 26th, at 7 30 A.M., lasting till 11 A.M. on the 27th, with 0.58 inch of melted snow—travelling from the plains of Kansas to the lower end of Lake Ontario, about 24 deg. Long., in a little more than 50 hours. It had reached St. Louis, a distance of about 10 deg Long. in 24 hours. The data referring to the appearance of the storm along the Lakes were received through the kindness of Dr. Bigelow.

In Virginia and in the District of Columbia the storm appeared in the form of rain, from the 26th to the morning of the 27th. Southward, according to the newspapers, the snowstorm spread over Kentucky and Tennessee, appeared at Memphis about the same time as here, extended into Northern Mississippi and Alabama, and on the morning of October 26th reached Northwestern Georgia as far as Rome, nearly Lat. 34°.†

The coldest days in October, observed by Dr. Engelmann in St. Louis, were the following:

1862,	October	26	21.5 deg.
1841,	"	25	22.0 "
1836,	"	20	24.0 "
1838,	"	29	25.0 "
1843,	"	26	26.0 "
1853,	"	24	26.0 "

Dr. Wislizenus gave an account of his observations of the electrical state of the atmosphere during and prior to this snowstorm. On the 24th, during the high wind, the electricity was at zero, indicating some great change in the atmosphere. Early next morning, while it was yet snowing, his instrument indicated a high degree (33) of positive electricity, such as he usually observed during snowfalls.

Dr. Shumard read a communication from Mr. Henry Engelmann, of the Illinois Geological Survey, on the Lower Carboniferous System as developed in Southern Illinois, being the results of some explorations made by him in the summer of 1862, as follows:

The field work of the writer during 1862 embraced one of the most interesting portions of Illinois. It is well known that in the southwestern part of the State, bordering on the Mississippi, the Lower and Upper Silurian, Devonian, Chemung, Lower Carboniferous, and Coal Measure formations are developed. Some interesting and heretofore undescribed and unobserved facts were elicited in regard to the older formations; but as I am still engaged in the field, and the fossils have not yet been care-

† Another remarkable snowstorm was that of November 7, 1862, which does not seem to have extended farther west than Louisville, Ky., where they had a light fall of snow on the night of November 6th, while we had foggy and dark weather; on the Alleghanies and eastwardly to the seacoast it snowed, on the 7th, at least from Virginia to Massachusetts. It is hoped that the learned Secretary of the Smithsonian Institution will, with the aid of the extensive observations sent to him from all parts of the country, cause the laws of these and other storms to be investigated.

fully examined, I will confine myself to a few remarks on the Lower Carboniferous.

This formation has been studied thoroughly in its development near the Mississippi River—in Central Illinois, Iowa, and Missouri. Underlying the Coal Measures, there have been distinguished

1. The Ferruginous Sandstone,
2. The St. Louis Limestone,
3. The Warsaw Limestone,
4. The Keokuk Limestone,
5. The Encrinital or Burlington Limestone.

Farther south, the Kaskaskia or Chester Limestone was found intercalated between the Coal Measures and the Ferruginous Sandstone; and then heavy masses of sandstone (the Millstonegrit) were observed next below the Coal Measures, and also beds of sandstone intercalated with the Chester Limestone.

My observations now show that in the extreme southern part of Illinois this upper division of the Lower Carboniferous attains a still greater and more varied development, while the lower subdivisions observed farther north appear to be lost or merged into one. I distinguish these:

A. Coal Measures.

B. Millstone-grit: purely quartzose, rather finely-grained, rarely conglomeratic sandstones, with some shaly intercalations. It reaches a thickness of about 500 feet, and includes, far above the middle, a seam of coal which has been found continuous along the outcrops of the formation through several counties, dividing it into Upper and Lower Millstonegrit.

C. Then follows a series of strata which correspond to the Chester Limestone and Ferruginous Sandstone, and which, as I have stated, forms the most prominent portion of the Lower Carboniferous formation of this district. It consists chiefly of alternations of siliceous Archimedes and Pentremital limestones, of shales, and sandstones; and where it is most fully developed, in Johnson and adjoining counties, reaches an aggregate thickness of about 1,000 feet. There it presents

1. Limestones, generally highly siliceous and even flinty, and shales, with an aggregate thickness of about 180 feet.
2. Quartzose sandstones, alternating with shaly beds, and in some places slaty limestone at its upper part, from 120 to 150 feet.
3. Limestones and shales, from 80 to 120 feet.
4. Quartzose sandstones with some beds of shale, over 100 feet.
5. Siliceous limestones and shale, in places as much as 140 feet.
6. Quartzose sandstones and shales, from 60 to 100 feet or more.
7. Siliceous limestones and shales, about 150 feet.
8. Quartzose sandstones with some shaly portions, about 150 feet thick. I have distinguished them by the name of Cypress Sandstones on account of their prominent development on Cypress Creek.
9. Siliceous limestones and shales, the latter in places arenaceous. These appear as beds of passage between C and D, while at many points No. 8 rests directly on D.
10. Locally, strata of sandstone intervene between No. 9 and D; they generally appear as an unimportant bed of transition, neither thick nor pure, but rather as an arenaceous development of the shales of No. 9.

The limestones of the formation C are usually highly siliceous, hard, and partly magnesian, of a grayish color, and vary between the closest texture and coarse crystalline. Some contain seams of flint, especially No. 1. They all contain fossils, described before from the Chester beds; but I have also found strata with a curious mixture of fossils of the lower formation, the position of which in the series could not be ascertained, and which may possibly belong to D. Some strata, which I believe to be the equivalents of No. 9, contain Oolitic portions, a feature else distinguishing D.

The sandstones are very variable in character; they occur usually in thick massive beds composed of fine, purely quartzose grains, loosely cemented. Sometimes they appear in large even layers, from 1 to 12 inches thick, very hard or even flinty, and often finely ripple-marked; sometimes they split regularly into rhomboidal slabs, and sometimes form irregular shells.

In No. 6 I observed a thin seam of coal, extending with remarkable continuity over many miles, so as to become a leading characteristic of this subdivision. At one point I found the coal 6 inches thick; but generally it is thinner, from 1 to 2 inches. Occasionally we find it represented by a thin band of shale, with thin laminæ of coal here and there interspersed through it.

The Cypress Sandstone, No. 8, may be regarded as a more fully developed equivalent of the Ferruginous Sandstone of the Missouri Geological Report, if the latter is not rather a representative of several of these sandstones combined. To retain the name of Ferruginous Sandstone, which may be well suited as a local designation in Missouri, for this rock in Southern Illinois, would however be decidedly inappropriate.

D—St. Louis Limestone. It attains a thickness of at least 200 feet, perhaps much more, and is differently developed at distant points. The Oolitic structure of some of the layers is a characteristic of the formation in this district. Near Anna, in Union county, we find in the descending order

1. White and bluish, purely calcareous, and partly Oolitic Limestone.
2. Siliceous gray limestones, usually of a close uncrystalline texture.
3. The Jonesboro quarry rock, consisting of whitish semi-crystalline limestone, replete with remains of Bryozoa.
4. Highly siliceous limestone, which has in places lost all its lime by lixiviation, leaving merely a highly porous skeleton of chert—a thickness, where fully developed, of 45 feet. As I have observed a similar appearance, on a smaller scale, in the Jonesboro strata, I conclude, in the absence of fossils in No. 4, that both must have been formed under similar circumstances during the prevalence of the same general conditions, and that, different as they may appear, they still belong to the same general formation.

These minor subdivisions are, however, not preserved farther east, in Johnson and adjoining counties.

Underneath the St. Louis Limestone follow shales and siliceous slates and some black laminated slate, equivalents of the black slate formation of Illinois and Indiana, which is by good authorities considered as of the age of the Chemung Group. To these shales and slates succeed well marked Devonian strata.

In conclusion, I wish to state distinctly, that the frequent alternation of sandstones and limestones of approximately the same thickness, which I have described above, is not, as it might appear to the reader, the fallacious result of imperfect observation, and deceptively produced by faults in the stratification; but it is the true structure of the country, and can be traced continuously over several counties. The dip of these formations is nearly uniform a few degrees to the east of north, and, as many creeks traverse the strike of the strata at nearly right angles, their succession can be proved at numerous localities. Bold rocky cliffs are of frequent occurrence in the district, and single ledges can sometimes be traced for miles, rising in high points to the southward and then breaking off in precipitous bluffs.

November 17, 1862.

Dr. C. W. STEVENS in the chair.

Seven members present.

Letters were read from K. K. Akad. der Wissensch., Wien, Aug. 1862; I. R. Acad. di Scienze, Lettere ed Arti, Padua, Feb. 15, 1862; Naturf. Verein, Riga, Ap. 10, 1862; Verein für Naturk., Presburg, July 20, 1862; Naturf. Gesellsch. Graubündens, July 16, 1862; K. böhmische Gesellsch. der Wissensch., Prag, March 12, 1862; Naturf. Gesellsch., Danzig, May 29, 1862; Physik.-med. Gesellsch, Würzburg, Jun. 29, 1862; Dr. Adolph Weiss, Vienna, Oct. 29, 1861; K. K. zool.-bot. Gesellschaft, Wien, Mar. 20, 1862, acknowledging receipt of Transactions and sending publications in exchange.

The following donations to the library were received:

Trans. Am. Phil. Soc., Philad., Vol. XII., N. S. Pts. 1 & 2, 4to. 1862, *from the Society*. Smithson. Rep for 1861, Washington, *from the Institution*. Rep. of the Geology of the Upper Mississippi Lead Region, by J. D. Whitney, with Plates, Albany, 1862, *from the Author*. Proc. Essex Institute, Vol. II., pp. 353-438, Salem, 1862, *from the Society*. Verhandl. der K. K. zool.-bot. Gesellsch, Wien, Bd. XI., 1861; Nachträge zu Malys Enumeratio Plantarum, von Aug. Neilreich, Wien, 1861, *from the Society*. Kentniss der Insekten-Metamorphose, 1860, von G. Ritter von Frauenfeld, *from the Author*. Die Fluorescenz der Pflanzenfarbstoffe, von Dr. Adolph Weiss, Bamberg, 1861; Abhängigkeit der Linien distanzen, von Dr. Weiss, Wien 1861; Verhalten des Kupferoxydammoniaks, von Dr. A. Weiss, u. Dr. J. Weisner, Wien, 1861; Dichten und Brechungs-Exponenten in Gemengen von Flüssigkeiten, von Dr. A. Weiss und Edm. Weiss, Wein, 1858, *from Dr. Adolph Weiss*. Würzburger Med. Gesellsch. Bd. II. Heft 3, Bd. II. Heft 2–3, 1861–2, *from the Society*. Uber das Wanken der Locomotiven, von Dr Gustav Zeuner, Zurich, 1861, *from the Author*. XI. Jahresbericht der Naturh. Gesellschaft, Hanover, 1862, *from the Society*. Schriften der Naturf. Gesellschaft, Danzig, Bd. VI. Heft 2–4, 1861–62, *from the Society*. Sitzungsb. der K. K. Akad. der Wissenschaften, Wien, 1862, Abth. I. Heft 1–2, Abth. II. Heft 1–4, *from the Academy*. Zoologische Garten, von Dr. D. F. Weinland, No. 1–6, 1862, *from the Editor*. Wochenscrift für Gärtnerei u. Pflanzenk. Berlin, 1861, No. 50–52, 1862. No. 1–16, *from the Society*. Sitzungsb. der K. böhmischen Gesellschaft der Wissenschaften, Prag, 1860–1, *from the Society*. Jahresbericht der naturf. Gesellschaft, Chur, Jahrg. V.–VII., *from the Society*. Verhandl. des Vereins für Naturk., Presburg, Jahrg. IV. 1859, Band V. 1860–1, *from the Society*. Correspondenz-Blatt des naturf. Vereins, Riga, 1862, *from the Society*. Die Fossilen Mollusken des Tertiar-Beckens von Wien, von Dr. Moriz Hörnes, Band II. No. 1–4, Bivalven, Wien, folio; Jahrbuch der K. K. geolog. Reichsanstalt, Wien, Bd. II. No. 2, 1861–2, *from the Imperial Institute*. Fall of Meteorites on the Earth, by W. Haidinger, F.R.S., 1861; the Imperial and Royal Geological Institute of the Austrian Empire—London International Exhibition, 1862, Vienna, *from the Director, W. Haidinger*. Revista Periodica della I. R. Acad. di Scienze, Lettere, ed Arti, in Padova, Vol. VII., VIII. & IX., 1859–61, *from the Academy*. Atti del' I. R. Istituto Veneto. T. VII. Disp. 3–5, 1861–2, *from the Institution*. Bull. de la Soc. Imp. zool. d'Acclimatation, Paris, No. 9, 1862, *from the Society*. Jour. Acad. Nat. Sciences, Philad, 4to, Vol. V., Pt. 2, 1862; Proc. of same, Nos. VII.–IX., July, 1862, *from the Academy*.

Dr. Engelmann announced the discovery, by Dr. C. C. Parry, of another new species of *Gentiana*, *G. barbellata*, in Colorado Territory, and of a new species of Spruce in the Rocky Mountains, which Dr. Parry had named *Abies Engelmanni*.

On motion, it was resolved to add the description of these species as a supplement to Dr. Engelmann's paper on Pines and Gentians.

Dr. Pollak presented a letter from the Western Sanitary Commission, St. Louis, asking the Academy to receive on deposit the remains of the McDowell Collection of Natural History, now in the Gratiot-street Prison. Referred to a committee.

December 1, 1862.

The President, Dr. Engelmann, in the chair.

Six members present.

Letters were read from the Académie Royale des Sciences, Lettres, et Beaux-Arts, de Belgique, Bruxelles, Oct. 19, 1862, acknowledging receipt of Transactions of the Academy and announcing publications sent in exchange.

Dr. Engelmann presented a copy of Dr. C. C. Parry's Physical Sketch of the Rocky Mountain Range.

Mr. Holmes, chairman of the committee appointed to remove the remains of the McDowell Collection of Natural History from the Gratiot-street Prison (McDowell's College) to the museum of the Academy, reported that the committee, assisted by Capt. Curry and Dr. John McDowell, had selected the best preserved anatomical preparations, specimens of animals, minerals, and other articles of value, and placed the same in the museum of the Academy. The committee had also made a list of the Collection and deposited a copy in the office of the Major General commanding this Department. Mr. Holmes further stated that, by the terms of the order of Maj. Gen. Curtis, the Collection was deposited in the Academy in trust for safe keeping.

Dr. Engelmann presented from Dr. C. C. Parry a specimen of fine grained granite from the summit of Pike's Peak.

Dr. Engelmann gave a *resumé* of his calculations on the altitude of Pike's Peak and other elevations in Colorado Territory, in a paper entitled "Altitude of Pike's Peak and other points in Colorado Territory."

December 15, 1862.

Vice-President Dr. Wislizenus in the chair.

Seven members present.

A letter was read from T. Apoleon Cheney, Esq., Leon, N. Y., Dec. 10, 1862, concerning exchange of publications.

Donations to the library were received as follows: Saliferous Rocks and Salt Springs of Michigan, by Alex. Winchell, State Geologist; Descriptions of Fossils from the Marshall and Huron Groups of Michigan, by Alex. Winchell, *from the Author.* Amer. Jour. Sci. & Arts, Nos. 97–100, *purchased.*

January 5, 1863.

The President, Dr. Engelmann, in the chair.

Eleven members present.

Letters were read from the Royal. Soc. London, Oct. 8, acknowledging receipt of Trans. No. 4; Smithsonian Institution, Oct. 31, 1862, notifying the transmission of packages.

The following publications were received:

Proc. Amer. Antiq. Soc., Worcester, 1862, *from the Society.* Bull. de la Soc. Imp. zool. d'Acclimatation, T. IX., No. 10, Oct. 1862, Paris, *from the Society.* Proc. Amer. Acad. of Arts & Sciences, concluding pages of Vol. V., 1862, *from the Academy.* Letter to M. Joachim Barrande on the Taconic Rocks of Vermont and Canada, by Jules Marcou, Cambridge, 1862; Obs. on the terms "Pénéen," "Permian," and "Dyas," by Jules Marcou, Boston, 1862; Défense des Colonies, par J. Barrande, Prag & Paris, 1861–2, Pts. I. & II., *from Prof. Jules Marcou.*

Mr. Holmes offered the following resolution, which was adopted:

Resolved, That the thanks of the Academy are due to Major General Curtis, as also to the members of the Western Sanitary Commission, for the interest taken by them in the preservation of what remained of the McDowell Museum of Natural History when it fell under their control; and that Captain Curry, of the Tenth Missouri Cavalry, and the men under his command, are entitled to our special acknowledgments for the zeal and fidelity with which the order of General Curtis, for the removal of the Collection to the Hall of the Academy was executed by them.

Dr. Pope presented hair balls from the stomach of a cow; also a collection of about one hundred and thirty species of fossils from the Palæozoic rocks of the United States, determined and labelled by Prof. Hall, and a specimen of *Scaphites Conradi* from the Cretaceous rocks of Nebraska.

Mr. Gast presented a lithographic portrait of Fred. von Hagenow and a chart of New Vospommern.

Dr. Wislizenus gave an account of his observations on Atmospheric Electricity during the year 1862, and illustrated his remarks by diagrams. On motion, Dr. Wislizenus was requested to prepare a paper on the same for publication in the Transactions, as an appendix to his published paper on that subject.

The Annual Report of the Corresponding Secretary was read and accepted.

The Annual Report of the Treasurer was read, examined, and accepted.

The President read his Annual Report for 1862, as follows:

ADDRESS OF THE PRESIDENT.

The seventh anniversary of the Academy of Science finds you again assembled to receive from your President his report on the condition and progress of your Institution during the year just closed.

You have worked under the disadvantages of civil war, with its disturbing and prostrating influences, a small but zealous band of friends of science, unabated in your energies, though (I may not conceal it) materially crippled in your resources. You have, nevertheless, nobly responded to the appeal made to you in my last annual report, and have commenced the publication of the first number of the second volume of your Transactions. That it has not yet been given to the scientific public is owing to circumstances beyond your control; but the expectation is, that it can be sent to your correspondents before long, thus fitly inaugurating for your Academy the year 1863; a year which we hope will be hallowed with blessed peace, that in its train brings affluence, and with it love and support of scientific exertions.

The semi-monthly meetings of the Academy have been regularly attended by the more active and zealous members, and the objects of your Institution furthered by the exhibition of specimens, the reading of scientific papers, and the discussion of communications introduced here.

Our Academy continues to be greatly indebted, as it has been since its foundation, to the liberality of Colonel John O'Fallon, for the ample accommodation which it has possessed for its museum, library, and hall of meeting, in the Dispensary building of O'Fallon Hall, entirely free of rent; a circumstance which has contributed much toward ensuring the existence and prosperity of the Institution.

We must again thank the Smithsonian Institution for the liberality with which it has transmitted our foreign exchanges. We are now in communication with one hundred and forty-one foreign and fifty-six home societies, institutions, and scientific authors: amongst them the most important and best acknowledged ones, sending them our contributions, and receiving from many of them more voluminous and valuable returns, oftentimes illustrated with splendid plates. Twenty-three foreign and eleven American societies or libraries, never having acknowledged our transmissions, have been dropped from our list of exchanges, while five foreign and two home societies have been added.

Principally through this exchange, the Academy's library has been increased during the last year by 373 volumes, parts of volumes and pamphlets. Some of them were presented by the following friends, or members of the Academy: Prof. Wm. Haidinger, Mr. E. Billings, Dr. D. F. Weinland, Col. S. H. Long, Prof. C. H. Hitchcock, Prof. J. Marcou, Mr. Wm. M. Gabb, Mr. T. A. Cheney, Prof. R Peter, Prof. J. S. Newberry, Prof. J. D. Whitney, Messrs. White and Whitfield, Prof. A. Winchell, Dr. Shumard, Dr. Pollak, Dr. Sander and Dr. Engelmann. Our library is kept in excellent order by the efficient librarian, Dr. F. E. Baumgarten, and is now probably the richest in publications on the Natural Sciences, west of the Alleghanies.

The museum was less richly endowed, though specimens in different branches of natural science were donated by Mr. W. H. Clark, Mr. John Riggin, (who sent us the supposed meteorite of Chesnut street), Dr. C. C. Parry, Dr. E. Sander, Dr. Engelmann, and principally, by Dr. Th. C. Hilgard, who presented a large collection of lichens and preparations of fresh water Algæ. The largest addition to our museum was made by two collections, originally forming part of the McDowell College Museum, which were deposited with us, the first by Dr. J. J. McDowell, in August, and the second and much larger one (though much injured), a few weeks ago, by order of Major General Curtis, to be kept with our own collections and under the same regulations, subject to the order of the rightful owner.

The following papers were read, during the past year many of them to be published in the Transactions:

Dr. A. Wislizenus—On Atmospheric Electricity, with plates and diagrams.

Prof. G. C. Swallow—Descriptions of new Fossils from Missouri.

Dr. B. F. Shumard—Notice of some New and imperfectly known Fossils from the Primordial zone, (Potsdam, Sandstone and Calciferous sand groups) of Wisconsin and Missouri.

———. Descriptions of new Palæozoic Fossils.

———. On the fall of the supposed Meteorite at St. Louis.

Mr. H. Engelmann—On the discovery of Topaz in Utah, and on the Formation of the Prairies of the Mississippi Valley.

Dr. T. C. Hilgard—A detailed Exposition of the Circuit of Generation of the fresh water Algæ, as thalline developments of Bryum Argenteum, with plates. On the Characters of some species and varieties of Vernonia.

Mr. N. Holmes—On Prof. Haidinger's Theory of Meteorites.

Dr. C. C. Parry—On his Ascent of Pike's Peak.

Mr. A. F. Bandelier, Jr.—Meteorological Observations made at Highland, Ills.

Dr. E. Leigh—On a new and ready Method of Notation of statistical facts on maps and charts.

Dr. J. M. Bigelow—On the Progress of Atmospheric Waves from west to east, along the chain of the great Lakes, as elucidated by the Government Lake Survey, under the superintendence of Col. J. D. Graham.

Dr. G. Engelmann—Meteorological Table for 1861. On the Fall of Rain in St. Louis, during the last twenty-three years, with a diagram. On the Difference of Temperature and Relative Humidity in the city and country. On the Correspondence of Barometical Variation in St. Louis and in the Rocky Mountains. On the Altitude of some interesting points in Colorado Territory, and the Limit of trees there, after Dr. Parry's barometrical measurements. On a New Species of Pine from the Rocky Mountains, with plates. On several New Species of Gentiana from the Rocky Mountains, with plates. Additions to the Cactus-Flora of the Territory of the United States. On the Formation of the Pulp in the Cacteæ, and in the genus Ribes.

Special mention is due to Dr. C. C. Parry, of Davenport, Iowa, one of our correspondents, who has, with much zeal and intelligence, during the two last seasons, conducted his botanical explorations in the fastnesses of the Rocky Mountains, and especially in the country about Pike's Peak. During the last summer, with the aid of an excellent mountain barometer, he has cleared up some doubtful and interesting points in the physical geography of a region which we consider as properly belonging to our domain.

The painful duty now remains for me to remind you of the loss, by death, of one our most active members, one of the founders, and formerly a President of this Academy. Our Institution loses in Hiram A. Prout, M.D., one of the most zealous, and, at the same time, unassuming members; who devoted all the leisure hours which could be spared from the duties of his profession to the pursuit of science. While among his friends and colleagues of this Academy his memory will live on brightly, the gigantic *Titanothertum Proutii* of the Mauvaises Terres of Nebraska will, to the world of science at large, stand forever a monument of his exertions in Palæontology.

During the last year, two new Associate Members have been added to our list, while a few old ones have neglected to act as members, and have voluntarily or negligently excluded themselves from the privilege of being patrons of science in our midst. The list of Correspondents has been increased by four names.

In our finances we share the troubles of the times. Our income has fallen off materially, and while old accounts have been paid up only partially, new ones have been increased, (in order to continue our publications,) notwithstanding the liberality of some patrons of the Institution. We have, however, reason to expect that returning prosperity will permit those of our members yet in arrears to fill up the gap in our treasury, and we hope that when peace returns to our country the Academy of Science will be put, financially, on a permanent footing, and will become one of the Institutions of our city.

The following gentlemen were elected officers of the Academy for the year 1863:

President, ...	George Engelmann, M.D.
1*st Vice-President*, . .	Charles A. Pope, M.D.
2*d Vice-President*, . .	Adolphus Wislizenus, M.D.
Corresponding Secretary,	Nathaniel Holmes, Esq.
Recording Secretary, .	Benjamin F. Shumard, M.D.
Treasurer, ...	Enno Sander, Esq.
Librarian, ...	F. E. Baumgarten, M. D.
Curators, ...	B. F. Shumard, Geo. Engelmann, Spencer Smith, Chas. W. Stevens, G. C. Broadhead.
Com. on Publication,	N. Holmes, B. F. Shumard, Geo. Engelmann.
Com. on Finance, . .	Britton A. Hill, James B. Eads, Samuel Reber.

John J. McDowell, M.D., was elected an Associate Member.

ADDITIONS TO THE CACTUS-FLORA *of the Territory of the United States.* By GEORGE ENGELMANN, M.D.

Since my *Synopsis of the Cactaceæ of the United States** was published, Dr. J. S. Newberry, attached to Lieut. Ives' Expedition to the ColoradoRiver, 1857–'58, has elucidated more fully the natural history of several species, heretofore only imperfectly known.† In the same year, 1858, and the following one, my brother, Henry Engelmann, Geologist to the Expedition sent under Capt. Jas. H. Simpson, U. S. Topog. Eng., to explore the best emigrant routes through the interior of Utah, discovered in that interesting country a number of new forms, which were placed in my hands for examination. My report on them, illustrated by several plates from the hands of our skillful artist, Mr. P. Rœtter, was in due time sent to the department; but the necessities of the country not permitting the official publication, I have received permission to communicate the substance of my investigations.

1. MAMILLARIA VIVIPARA, *Haw. Engel. Syn. Cact.*, p. 13. In the South Pass, and on Sweetwater River, no specimens of this wide-spread species have turned up from the other side of the great mountain chain.

2. ECHINOCACTUS SIMPSONI, *spec. nov.:* e basi turbinata simplex, subglobosus seu depressus, mamilliferus; tuberculis laxis ovatis oblique truncatis axilla nudis; areolis ovatis seu ovato-lanceolatis, nascentibus albo-villosissimis mox nudatis; aculeis exterioribus sub-20 tenuibus rigidis rectis albidis, interioribus 8–10 erecto-patulis robustioribus paulo longioribus obscuris; areola florifera sub tuberculi apice aculeis contigua circulari; floribus in vertice dissitis minoribus; sepalis ovarii paucis et tubi brevis inferioribus orbiculatis crenulatis, superioribus ovatis obtusis, petalis oblongis cuspidatis e virescente roseis, stigmatibus 5–7 brevibus in capitulum globosum compactis; bacca parva sicca umbilico latissimo truncata flore marcescente demum deciduo coronata; seminibus paucis magnis oblique obovatis minute tuberculatis.

Var. β. MINOR: tota planta, tuberculis, aculeis, seminibus minoribus.

Butte Valley, in the Utah Desert, and Kobe Valley, farther west; var. β. in Colorado Territory, e. g. in coarse gravel or in crevices of rocks, abundant near Mount Vernon, at the base of the mountains, *Parry, Hall & Harbour;* fl. in May, fr. in July and August. With the New Mexican *E. papyracan-*

* Proceedings Amer. Acad. Arts &Sciences, Vol. III., p. 259–314; p. 344–346, Nov. 1856.

† See my account in Lieut. Ives' Colorado River Expl. Exped., Washington, 1861, Botany, p. 12–14.

thus,* the Mexican *E. horripilus*, Lem., and perhaps the South American *E. Odierii*, Lem., and *E. Cummingii*, Salm, this species forms a small section of Echinocacti with the appearance of Mamillariæ, named by Prince Salm, (Hort. Dyck., 1849, p. 34,) *Theloidei*. Through the *Coryphanthæ* they are nearly allied to Mamillaria, while our species at least, (the fructification of the others not being known,) by its dry fruit, its black tuberculated seeds, and especially the large and curved embryo and the presence of an albumen, proves itself a true Echinocactus, very closely connected with the regularly ribbed *E. intertextus*, Eng. Cact., Mex. Bound. t. 34. The similarity in all essential organs of these two species is such that no system ought to separate them, proving again of how little essential importance among Cactaceæ the external form must be regarded; another striking example, among many, is the rat-tail *Cereus tuberosus*, and its globular or oval allies, *C. cæspitosus*, etc.

Full grown specimens are 3–5 inches high and 3–4 inches in diameter; dark green tubercles, loosely arranged in $\frac{8}{21}$ or $\frac{13}{34}$ order, 8 and 13 spirals being most prominent; tubercles 6–8 lines long, at base 6–7 l. wide in the vertical and 4–5 l. in the transverse diameter, fruit-bearing ones rather shorter and stouter; areolæ 3–4 l. long; external spines 4–6 l. long, whitish, with the addition of several bristles at the upper end of the areola; central spines 5–7 l. long, yellow, reddish, deep brown, or even black, upwards. Flowers 8–10 l. long, and of nearly the same diameter, with a short and wide tube, externally greenish purple, petals yellowish-green verging to pale purple; the short stamens arise from the whole inner surface of the tube, leaving only a very small nectariferous space in its base; funiculus very short, stout and straight, and not curved over the micropyle, as I have found it in almost all other cactus flowers examined. Fruit 3–3½ l. long, about the same in width, with 1–3 small calycine scales towards its flat top, each with 1 or 2 small spines in its axil; it usually bursts irregularly on the side, and, falling off, leaves its base adhering to the areola, as is the case in other dry-fruited Echinocacti; e. g. *E. horizonthalonius*. Seeds 1½ l. long in the longest diameter, covered with minute closely set tubercles, with a large oval subbasilar hilum, and an embryo strongly curved around a small albumen. The plant germinates with

* *Mamillaria papyracantha*, Eng. Pl. Fendl., p. 49; Syn. Cact., p. 8. A closer examination of the dry specimen obtained by Mr. Fendler near Santa Fé proves that the floral areola joins the spiniferous one on the top of the small nascent tubercles, making the plant an Echinocactus, according to the views at present prevalent. It is singular that Fendler's single specimen has remained, thus far, the only one ever obtained of this well marked species.

erect pointed cotyledons, and when a few weeks old begins to develop its then pubescent spines.

Var. *β.* with smaller tubercles in $\frac{8}{21}$ or $\frac{13}{34}$, or even $\frac{21}{54}$ order, closely set, bearing smaller but often more numerous spines, (20–28 ext., 6–7 int.,) may be confounded with the simple mountain form of *Mam. vivipara*, from which, when not in flower or fruit, only a close examination can distinguish it.

3. Echinocactus pubispinus, *spec. nov.:* parvus turbinatus; costis 13 subobliquis compressis interruptis; areolis orbiculatis; aculeis breviusculis velutinis demum nudatis albidis apice adustis, radialibus inferioribus lateralibusque 5–8 brevioribus, superioribus 1–2 robustioribus rectis curvatis seu hamatis, centrali deficiente seu singulo robustiore longiore arrecto sursum hamato.

Pleasant Valley, near Salt Lake Desert, found in May without flower or fruit, but exhibiting in the vestiges of the small supraspiral floriferous areolæ the character of the genus. Perhaps the smallest species of the genus, 2 inches high, 1–1¼ in diameter; ribs formed by compressed confluent tubercles; areolæ 4–6 lines apart; radial spines 1–4 l. long, more densely pubescent, or even tomentose, than I have seen them in any other Cactus; on the lower areolæ 5 or 6, on the upper ones 9–12; here and there a single central spine makes its appearance, 5–6 l. long, stouter, and always strongly hooked.

4. Echinocactus Whipplei, *Engelm. & Bigelow, Cact. Whipp. p.* 28, *t.* 1 *; Syn. Cact., p.* 15 *; Ives' Exped. Bot., p.* 12. Var. spinosior: aculeis radialibus 9–11, inferioribus sæpe obscurioribus, reliquis longioribus niveis, summis 2 sæpe elongatis latioribus curvatis; centralibus 4, summo longo plano flexuoso, cæteris paulo brevioribus obscuris, solo infimo seu omnibus hamatis.

Desert Valley, west of Camp Floyd, Utah, with the remnants of flowers and fruit, and with seeds hid between the spines, exactly like the seeds figured in the plate cited above; embryo curved about ¾ around a large albumen; stigmas 6–7. The locality is about 5 degrees north of the place where Dr. Bigelow, and afterwards Dr. Newberry, found the plant.

5. Cereus viridiflorus, *Engelm.;* evidently the most northern Cereus, found as far north as the Laramie region, and not rare in Colorado, where it occurs 1–3 inches high, mostly with 13 ribs, and with the greatest variability in the color of the radial spines, and in the presence of the 1–2 central ones.

6. Cereus Engelmanni, *Parry:* in the Salt Lake Desert, far to the northwest of the country where it was originally discovered; always characterized by the cruciate central spines.

7. Opuntia sphærocarpa, *Eng. & Big.* var.? Utahensis: diffusa; articulis orbiculato-obovatis crassis, junioribus

sæpe globoso-obovatis vix tuberculatis; areolis subapproximatis; foliis minutis subulatis divaricatis; setis brevissimis, aculeis nullis seu parvulis seu rarius singulo longiore recto robusto albido; floribus sulphureis; sepalis exterioribus transversis obcordatis cuspidatis; petalis 8 late obovatis emarginatis; stigmatibus 8 brevibus erectis; bacca obovata areolis sub-25 stipata; seminibus irregulariter compressis anguste marginatis.

In the Pass, west of Steptoe Valley, in the Utah basin; in flower and fruit at the end of July. Joints 2–3 inches long, and of nearly the same diameter; areolæ 6–8 lines apart; leaves smaller than in any other of our species, except *O. basilaris*, scarcely 1 line long; bristles few on young, none on old joints, about ½ l. long; stouter spines, when present, ¾–1 inch long. Flowers 3 inches in diameter, pale or sulphur-yellow; fruit 1 inch long, half as thick, with a very deep umbilicus and with a few bristles, or here and there a minute spine on the areolæ — in the specimens before me apparently fleshy, but perhaps dry at full maturity; seeds very irregular, 2 l. or in the longest diameter 2½ l. wide. Loth to increase the number of illy defined species, I provisionally attach this to the New Mexican *O. sphærocarpa*, of which, however, leaves and flowers are as yet unknown, and the fruit is rather different.

8. Opuntia hystericina, *Eng. & Big.*, is evidently a western representative, or may be a western form, of *O. Missouriensis*. (See Bot., Ives' Exp., p. 14.) It was collected in the present Territory of Nevada, between Walker and Carson Rivers. Flowers 2½–3 inches wide, larger than in Dr. Newberry's specimen; stigmas 8–10, short, erect.

9. Opuntia Missouriensis, *DeC.*, itself is not rare in the deserts between Salt Lake Valley and Rush Valley. Var. albispina, approaching to var. *trichophora*, was found on Smith Creek, Lookout Mountains; flower 3–3½ inches in diameter; ovary with 20 or 25 scarcely spiny areolæ; 5 very short erect stigmas.

10. Opuntia fragilis, *Haw. Suppl., p.* 82; *Cactus fragilis, Nutt., gen. I, p.* 296. Fort Kearney to the North Platte country, in flower in June and July. This, I believe, is the first time, since Nuttall's discovery in 1813, that the flowers of this species were collected. Travellers report the plant very common on the sterile prairies at the foot of the Rocky Mountains, but rarely found in flower, and still more rarely in fruit; it seems to propagate principally by the extremely brittle joints, which even the wind is apt to break off and carry about. I have had for many years specimens in cultivation, brought by Dr. Hayden, but have never been able to obtain flowers. Nuttall says the flowers are solitary and small; in the specimen before me they are nearly 2 inches in

diameter, pale yellow; ovary 8–9 l. long, with 13–15 areolæ, densely covered with white wool, the upper ones with a few white spines; lower sepals broadly oval, with a short cusp; petals 5 obovate, roundish, crenulate; style longer than stamens; stigmas 5, short, cuspidate, erect.

11. Opuntia pulchella, *spec. nov.:* parvula, diffusa; articulis obovato-clavatis leviter tuberculatis; foliis minutis e basi ovata subulatis; areolis confertis, superioribus aculeos albidos rectos, singulum longiorem complanatum porrectum seu deflexum, cæteros brevissimos radiantes gerentibus; floris purpurei ovario areolis 13–15 albo-villosissimis et aculeoligeris dense stipato; sepalis inferioribus lineari-oblongis breviter cuspidatis, superioribus cuneato-spatulatis; petalis 8 obovatis obtusis; stylo cylindrico exserto, stigmatibus 5 linearibus suberectis.

Sandy deserts on Walker River, Nevada; fl. in June. This is one of the smallest and prettiest species of the genus and belongs to the section *Clavatæ* (Syn. Cact., p. 46); it is readily distinguished from its allies by the small joints and purple flowers. Joints 1–1¼ inches long; leaves scarcely 1 line long; flower bright purplish red or deep rose red, 1¼–1½ inches in diameter; ovary 4–5 l. long, beset with white bristly spines, 15–25 on each areola; style not ventricose in the lower half, as is usual in this genus;* stigmas slender, pale yellow.

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From other sources I am enabled to give the following further Additions and Corrections to my former publications:

Many *Eumamillariæ* (Syn. Cact., p. 4) have an "*ovarium exsertum ;*" not only the large flowered *Longimammæ*, which approach closely to Corypantha, deviate in this respect from the assumed character of the subgenus, but in a great many other species I find the same peculiarity; so that I am inclined to restrict the *ovarium immersum* to that natural subdivision, the *Lactescentes*, already recognized by Zuccarini; probably all those with limpid juice have an exsert ovary.

Mamillaria barbata, Eng. This species is easily propagated by seed, and is apt to flower already in the second year. The first flowers in spring (May) appear in the axils of the last, innermost tubercles of the last year, and are, therefore, almost central; the later ones seem to be developed from the axils of the first tubercles of the same spring! Flowers 9–10 l. long, of the same diameter; tube constricted above the exsert oval ovary; 12–13 exterior green sepals, lanceolate, cuspidate, fimbriate, 8 interior ones, reddish, longer, lance-linear,

* Another deviation from the usual form I observe in the style of *O. coccionellifera;* from a very narrow and short base it is suddenly dilated 5 or 6 times its diameter, and then gradually contracts upwards.

slightly ciliate; 18–21 petals, rose red, with a deeper colored streak, lance-linear, shorter and narrower than the inner sepals, entire; stamens not half as long as petals, with oval anthers; style much longer than stamens, with 5–6 short, greenish yellow subereet stigmas.

Mamillaria bicolor, Lehm., is not a Texan plant, as has been stated, inadvertently, in Synops. p. 7. Dr. Poselger found it on another Rio Grande, between Tampico and Real del Monte, Mex.

Mamillaria papyracantha, Eng., is an Echinocactus, as stated above.

Mamillaria recurvispina, Eng., in Cact. Mex. Bound., p. 12; Syn. p. 10. As there is already a species named thus by Vriese, (see Walp. Rep. 2, p. 301,) I now name the Arizona species *M. recurvata*. *M. recurva*, Lehm., is a form of *M. macracantha*, D.C., fide Salm.

Cereus variabilis, thus named in Cact. Mex. Bound., p. 40 t. 60, f. 5-6, and in Synops. p. 31, is not Pfeiffer's plant, figured in Abbild. 2, t. 15, but seems to be, as regards fruit and seeds, identical with a species obtained by Dr. Poselger near Tampico, and decided by him to be *C. princeps*, Hort. Würzb. ex-Pfeiff. Enum. p. 108. Plants from the Rio Grande have repeatedly bloomed here at the late Mr. Grieve's, and as the flower has never been described, I here supply the omission. Fruit and seed, obtained near Matamoras, have been described and figured in Mex. Bound. Cact. l. c.

Flores ad apicem caulis ramorumve pauci magni albi nocturni; ovario ovato areolis aculeolatis 25-30 stipato; tubo elongato cylindrico sursum sensim ampliato areolis 16–20 vix squamigeris, inferioribus aculeolatis munito; sepalis superioribus 20–25 lanceolatis patulis reflexisve; petalis 40–50 pluriseriatis lineari-lanceolatis patentissimis; staminibus superiori tubi parti gradatim adnatis; stigmatibus 12–13 in capitulum clavato-obovatum coarctatis pallide virescentibus.

In bloom from July to September, flower 7–8 inches long, 5½–6 inches wide; tube 4–5 inches long; lower sepals near the well defined upper edge of the tube reddish green, 3–9 lines, upper ones petaloid, 9–18 l. long; petals 2 inches long, and about 4 l. wide; lower part of tube for 2 or 2½ inches, with a naked, nectariferous surface; the upper part, 2½–3 inches, densely beset with stamens of about equal length, so that the mass of the anthers form a deep funnel, corresponding to the shape of the upper part of the tube; the outer series of stamens forms a regular crown, but is not separated from the inner lower ones by a naked belt, such as is found in many species; nor are the filaments declined, and, so to say, fasciculated. This is interesting, as it weakens the value of this arrangement of stamens as a generic or subgeneric character; nevertheless, it is one of the few general characters left us, to be used in the arrangement of the very large number of species of this protean genus, to which several lately established genera have to be reduced. The following disposition is suggested:

1. *Cerei flore regulari, plerumque breviore; staminibus tubo gradatim adnatis.*
    Echinocereus, Eng.
    Acanthocereus.
    Lepidocereus, Eng.
    Pilocereus, Lem.

2. *Cerei flore sæpe obliquo, plerumque longiore; corona staminum exteriorum erectorum a cæteris gradatim adnatis plus minus declinatis discreta.*
    Echinopsis, Zucc.
    Eucereus.
    Phyllocactus, Link.
    Disisocactus, Lindl.

Under the name Acanthocereus I comprise the species of this division with spiny fruit, but not belonging to Echinocereus; it is probable that Pfeiffera, Salm, is only a diminutive form of Acanthocereus. Lepidocereus, to which many tropical species must be referred, and also a few which lately have been classed with Pilocereus, is distinguished from the latter by the uniformity of the fertile and sterile branches and areolæ, while in Pilocereus the fertile areolæ are closer together and densely beset with bristly spines or long wool. Eucereus, in a more restricted sense than Miquel has used it in his Genera, or 9 in the Synopsis, would comprise the largest number of Cerei of the second division, of very different external shape, and would probably have to be again subdivided when we get to know more of the fructification of the different species. Neither Echinopsis nor Phyllocactus do in their flowers differ from Eucereus, and Disisocactus is but a depauperate Phyllocactus, with scarcely more than the crown of stamens left, a few single ones representing the great mass of inner stamens of the allied sections. I am as yet undecided whether Epiphyllum, as restricted by Prince Salm, has also to be united with Cereus or not; the fasciculated declined stamens spring from the whole tube; the exterior ones form no crown, but the innermost ones are separated from the rest, and form, with their confluent bases, a kind of vault, which is arched over the base of the tube. I have had no opportunity to examine fruit and seed.

I am not sure whether the true *Cereus variabilis* is also found on the Lower Rio Grande. A specimen in Mr. Gœbel's horticultural establishment, said to come from that region, has repeatedly flowered and borne fruit; the flowers opened in May, and the fruit ripened after 10 or 11 months; flower 9 inches long, white, open only at night; ovary angular, with

5 or 6 triangular scales, but no spines; long tube with about 8 scales; crown of exterior stamens distant from the others 8 or 9 lines; about 10 filiform spreading stigmas; fruit irregularly oval, about 2 inches long, naked, deep violet purple, at last bursting and dropping seeds and pulp; seed quite different from that of the last species, very obliquely obovate, almost curved from a narrow base, with an orbicular hilum, 0.9 l. long, smooth, shining, with a few irregular dots.

Through the kindness of Dr. A. W. Chapman, of Apalachicola, Florida, I have received living specimens and fruit of the little southeastern sea coast Opuntia, so that I can now complete and correct the description of this very distinct species.

Opuntia Pes Corvi, Le Conte in herb.; Engelm. App. to Syn. Cact. in Proc. Am. Acad. A. & S. 3, p. 346; Chapm. South. Flora, p. 145: læte viridis, diffusa; articulis parvis ovatis seu obovatis tumidis sæpius teretiusculus fragilibus; pulvillis pulvinatis; foliis ovatis cuspidatis incurvis; areolis junioribus albo-tomentosis setas parcas brevissimas pallidas et plerisque aculeos 1–3 rectos rigidos sæpe basi compressos tortosque obscuros gerentibus, infimis inermibus; floribus minoribus flavis; ovario obovato pulvillis perpaucis fusco-villosis stipato; sepalis exterioribus ovato-lanceolatis, interioribus obovatis cuspidatis; petalis sub–5 obovatis spatulatis obtusis; stigmatibus 4–5 erectis; seminibus paucissimis anguste obtuseque marginatis in pulpa viscosa baccæ sæpe floris rudimentis coronatæ nidulantibus.

Barren sands along the coast of Georgia and Florida. Joints 1–3 inches long, obovate, tumid, or narrower and subcylindric, usually many of them growing in the same season, one from the top of the last one, till they at last become prostrate, and 1 or 2 feet long; pulvilli somewhat prominent, 4, 6, or even 8 lines apart; leaves $2\frac{1}{2}$–$3\frac{1}{2}$ l. long; spines 1–$1\frac{1}{2}$ inches long, very straight, when in threes, divergent. Flowers $1\frac{1}{2}$–$1\frac{3}{4}$ inches in diameter; sepals and petals less numerous and narrower than in any allied species; ovary $\frac{1}{2}$ inch long, with only 2 or 3 areolæ on its surface, and 3–5 on its upper edge. Fruit obovate, 6–7 l. long, rose-purple, with a shallow umbilicus, areolæ almost obliterated; seeds 2 l. in diameter, 1–3, rarely as many as 5, in one fruit. Evidently near *O. vulgaris*, from which the shape and armature of the joints sufficiently distinguishes it; far removed from *O. fragilis*, with which, at first glance, the tumidity and fragility of the joints would seem to connect it.

On Pinus aristata, *a New Species of Pine, discovered by Dr. C. C. Parry in the Alpine Regions of Colorado Territory, and on some other Pines of the Rocky Mountains.* By G. Engelmann, M.D.

During his first botanical expedition to the Pike's Peak region, Dr. Parry, in searching for James' *Pinus flexilis*, found, instead of one, two five-leaved pines, which evidently had been confounded by Dr. James; thus the discrepancies of his description are fully explained. His general description of the tree and the edible seeds belong to what we now name *P. flexilis*, while the "erect cones" (smaller than those of *P. rigida*) "with unarmed scales" must be either very imperfect young ones of this, or old ones of the new species, which had lost their awns.

Pinus aristata, *spec. nov.*: arbor mediocris seu humilis; foliis dense congestis quinis uncialibus integris acutiusculis ex axillis perularum per plures annos persistentium, squamis vaginantibus obtusis mox patulis squarrosis demum totis deciduis; amentis masculis ovatis involucro 4-phyllo munitis in axilla bracteæ ovatæ acuminatæ persistentis stipitatis, antherarum crista ad umbonem parvulum singulum vel binos reducta; amentis femineis erectis herbaceo-echinatis atro purpureis; strobilis ovatis horizontalibus violaceo-fuscis, squamarum elongato-cuneatarum apophysi rhombea parum tumescente transverse carinata medio in umbone parvo breviter aristata; seminibus ala ipsa oblique obovata duplo minoribus.

On alpine heights, between 9,200 and 11,800 or 12,000 feet high, on Pike's Peak and the high mountains of the Snowy Range, *Dr. Parry*, 1861 and 1862; *Messrs. Hall & Harbour*, (Coll. No. 530) 1862. Also on the heights of the Coochetopa Pass, nearly S.W. of Pike's Peak, (altitude over 10,000 feet,) where Capt. Gunnison discovered in 1853 what seems to be this species without fruit; (see Pac. R.R. Rep. II., p. 130;) the leaves which I could compare are those of our plant Fl. end of June and beginning of July. Flourishing best in the higher elevations and never descending below 9,000 feet, in its lower ranges not ripening its fruits as well as on the bleak heights, this truly alpine species—in that respect our representative of the European *P. Pumilio*—characterizes the highest belt of timber on the peaks of Colorado. On sheltered slopes a tree 40 or 50 feet high and 1–2 feet in diameter, it becomes a straggling bush, prostrate, and almost creeping, on the bleak summits of the high ridges. The bark is thin and scaly, even in older trees not more than 3 or 4 lines thick, of a light grayish-brown color; that of younger branches smooth, with many large vesicles containing a clear fluid balsam, which remains between the layers of the old bark.

Wood white, tough, not very resinous; of extremely slow growth, so that a small smooth-barked stem of 13 lines diameter exhibited about fifty annual rings, all between $\frac{1}{6}$ and $\frac{1}{60}$ line wide, the smaller ones consisting of 3–6, the widest ones of 15–25 layers of cells, each cell 0.007 line in diameter. A tree of 2 feet thickness would at that rate indicate an age of over 1,000 years; but the annual rings of larger trees growing in favored situations are wider, and, if a specimen sent by Dr. Parry is not mislabelled, sometimes as wide as $\frac{1}{3}$ line, giving the largest trees a probable age of 500–800 years. Branches spreading, very often many of them twisted, stunted, or dead; the larger branches and the stem itself frequently covered with young branches or shoots, which seem to keep life in the old trunk Leaves crowded from the axils of ovate, acuminate, brittle, at first light brown scales, which, persisting longer than the leaves themselves, cover the branches with their rough blackish remains; leaves light green on both sides without white dots, mostly with numerous exsudations of white resin, usually curved upwards, entire on edges and keel, abruptly acutish, stouter in fruit bearing, more slender in such trees as produce principally male flowers, in very robust specimens $1\frac{1}{4}$ and rarely even $1\frac{1}{2}$, usually about 1 inch long; on sterile branches straight and horizontal, "giving the branches the appearance of so many bottle brushes." The vaginæ consist of 7–8 oblong scales with fringed margins, adpressed and forming a sheath 3–4 lines long on the young leaf, soon spreading and squarrose, falling off in the second or third year. Many lanceolate acuminate scales, perulæ, sheathe the lower part of the young shoots; shorter and broader bracts, bearing in their axils the male aments, follow next. The aments together form a very short spike, or rather head, 6 or 8 lines long; often these heads persist on the axis for 2 or even 3 years with a few bunches of leaves above each one, giving the appearance of a leafy spike 1 or $1\frac{1}{2}$ inches long! Our figure does not represent this condition distinctly, but it shows the numerous naked spaces, about 10 in number, which in former years had been occupied by male flowers. I have seen branches with 16 such naked spaces, proving that leaves were persistent for 16 years—a fact unheard of among pines, where leaves are said to endure generally only 3 years. The stipitate oval ament 3–4 l. long, has a proper involucrum of 4 oblong scales or bracts of equal length. It seems that the involucrum of the male ament and the form of the ament and of the anthers, together with the fruit and seed, offer characters of importance for the distinction and arrangement of species, hitherto neglected probably because living nature has not been studied as diligently as the dried mummies of the herbaria, and these contain so few good flowering specimens of Pines; the number of leaves, so much relied on, is of secondary consideration, and is often calculated to mislead, separating the most natural affinities, such as our Cemboid Nut-pines with 1–5 leaves, or the Pineoid Pines (*P. Pinea*, *P. Sabiniana*, *P. Torreyana*) with 2–5 leaves. *P. sylvestris* has an oval ament 3 l. long, with an involucrum of 3 equal lance-linear acute scales in the axil of a lanceolate recurved bract, which is deciduous with the ament; anther with a short, nearly entire crista. *P. Austriaca* has a cylindric curved ament 1¼ inches long, with an involucrum of about 10 very unequal and almost distichous oval scales, in the axil of a linear-lanceolate recurved persistent bract; anther, with a semicircular entire crista, large enough to entirely hide the body of the anther in the yet closed ament, and give the latter the appearance of a young cone. — Crista of the anther scarcely indicated by a knob, smaller than in any pine examined by me. Female aments single, or 2 together, near the end of the young shoot, bristling with the lanceolate, aristate, erect scales, of purple-black color. Cones oval, obtuse, 2¼–2½ inches long, about half as much in diameter, often covered with resin as if varnished; their purplish-brown or blackish color is found also in a little group of alpine pines of the Popocatepetl with 3–5 leaves, discovered by Roezl. Bracts, as in all pines, not obliterated ("evanidæ") as is usually stated, but much altered, and rather indistinct; more or less thickened and partly connate with the base of the scale; in our species, only the upper obtuse mucronate part membranaceous and free; scales 10–15 l. long and 4–6 l. wide at their exposed part; transverse ridge of the rhombic, rather flat, protuberance of the scale very conspicuous; the slender mucro or awn, from the small rhombic central knob, 2–3 l. long, curved upwards, at last tortuous and easily broken off, has suggested the name for the species. Seed nearly 3 l. long, with the obovate wing 6–7 l. long; embryo in all the seeds examined by me with 7 short cotyledons.

Systematically, this species belongs to Endlicher's section *Pseudostrobus*, which comprises many Mexican, some Central American, and a single West Indian species; it is its only representative in the territory of the United States.

EXPLANATION OF THE PLATES.

Pl. 5. Branches gathered about July 1st; the upper one with stouter leaves and half grown cones, about a year old, the young shoot of the present year just pushing out, showing the scales variously broken, and in their axils the tips of the young leaves.

The lower branch, with more slender leaves, bears male flowers.

Pl. 6, Fig. 1, 2. Ripe cones—a smaller one closed and a larger one with open scales; *a*, *b*, *c*, single scales from the side and upper surface, and seeds; these are incomplete, the only ones then seen by me; better ones are figured Pl. 11, Fig. 7—*a*, external or upper; *b*, internal or lower side. Fig. 8, embryo 10 times magn.

Fig. 3, 4. Fascicles of leaves, 2 magn. Fig. 3, young ones with their bract; Fig. 4, full grown ones with the sheathing scales recurved.

Fig. 5. Upper part of leaf of the fruit-bearing branch, 10 magn.; upper or inner side (section at base not correctly drawn).

Fig. 6, 7, 8. Sections of leaves dry and the same soaked, 10 magn.; f. 6, section of Fig. 2; f. 7, of another leaf; f. 8, of a leaf of the male branch.

Fig. 9. Bunch of male aments with their perulæ and bracts; the obtuse involucral bracts visible between the others; 2 magn. *a.* An anther from above, 10 magn.; depauperate crista visible at the end of the commissure. *b.* Pollen, 100 magn.

Another 5-leaved species of the Rocky Mountains, first noticed more than 40 years ago, but hitherto very imperfectly known, is

Pinus flexilis, *James, in Long's Exped.* 2, *p.* 27 & 34; *Torrey, in Ann. Lyc. N. Y.* 2, *p.* 249: arbor mediocris seu elatior; foliis dense confertis quinis sub-biuncialibus rigidis integris acutiusculis ex axillis perularum lanceolatarum deciduarum, squamis vaginantibus obtusis laxis mox evanidis; amentis masculis ovatis involucro sub–8–phyllo munitis in axillis bracteæ lanceolatæ patulæ deciduæ sessilibus, antherarum crista minore irregulariter inciso-dentata; amentis femineis suverticillatis in pedunculo brevi perulis late lanceolatis acutis dense stipato erectis squarrosis; strobilis ovato-cylindraceis squarrosis horizontalibus seu declinatis e rubello fuscis, squamis e basi breviter cuneata latissimis orbiculato-rhombeis, apophysi convexa semicirculari incrassata margine area parva subrhombea inermi notata; seminibus magnis obovatis exalatis carinatis.

On the Rocky Mountains, from New Mexico to the 49th parallel, "occupying the subalpine belt, never forming entire forests, in the lower elevation associated with *P. contorta*, approaching the alpine districts, scattering with *P. aristata*" (Parry's Notes); on the Sandia Mountains, New Mexico, 12,000 feet high, to the top, *Dr. Bigelow*; mountains of Santa Fé, *A. Fendler* (No. 832); Colorado, *James*, *Parry*, *Hall & Harbour* (No. 529); Laramie Mountains, *H. Engelmann*; mountains from the Platte to the Bear River, *Nuttall*; Wind River Mountains, *Frémont*; Big Horn Mountains and mountains at the headwaters of Snake River, *Dr. Hayden*, to the British boundary, *Dr. Lyall.* Nuttall's figure in his Sylva, pl. 112, is very poor, and even quite incorrect; nor can I learn that any specimen of his is preserved in the herbarium of Mr. Durand or of the Academy of Natural Science, in Philadelphia, but suppose that he had our species in view. — *P. flexilis*, the American representative of *P. Cembra* of the old world, is a middle-sized tree, usually 30–50 feet high, though Fendler, a good authority, saw it near Santa Fé 60–80 feet high; Dr. Bigelow's trees, of the height of 100–130 feet, on the San Francisco Mountain (Bot. Whipple, p. 20), must belong to some other 5-leaved species.

In Colorado it is a fine tree, with tapering trunk and oval outline, branching almost from the base, lower branches horizontal, upper ones ascending; wood white, hard, annual rings from $\frac{1}{8}$ to $\frac{1}{2}$ line, on an average $\frac{1}{4}$ line wide; trees become in 250–300 years about 1 foot thick. Leaves crowded towards the end of the very flexible branches, persistent 5 or 6 years, usually $1\frac{1}{2}$–$2\frac{1}{2}$, very rarely 1 or 3 inches long; sheaths similar to those of *P. Strobus* or *P. Cembra*, 8 l. long, deciduous. Male aments 4–5 l. long, forming a thick spike 10–12 l. long, cones subcylindric, tapering to the end, 4–5 inches long, 2 inches in the largest diameter, on short peduncles; scales 12–14 l. long, 10–12 l. wide, squarrose; lowest sterile ones recurved; fertile ones with deep impressions for the reception of the seeds both on the upper, inner side and on the back, the latter cavities partly formed by the large (4–6 l. long) ligneous or rather corky bract. Seeds 4–5, rarely 6 l. long, irregularly ovate or obovate; wing minute, not deciduous nor adhering to the scale, as in *P. Cembra*, *P. edulis*, etc., but reduced to a persistent keel on the upper end and outer edge of the seed; embryo with 8 or rarely 9 cotyledons.

PINUS ALBICAULIS; *P. cembroides*, *Newberry*, *Pac. R.R. Rep.* 6, *Bot.*, *p.* 44, *c. ic.*, *non Zucc.*, an alpine species from the Cascade Mountains, in Oregon, may be a western form of this species, though I am inclined to consider it as different, and intermediate between *P. flexilis* and *P. Cembra*, distinguished by the pubescent branchlets, few scattered teeth on the edges of the leaves, and especially by the short oval cones with thick squarrose scales pointed with a knob. The name is suggested by the color of the bark of the tree, which is "as white as milk."

While studying the Coniferæ of the Rocky Mountains, I was led to investigate the characters of the different types which Linnæus had comprised in his genus *Pinus*. The great master himself had at one time thought proper to divide that rather incongruous mass, considering *Abies* as distinct from *Pinus*, reuniting them, however, afterwards. Since then many botanists have investigated this interesting subject, and while some of the highest standing — I mention only the names of Endlicher and Hooker — have adhered to the Linnæan circumscription of the genus, others of no less authority have thought it more natural to recognize the distinctions already made by popular language, and some of them adopted by the older botanists. The first who more thoroughly examined the question was Link, who (Linnæa, Vol. 15, 1841) characterized 5 genera, *Abies*, *Picea*, *Larix*, *Cedrus*, and *Pinus*. Endlicher, in Synops. Conif., 1847, further separated Link's *Piceæ desciscentes* under the name of *Tsuga*, considering all these as subdivisions of the genus

Pinus. Carrière (Traité des Conifères) adopted Link's genera, with Endlicher's addition, without further developing their distinctive characters. My investigations lead me to adopt Carrière's views, more firmly establishing those six genera — not without some misgivings, however, as it will appear from the following, that, besides the characters derived from the organs of fructification, in one instance at least the characters of vegetation have also to be brought in to distinguish two apparently not very nearly allied genera, Larix and Tsuga; while others, thought to be closely connected, such as Picea and Tsuga, or Larix and Cedrus, recede far from each other in their essential organs. Otherwise the characters of fructification and vegetation go so well together as materially to confirm one another and to establish the generic differences. An interesting fact is, that the pollengrains of Abies, Tsuga and Picea are largest (in four species 0.053–0.060 l. in the longest diameter), those of Larix and Cedrus smaller (in two species 0.042–0.043 l.), and those of Pinus the smallest (in four species 0.034–0.038 l.) Will the characters or vegetation, after all, outweigh those of fructification, and will we have to fall back to old Tournefort's views and recognize his three genera — *Abies*, with single leaves and large pollen; *Larix*, with crowded leaves and middle-sized pollen; and *Pinus*, with fasciculated, sheathed leaves and small pollen?

I have, with Du Roi, Link and Endlicher, and against Linnæus', Lambert's and Loudon's authority, adopted the ancient Plinian name of *Picea*, the *pitch* tree, for those with quadrangular leaves and pendulous cones, the original representative of which is the well known pitch tree of Europe, here usually called "Norway Spruce," and the name of *Abies* also in the Plinian sense for those with flat leaves and erect cones, the Fir trees.

Abietineæ veræ.

I. *Fructificatio annua;* squamæ strobili tenuiores bracteis plerumque tenuibus pergamentaceis hinc excrescentibus rarissime lignescentibus suffultæ. Semina facie superiore basi alæ fere persistentis obtecta eaque plus minus inclusa. Amenta mascula femineaque perulis indefinitis suffulta, in ramulis anni prioris axillaria, rarius terminalia; antheræ variæ. Folia singula seu, axi abbreviata, fasciculata integerrima.*

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* Though the leaves are usually entire, I have seen a seedling of *Picea excelsa* from the woods of Trient, in Switzerland, with spinulose leaves; whether that is the ordinary occurrence I do not know. The young of *P. nigra*, from the White Mountains, have entire leaves.

§. Antheræ connectivo apice apiculato recurvato, loculis rima transversali dehiscentibus confluentibus. Folia subtus carinata, supra canaliculata planave.

1. ABIES, *Link:* squamæ strobili erecti maturitate ab axi deciduæ; semina basi alæ inclusa libera, testa vesiculis balsamiferis repleta; amenta mascula in axillis foliorum versus apicem ramorum annotinorum sessilia; folia petiolata, pseudodisticha, cicatricem circularem relinquentia, sicca persistentia.—*Fir.*

2. TSUGA, *Endl. sub Pino; Carrière:* squamæ strobili cum ramulo declinati persistentes; semina basi alæ adnata; amenta mascula in axillis foliorum versus apicem ramorum annotinorum sessilia vel terminalia; folia petiolata pseudodisticha, cicatricem semicircularem relinquentia.—*Hemlock-spruce.*

Micropeuce, Spach: bracteæ strobili inclusæ; testa vesiculis balsamiferis repleta; folia sicca decidua.

Peucoides, Spach: bracteæ strobili exsertæ; testa vesiculis balsamiferis destituta; folia sicca persistentia.

3. LARIX, *Link:* squamæ strobili in ramulo brevissimo terminalis nutantis seu adscendentis persistentes; semina basi alæ adnata, testa vesiculis balsamiferis repleta; amenta mascula ex apice ramulorum abbreviatorum annotinorum; folia angustissima, fasciculata, sola inter cætera annua, cicatricem triangularem relinquentia, sicca decidua.—*Larch.*

§§. Antheræ connectivo apice in cristam transversam circularem seu semicircularem recurvatam excrescente, loculis longitudinaliter dehiscentibus distinctis. Folia infra supraque carinata tetragona cicatricem subrhombeam relinquentia, sicca decidua.

4. CEDRUS, *Link:* squamæ strobili in ramo breviter minalis erecti versus apicem incrassatæ, demum ab axi solutæ cum bracteis lignescentibus deciduæ; semina alæ basi laceræ adnata, testa vesiculis balsamiferis repleta; embryo solus inter cæteros curvatus; amenta mascula ex apice ramulorum annotinorum fere biennia (ætate præcedente evoluta); folia fasciculata.—*Cedar.*

5. PICEA, *Link:* squamæ strobili nutantis vel cum ramulo declinati persistentes; semina demum e basi alæ liberæ decidua, vesiculis balsamiferis destituta; amenta mascula in axillis foliorum versus apicem ramorum hornotinorum sessilia; folia circum axin undique porrecta.—*Spruce.*

II. *Fructificatio biennis;* squamæ strobili sublignosæ, apice apophysi sæpius pyramidata incrassatæ, cum bracteis plus minus lignescentibus persistentes. Semina basi alæ demum deciduæ velut annulo cincta vesiculis balsamiferis destituta (ala in paucis angustissima squamæ adhærens, in singula P. flexili cariniformis persistens). Amenta mascula ex axillis bractearum scariosarum orta, squamis scariosis sub-definitis involucrata, in infima ramulorum hornotinorum parte in spicam compositam congesta; antheræ connectivo apice in umbonem sæpius emarginatum seu in cristam transversam variam excurrente, loculis longitudinaliter dehiscentibus distinctis. Amenta feminea in ramulis hornotinis subterminalia singula seu subverticillata. Folia ex axillis perularum singula-quina, basi vaginis membranaceis polyphyllis inclusa, integra seu margine et carina superiore serrulata; singula teretia, bina supra plana seu demum concava, dorso convexa, plura supra carinata, dorso plana seu convexa.

6. Pinus, *Lin. gen. ed.* 1, *Link.* — *Pine.*

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Picea Engelmanni, *Parry, sub Abiete, St. Louis Trans.* 2, *p.* 122; *Abies nigra, Engel. in Sill. Jour.* 33, *p.* 330, *non Poir.:* arbor elatior, pyramidata; cortice tenui squamato rubello; ramulis pubescentibus; perulis ovatis obtusis squarrosis; foliis confertis robustis compresso-tetragonis abrupte acutiusculis plerumque curvatis; amentis ovato-cylindricis perulis late ovatis involucratis, feminearum bracteis squamas ovatas obtusas crenulatas squarrosas longitudine subæquantibus; strobilis ovato-cylindricis obtusis terminalibus lateralibusve cum ramulis suis horizontalibus seu declinatis, squamis tenuibus obovato-rhombeis apice plus minus truncatis emarginatis crenulato-erosis; seminum ala oblique obovata.

Higher parts of the Rocky Mountains, from New Mexico to the headwaters of the Columbia and Missouri Rivers, and probably further; from the subalpine to the alpine districts, and with *Pinus aristata* reaching the highest limits of timber; occupying in Colorado a belt between the limits of 8,000 and 12,000 feet, it reaches its fullest development between 9,000 and 10,000 feet, near the headwaters of the streams on both slopes of the Snowy Range, constituting magnificent forests about the head of Middle Park, at Tarryall, etc., often mixed with *Abies grandis;* not found lower down, e. g. at Fontaine-qui-bouit, where *Picea Menziesii*, with *Tsuga Douglasii*, reign as monarchs of the forest. Fl. end of June.

In its most favorable localities this species makes a stately tree, 60–100 ft. high, forming a narrow, sharply-tapering spire, of a rather darkish hue; trunk perfectly straight, columnar, tapering very gradually, $1\frac{1}{2}$–$2\frac{1}{2}$ feet in diameter; branches mostly small, lower ones horizontal, upper ones ascending: on higher altitudes it is a smaller, nearly round-topped tree, very much branched, bearing more perfect fruit than in either lower or higher elevations; on the highest summits a prostrate and almost creeping, sterile shrub, just as *Picea nigra* is found on Mt. Washington, N. H. Bark only 1–$1\frac{1}{2}$ lines thick, scaly, reddish, grayish-purple or light purplish-brown, containing much tannin; wood soft, white, not knotty nor resinous, therefore much esteemed for inside and cabinet work; annual rings $\frac{1}{4}$–$1\frac{1}{4}$ lines, on an average $\frac{2}{3}$–1 line, wide. Leaves stouter than they usually are in *P. alba* or *nigra*, but less so than in *P. Menziesii;* in the higher localities 6–9 lines long and not quite 1 line wide; strongly carinate below, less so above, with a few lines of white stomata above and below, abruptly but not sharply acute; in lower localities the leaves are more slender and 8–12 l. long, and, if I am correct in referring here some doubtful forms, it occurs also with whiter, more slender and longer leaves, (10–15 l.; *Fendler*, No. 833, from a young tree without cones, mountain valley above Santa Fé,) and with almost glabrous branches and still more slender and very acute leaves (5–10 l.; *Dr. Hayden*, from the Big Horn Mountains; detached cones from that locality certainly belong here). I find the leaves in this genus extremely variable; *P. nigra* at least, of which I have been able to compare a large number of specimens, varies so much, that any attempt to base specific characters on the form of the leaves seems nugatory; the leaves in that species are straight or curved, slender or stout, quadrangular or compressed,—acute, subacute or very obtuse,—whitish, pale or dark green,—usually only 4–6, but also 10–15 lines long; the fruit, however, differs in its position from that of all other Piceæ known to me, being borne on short, recurved, scaly peduncles; it is 10–20 lines long, oval, acutish; scales thick at base, very thin at the crenulate edges. *P. alba* is also best characterized by the slender cylindric cones, 1–3 inches long, with thin scales, entire but not thickened, as I inadvertently stated in Sill. Jour. l. c. The true characters and the limits of variation of these species are now being investigated by Prof. O. Brunet of Quebec, who, living in the midst of them, will be able to solve many doubts heretofore existing and to give us their correct history. — Male aments of *P. Engelmanni* 6–9 l. long, on short stipes; anthers $1\frac{1}{3}$ l. long; female aments 9–10 l. long, with ovate lanceolate scales almost equalling in length the dark purple, fleshy scales. Cones scattered on the tree, never very abundant, $1\frac{1}{2}$–$2\frac{1}{4}$ (usually less than 2) inches long, $\frac{3}{4}$ inch or less in diameter when closed; light yellowish-brown with the lower part of the scales dark when fresh, all reddish-brown when old; scales 6 l. wide and 6–8 l. long in well grown specimens, rhombic with truncated end; in poorer ones, such as grow in lower elevations, shorter, more rounded, with the truncation indistinct. I observe the same difference in cones of *P. excelsa*, grown on bushy trees near their *upper* limit in Switzerland; there also cones, scales and seeds are smaller, and the truncation of the scales is almost imperceptible. Seeds about 1 l. long without and $4\frac{1}{2}$ l. long with the wing, which here, as in all Piceæ, overlaps the inner edge of the seed, dropping it at maturity; cotyledons, as in most species, 6, rarely 5; in *P. excelsa* I find 8, or rarely 9, (not 2--3, as Endlicher inadvertently stated,) and in the alpine specimens, mentioned above, only 6 cotyledons.

Picea Menziesii, the only other species of Colorado, is entirely subalpine, occurring between the limits of 7,000 and 9,000 feet, in low, moist or marshy soil, especially on the borders of streams; it is, as Dr. Parry informs me, a tree of a more oval outline, pointed upwards, with a more rapidly tapering trunk; thicker (½ in.), grayish, moderately rough bark; rapidly-growing (annual rings 1½--2 l on an average), harsh-grained, brittle, knotty, resinous wood; stout, light colored, smooth, glossy branchlets; stout, broad, sharply-pointed leaves; longer (9--12 l.) male and female aments, the latter composed of pale, glistening, orbicular scales, which are many times longer than the minute bract; cylindric cones, 3--4½ inches long, drooping perpendicularly with the branch or usually at an angle with it, abundant even on young (12--15 feet high) trees, crowded especially towards the top of the tree and very conspicuous, whitish at maturity but turning light brown and persisting on the tree for another year until the new crop matures; scales elongated rhombic, 9--11 l. long, truncate, more than twice as long as the seed with its triangular obovate wing. The alpine *P. Williamsonii*, Newb., from the Cascade Mountains, Oregon, which I have not been able to compare, seems to be well distinguished by its peculiarly reflexed scales.

New Species of GENTIANA, *from the Alpine Regions of the Rocky Mountains.* By GEORGE ENGELMANN, M.D.

GENTIANA (AMARELLA) ACUTA, *Michx. var.* NANA: pusilla, subsimplex; calycis 4--5 fidi lobis inæqualibus tubum corollæ cœruleo-virescentis æquantibus; laciniis corollæ fauce ciliis paucis ornatæ ovatis obtusis.

On alpine slopes, together with *G. prostrata* in mats of *Silene acaulis; Parry*, No. 309.—Stems 1½--2 inches high, flowers 4--5 l. long; distinguished from the ordinary form by the short and broad lobes of the corolla, which bear a few (1--4) single ciliæ at their base, and by the short oval anthers.

G. acuta is evidently but a form, a geographical variety of *G. Amarella*, as Dr. Hooker has indicated, and which is confirmed by our dwarf variety and other forms collected in Colorado by Messrs. Hall & Harbour (No. 473); the characters of acutish lobes of the corolla and small seeds do not hold good; Dr. Parry's No. 307 has seeds as large as *G. Amarella* from Prussia, and several forms have quite obtuse lobes. I have even some doubts about the specific difference of *G. tenuis*, which is characterized by smaller flowers, short, obtuse or retuse lobes of the corolla with sparing fringes, and (in my specimens) very indistinct glands at the base: specimens of *G. acuta*, with strictly erect branches, smaller, greenish flowers, and small seeds, seem to approach it almost too closely.

Pl. 9, Fig. 6, represents two specimens of our plant; 7, a flower; 8, corolla laid open; 9, pistil. Fig. 7--9, 4 times magnified.

Gentiana (Amarella) heterosepala, *spec. nov.:* annua, humilis, erecta, simplex, pauciflora, glabra; foliis infimis obovato-spatulatis, superioribus ovatis basi lata sessilibus obtusis seu subacutis margine (sub lente) scabrellis; floribus singulis breviter pedunculatis; calycis 5-fidi lobis 2 maximis ovatis acutis corolam fere æquantibus, reliquis 3 brevioribus lineari-subulatis; corollæ basi indistincte glanduliferæ fauce ciliis paucis barbatæ laciniis lineari-oblongis obtusis tubum dimidium æquantibus patulis; antheris ovato cordatis; pistillo lineari.

Northern slope of the Uintah Mountains, east of the Great Salt Lake; beginning to flower at the end of August; *H. Engelmann*, in Capt. Simpson's Exped., 1859.—A very slender plant, 2--4 inches high, usually with 4 pairs of leaves of a delicate pale green color, the larger ones 6--10 l. long, 4--5 l. wide; fl. 6 l. long, pale grayish-blue; ciliæ of throat few, in two fascicles at the base of each lobe. Remarkable for the great disparity of the calyx lobes; in that respect near *G. campestris*, but very different otherwise, and, like *G. tenuis*, a connecting link between Grisebach's Amarellæ and Arctophilæ.

Pl. 8, Fig. 1. One of the largest specimens: 2, a single flower; 3, calyx, spread out; 4, corolla, laid open; 5, pistil. Fig. 2--5, 4 times magnified.

Gentiana (Arctophila) Wislizeni, *spec. nov.:* annua, erecta, ramosa, glabra; foliis (sub lente) margine scabrellis, imis spatulatis obtusis, superioribus e basi latiore sessili lanceolatis 3--5 nerviis obtusiusculis, summis acutis; cyma contracta thyrsiformi; calycis membranacei truncati lateraliter fissi spathacei lobis herbaceis linearibus tubo suo multo brevioribus corollæ tubum dimidium fere attingentibus; corollæ laciniis ovato-lanceolatis acutiusculis tubo angusto sensim dilatato basi glandulifero bis brevioribus basi breviter barbatis vel nudiusculis; ovario capsulaque lineari-lanceolata subsessili.

Mountains of Llanos in the State of Chihuahua, 7,000--8,000 feet high, in pine woods; fl. in October; *Dr. A. Wislizenus*, 1846.—Stems 10--12 inches high, strictly erect; leaves 1--1¼ inches long, 3--4 l. wide at base; calyx 2 l. long, slit to the base; pale bluish corolla, 5 l. long, with 5 strongly marked glands near the base; throat naked, or usually with an irregularly dentate or ciliate membrane at the base of each lobe; seeds oval, rounded, 0.2 l. long.—Abundantly distinguished by the spathaceous calyx, which is not found in any other allied species, though not rare in the sections Pneumonanthe and Cœlanthe.

GENTIANA (CROSSOPETALUM) BARBELLATA, *spec. nov.:* e caudice perenni tunicato 1--2-caulis, humilis, glaberrima, uniflora; foliis carnosulis obtusis margine tenuissime cartilagineo-crenulatis, infimis lineari-oblongis in petiolum basi vaginantem attenuatis, caulinis paucis linearibus basi connatis, inferioribus 2 elongatis basi attenuatis, summis 2--4 basi latiore florem subsessilem fere involucrantibus acutis; calycis 4-fidi lobis triangulato-lanceolatis tubo suo vix longioribus tubum corollæ longe excedentibus, exterioribus paulo latioribus margine membranaceo sæpius dentatis; corollæ laciniis lineari-oblongis obtusis erecto-patulis margine medio breviter ciliatis versus apicem dentatis tubo profunde campanulato intus ad basin filamentorum ciliato glandulifero fere duplo longioribus; ovario ovato basi attenuato, stigmatibus semiorbiculatis sessilibus; seminibus squamulosis.

On the alpine summit of Mount Flora, in the Snowy Range, Colorado, *Dr. Parry;* fl. September.—A perennial, 2--4 inches high; radical leaves 1 inch long and 3--4 l. wide; single pair of cauline leaves on the lower half of the short stem $1\frac{1}{2}$--$1\frac{3}{4}$ inches long, narrowed at base; the 2--4 upper involucral leaves much broader at base; calyx about 1 inch and corollæ $1\frac{3}{4}$ inches long; lobes of corolla deep azure blue, about 1 inch long, 3 lines wide; tube inside greenish yellow, with short purplish-brown filaments; lower part of the filaments attached in the middle, the free edges beset with long and slender fringes; oblong glands between the bases of the filaments very marked; seeds (unripe) very similar to those of the allied *G. crinita*, rough from scales, which, properly are dessicated vesicles, protruding epidermis cells. Our species is in many respects the American representative of the European *G. ciliata*; both are perennials with short peduncles, with ciliated bases of the filaments and short oval ovaries, but the seeds are very different.*

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* The section of *Crossopetalum* may be arranged thus:

a. Lepidospermeæ.

1. *G. crinita*, Froel.: annua, in pedunculis elongatis multiflora, crossopetala.—Our American *G. detonsa* can be distinguished only by the narrow bases of the leaves; the characters taken from the shape of the ovary are variable; whether the original European *G. detonsa* is distinct, I can not at present ascertain.

2. *G. lanceolata*, Gris.: perennis? in pedunculis elongatis pauciflora, leiopetala.

Gentiana (Chondrophylla) prostrata, *var.* Americana: foliis erecto-patulis ovatis obtusis mucronulatis seu muticis; floribus parvis 4-fidis azureis, calycis corollæque lobis acutis, plicis triangulatis plerumque integris; capsula lineari-oblonga in stipitem brevem attenuata.

On Mount Flora and other alpine peaks of the Snowy Range, Colorado, *Parry*, No. 306; *Hall & Harbour*, No. 475; Russian Arctic America, *Chamisso* in Herb. Gray. — A very small form, 1--2½ inches high, single or with a few ascending or prostrate branches from the base; flowers always 4-parted, (in the European plant, which I have been unable to compare, they are said to be 5-parted,) deep azure blue, 5½--6 l. long, scarcely 1 l. in diameter; capsule tapering at base, not abruptly rounded; seeds finely striulate, ½ l. long.

Pl. 9, Fig. 10, 3 specimens of the smaller form, nat. size: 11, a flower; 12, corolla, laid open; 13, pistil; 14, capsule,—all 4 times magnified; 15, seeds, 10 times magnified.

Gentiana (Chondrophylla) humilis, *Stev. in Act. Mosq.* 3, p. 258, ex Gris. in DeC. Prod. 9, p. 106; *G. Fremontii*, Torrey in Frém. 1st Exped., p. 94; along moist grassy banks of Upper Clear Creek, Bear Creek, and other mountain streams, with *Polygonum viviparum*, almost hidden among grass and sedges; *Parry*, No. 135; *Hall & Harbour*, No. 474; on the Wind River Mountains, Frémont; fl. June and July.—Many erect or ascending, rarely prostrate, one-flowered, fragile, succulent stems, 1--5 inches high; pale green leaves with a broad white margin, cuspidate or mucronate,—lower ones orbicular or ovate, rosulate,—cauline ones linear-oblong, connate at base and sheathing; flowers on short or longer peduncles, 4-4½ l. long, with spreading rotate limb (Parry), green with bilobed white and transparent folds; ovary lance oval on a short stipe, style short with recurved stigmas; capsule on a stipe of different length, usually raised above the corolla, but sometimes enclosed in it, and then, at last, bursting sideways through the integuments, as appears on the left hand branch of our figure; valves of capsule at last widely opening, as the figure shows, and giving the plant a very singular appearance; seeds irregularly linear-oblong, nearly ½ l. long, finely striulate, very similar to those of the last species.

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3 *G. barbellata*, Eng.: perennis, in pedunculis subnullis uniflora, crossopetala.

b. Pterospermeæ.

4. *G. ciliata*, Linn.: perennis, in pedunculis brevibus pluriflora, crossopetala.

5. *G. simplex*, Gray: annua, in pedunculo elongato uniflora, leiopetala.

The seeds of the annual *G. ventricosa*, *G. macrocalyx*, and the perennial *G. macrantha*, all with fringed corolla, are unknown.

Specimens from the Altai Mountains are absolutely identical with ours with the exception of the folds of the corolla, which in the former have acute and in ours obtuse lobes.

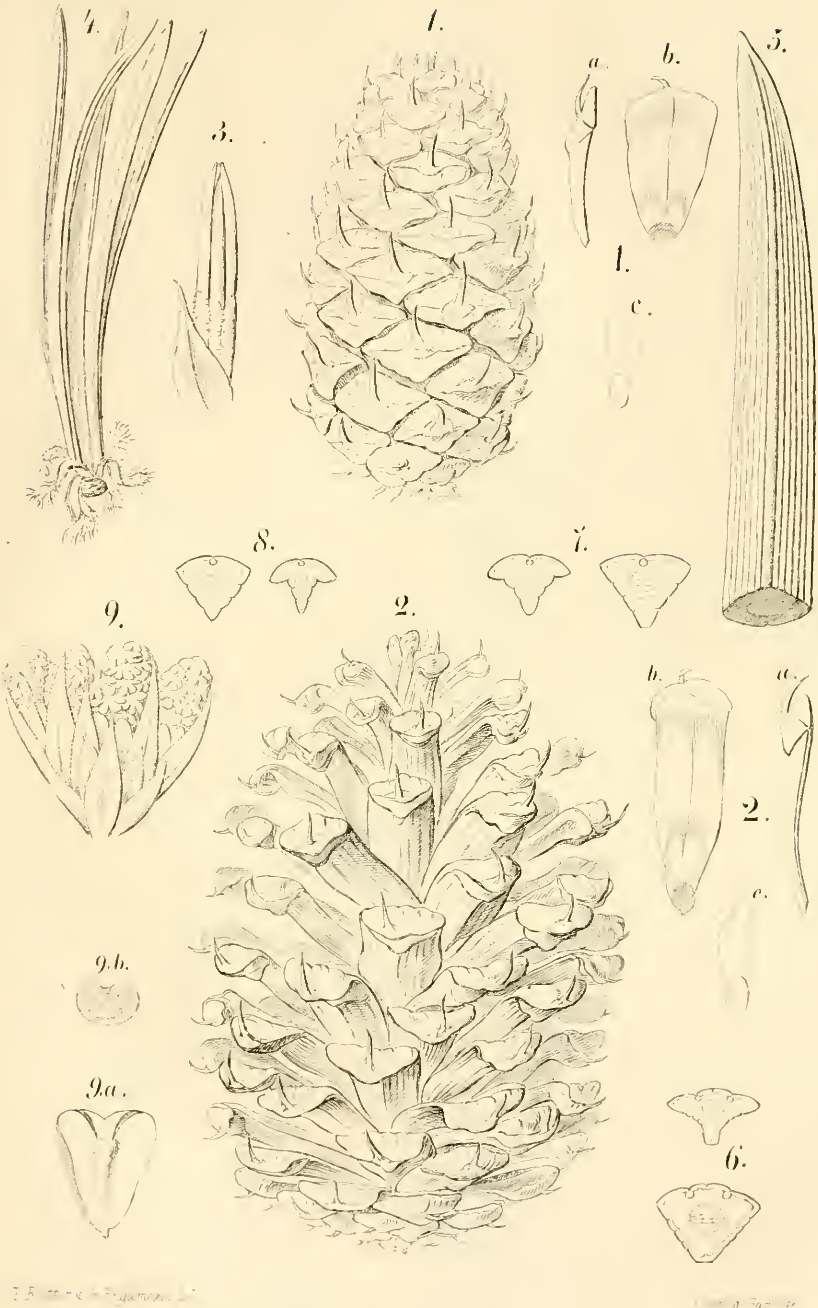
GENTIANA (PNEUMONANTHE) PARRYI, *spec. nov.:* caulibus e radice perenni ascendentibus vel erectis spithameis singulis pluribusve simplicibus foliosis paucifloris; foliis glaucescentibus e basi lata ovato-subrotundis ovatis seu ovato-lanceolatis obtusiusculis seu acutis patulis, summis angustioribus carinatis naviculatis flores sessiles involucrantibus; floribus paucis capitatis magnis purpureo-cyaneis; calycis 5-fidi membranacei integri hinc plus minus spathaceo-fissi lobis linearibus tubo suo brevioribus; corollæ apertæ tubo obconico calycem bis superante, lobis erectis late obovatis brevissime acutiusculis plicas bifidas vix excedentibus; ovario lanceolato basi in stipitem attenuato.

Near the base of alpine slopes on the Snowy Range, Colorado, *Parry*, No. 304, the broad-leaved form; *Hall & Harbour*, No. 470, partly a narrow-leaved form; Middle Park, *Parry*, a narrow-leaved 1-flowered variety; a form with narrow leaves has also been collected by Frémont, Creutzfeld and Howard, as Prof. Gray informs me. Fl. in August.— A very striking species, the large dark purplish blue flowers contrasting beautifully with the broad pale leaves; stem 5–9 inches high, leaves 10--12 or 15 lines long, and from 3 to 10 lines wide, slightly roughened on the edges; flowers 15--18 lines long, enclosed by a pair of boat-shaped bracts; calyx with its short linear lobes half as long as the tube of the corolla, entire or sometimes more or less slit on one side; lobes of the corolla about one-third as long as the tube, wider upwards than at base; slender segments of the folds almost as long as the lobes.— The nearly allied *G. calycosa*, Gris. differs by its single flowers, absence of involucrum, large oval lobes of calyx, and the length and shape of the folds; *G. Menziesii*, Gris., and *G. platypetala*, Gris., both, like the former, northwestern species, have also single flowers, a different calyx, and subcordate lobes of the corolla. The Asiatic *G. septemfida*, Pall., has long folds slit into many bristle-shaped lobes.

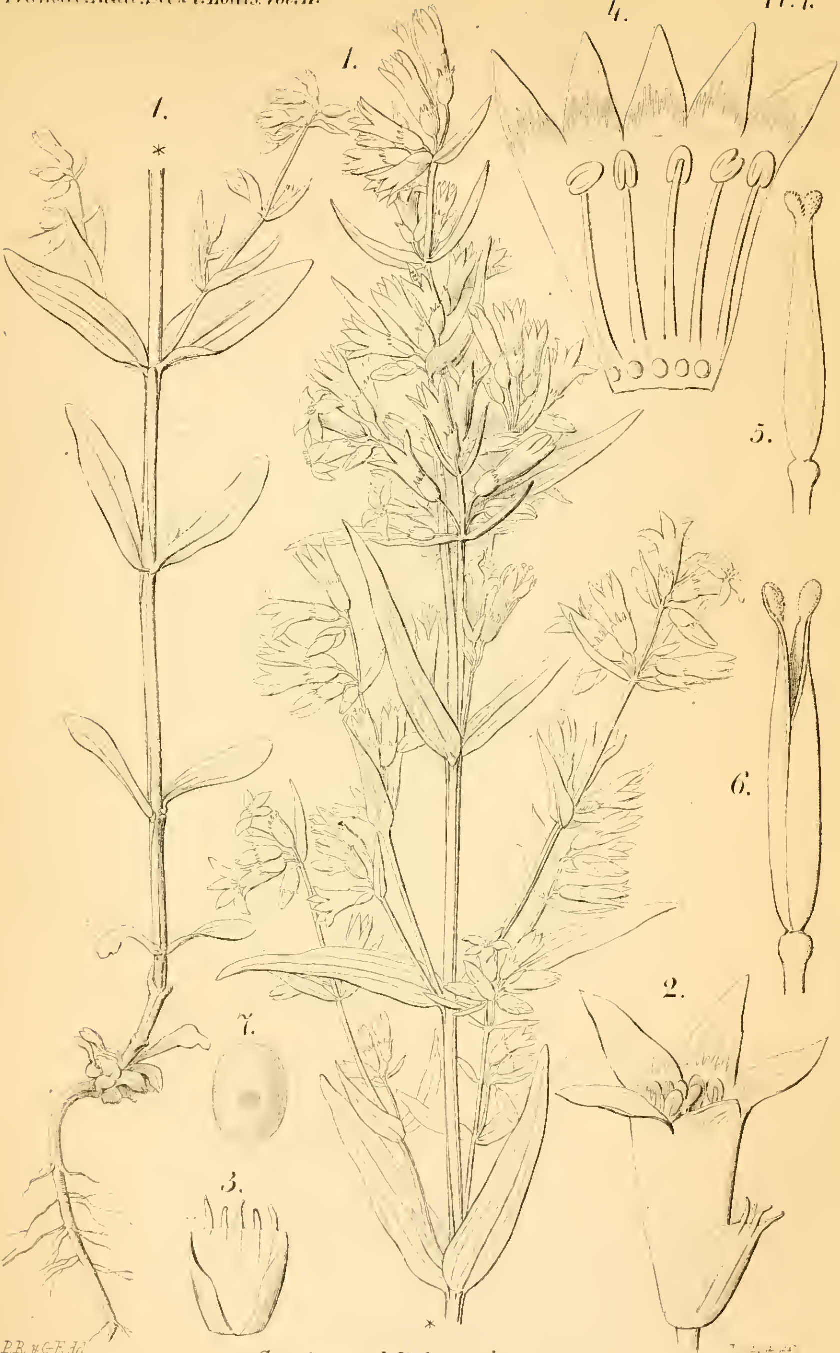
Pl. 10 represents the broad-leaved form of our species; in the figure on the left side the uppermost leaf is bent down, to show the shape of the calyx and of the bracts; small flower buds with their bracts are seen on the sides.

Paulus Roetter del. Leopold Gast lith.

Pinus aristata.

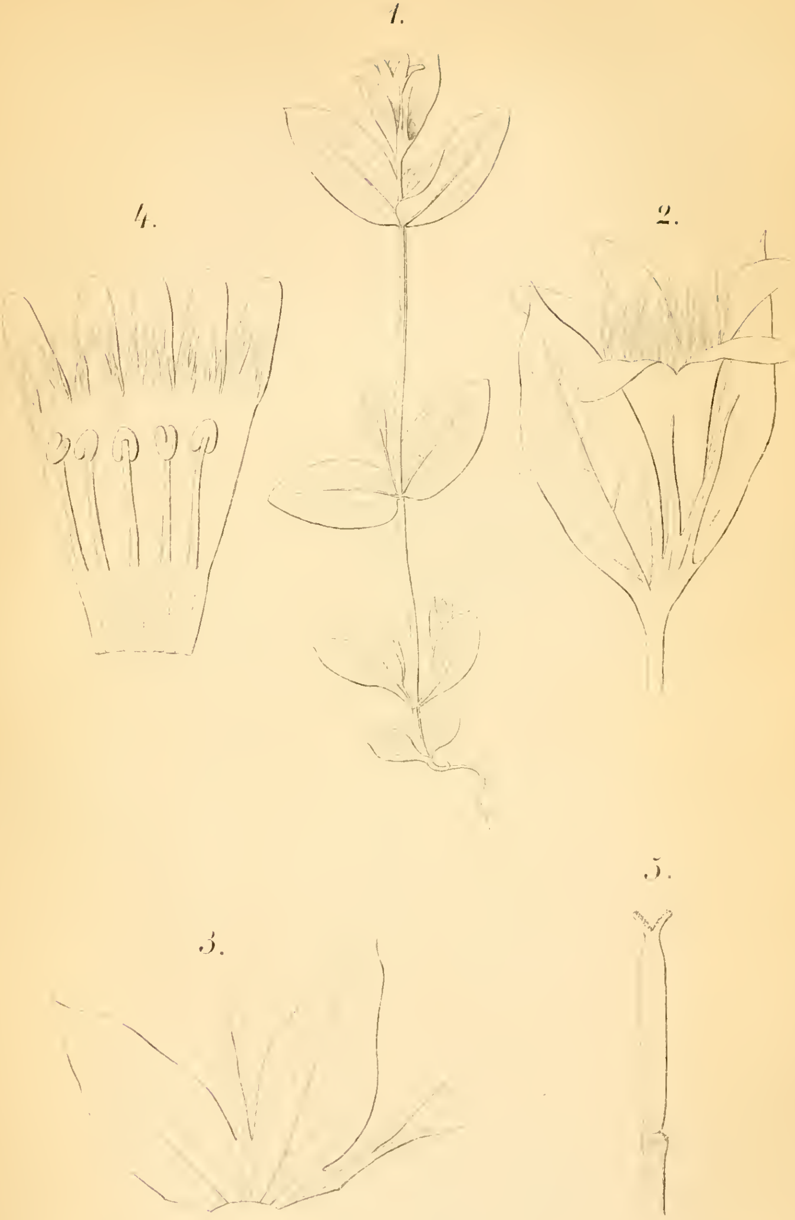


Pinus aristata.



P.R. & G.E. del.

Gentiana Wislizeni.



Gentiana heterosepala.

1–5 G. humilis. 6–9 G. acuta var. 10–15 G. prostrata var.

Gentiana Parryi.

1–6 *Gentiana barbellata.*
7–8 *Pinus aristata.*

NOTE.—The sheets of this number, from pages 1 to 114, were printed and partially distributed May 1, 1862. Owing to circumstances beyond our control, it has been impossible to issue the entire number before the present time, May 5, 1863.

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Committee on Finance.

Britton A. Hill, Esq.
James B. Eads, Esq.
Hon. Samuel Reber.

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Prof Louis Agassiz
Cambridge
with the respects
of
G. Engelmann

THE

TRANSACTIONS

OF THE

ACADEMY OF SCIENCE

OF ST. LOUIS.

WITH PLATES ILLUSTRATING PAPERS.

Vol. II. No. 2.

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EXPLANATIONS OF PLATES

(*Omitted in their proper places*).

Pl. 7—fig. 1, *Gentiana Wislizeni;* 2, a flower; 3, calyx; 4, corolla laid open; 5, pistil; 6, capsule; 7, seed. Figs. 2–6 are twice and 7 ten times the natural size.

Pl. 9—fig. 1, *Gentiana humilis;* 2, flower; 3, corolla laid open; 4, pistil; 5, seed. Figs. 2–4 are four times and 5 ten times magnified.

Pl. 11—fig. 1, *Gentiana barbellata,* a specimen with two pairs of cauline leaves; 2, a stem with a single pair, calyx laid open; 3, corolla laid open, showing the glands at base, the hairs at the base of the stamens, and the ciliation of the lobes; 4, a part of a corolla lobe four times magnified; 5, pistil; 6, seed, ten times magnified.

Fig. 7—Seeds of *Pinus aristata,* outer and inner side, better than those figured on Pl. 6; 8, embryo, ten times magnified.

TRANSACTIONS

OF THE

ACADEMY OF SCIENCE OF ST. LOUIS.

JOURNAL OF PROCEEDINGS.

January 19, 1863.

The President, Dr. ENGELMANN, in the chair.

Ten members present.
Letters were read

from the Smithsonian Institution, Dec. 31, 1862; Naturf. Gesellschaft in Danzig, Jan. 10, 1862; Naturf. Gesellschaft in Emden, Feb. 17, 1862; K. Leopoldinisch-Carolinische Acad. der Naturforscher, Jena, Sept. 25, 1861; Royal Society of London, June 9, 1862; Museum Francisco-Carolinum, Linz, Aug. 28, 1862; Mineralogische Gesellschaft, St. Petersburg, Sept. 10, 1862; Dorpater Naturf. Gesellschaft, Dorpat, May 12, 1862; Naturf. Gesellschaft in Danzig, June 19, 1861; K. Physikalisch-ökonom. Gesellschaft, Königsberg, May 6, 1861; Naturf. Gesellschaft, Görlitz, April 27, 1861; Royal Hungarian Acad. of Sciences, Pesth, Dec. 15, 1861; Naturf. Gesellschaft in Halle, Aug. 16, 1862; W. Lykins, Esq., Lawrence, Kansas, Jan. 14, 1863,—

acknowledging the receipt of the Trans. of the Academy, and announcing publications sent in exchange.

The following publications were received:

Proc. Amer. Acad. of Arts and Sciences, Boston, pp. 313–384, *from the Academy;* Naturf. Gesellschaft zu Görlitz: Abhandlungen, Band VIII. 1857, Band X. 1860,—Geognostiche Karte der Oberlausitz von E. T. Glocher, 1857,—Karte von den Land-und forstwirth schaftlichen Bodenklassen, *from the Society;* Mém. de l'Académie Imp. des Sciences de St. Petersbourg, T. IV., No. 1–9, 1861–2,—Bulletin, T. IV., No. 3–6, *from the Imperial Academy;* Naturf. Gesellschaft zu Halle: Abhandl., Band VI., Heft 2–4, Bd. VII., Heft 1, 1861–2, *from the Society;* Königl. Physikalisch-ökonom. Gesellschaft in Königsberg: Schriften, Jahrg. 1, Abth. 2, 1861, *from the Society;* Naturf. Gesellschaft in Danzig: Schriften, Band VI., Heft 2–3, 1861, *from the Society;* Société Linnéenne de Normandie: Mémoires, Vol. XII., années 1860–1,—Bulletin, T. VI., années 1860–1, *from the Society;* La Société Linnéenne de Bordeaux: Actes, T. XXIII., Ser. ii.,

T. III., Livr. 1–6, 1860–2, *from the Society;* L'Acad. Imp. des Sciences, Arts et Belles-Lettres de Dijon: Mémoires, Ser. ii.. T. IX., 1861, *from the Academy;* L'Acad. Imp. de Caen: Mémoires, 1862—Prix Le Sauvage: Rapport sur le Concours ouvert le 26 Fevrier, 1858, par M. Roulland, Caen, 1862, *from the Academy;* La Société Géologique de France: Bulletin, Ser. ii., T. XIX., Feuilles 1–20, 1861–2, *from the Society;* Würzburger Medicinische Zeitschrift, Band II., Heft 3, 1861, *from the Society;* Naturf. Gesellschaft in Emden: Jahresbericht, 1861,—Witterungs-Beobachtungen, 1860–1, von Dr. M. A. F. Prestel, *from the Society;* Aus der Heimath, von Dr. E. A. Rossmässler, Leipzig, 1861, No. 1–25, *from the Editor;* Dorpater Naturf. Gesellschaft: Archiv., Band II., ser. i., 1861,—Band IV., ser. ii., 1861, *from the Society;* La Société Imp. des Sciences Naturelles de Cherbourg, T. VIII., 1861, *from the Society;* K. Mineral. Gesellschaft, St. Petersburg: Verhandl., Jahrg. 1862, *from the Society;* Mus. Franc.-Carolinum, Linz: Bericht, xxi. & xxii., Lief 16–17, 1861–62, *from the Institution;* La Soc. Imp. zoologique d'Acclimatation: Bulletin, T. IX., No. 11, 1862, Paris, *from the Society;* Proc. Royal Soc. of London, Vol. XI. No. 48, XII. No. 49–50,—Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, 1862, *from the Royal Society;* Proc. Royal Horticultural Soc., Vol. II. No. 4–8, April to August, 1862, *from the Society;* Semitic Comparative Philology, by Dr. Tafel and Prof. R. L. Tafel, Ph. D.,—Latin Pronunciation and Latin Alphabet, by same,—Investigation into the Laws of English Orthography and Pronunciation, by Prof. R. L. Tafel, *from the Authors.*

February 2, 1863.

The President, Dr. Engelmann, in the chair.

Seven members present.

A letter was read from the Amer. Phil. Soc. of Philadelphia, Jan., 1863, announcing publications sent.

The following publications were laid upon the table:

Monograph of the Order *Pholadaceæ*, by Geo. W. Tryon, Philad., 1862, *from the Author;* Transactions of the Royal Scottish Soc. of Arts, Vol. VI., Pt. ii., Edinburgh, 1862, *from the Society;* The Canadian Naturalist and Geologist, Vol. VII., No. 6, 1862, Montreal, *from the Society;* Proc. of the Boston Soc. of Nat. Hist., Dec., 1862, *from the Society;* Proc. Amer. Phil. Soc., Nos. 66–68, Philad., 1862, *from the Society;* Amer. Jour. Arts & Sciences, New Haven, Jan., 1863, *purchased;* Selish or Flat-head Grammar, by the Rev. Gregory Mengarini, S. J., New York, 1861, *from Dr. B. F. Shumard.*

February 16, 1863.

The President, Dr. Engelmann, in the chair.

Nine members present.

A letter was read from Prof. James Hall, Albany, Feb., 1863, announcing publications sent as a donation to the library.

The following works received were laid upon the table:

Contributions to Palæontology: Descriptions of New Species of Fossils from the Upper Helderberg, Hamilton, and Chemung Groups, Albany, 1862, by James Hall,—Observations upon New Fossils from the rocks of the Hudson River Group, of Ohio, and the Western States, with Descriptions, by James Hall,—*from the Author;* On the Higher Subdivisions in the Classification of Mammals, by James D. Dana, New Haven, *from the Author.*

Dr. Engelmann made some remarks on the Linnæan genus *Pinus,* and its subdivisions, the Firs, Spruces, Hemlocks, Larches, Cedars, and Pines proper.

John M. Bigelow, M.D., of Detroit, Mich., was elected a Corresponding Member.

March 2, 1863.

The President, Dr. Engelmann, in the chair.

Ten members present.

The Corresponding Secretary laid upon the table the Bulletin de la Soc. Imp. zoologique d'Acclimatation, Paris, No. 12, Dec., 1862, a donation from the Society.

Mr. G. C. Broadhead presented sundry concretions from the Quartenary deposits, near St. Charles, Mo.

Dr. Engelmann exhibited a series of beautifully executed pencil drawings, by Mr. Paulus Roetter, representing several species of *Coniferæ* discovered by Dr. Wislizenus in the mountains of Chihuahua in 1846, and by Dr. Parry, last year, in the region of Pike's Peak; and, also, a Diagram of the stage of the Mississippi River at St. Louis during the year 1862, constructed from the daily observations made by T. J. Homer, Esq., City Engineer.

Dr. Engelmann stated that the past winter had been one of the warmest and most humid experienced at St. Louis in the last twenty-five years, only two warmer and two more humid winters having been observed in that period. He gave the following data*:

	Mean Temp.	Min.	Max.	Rain.	Snow.	Total Precip.
December, 1862	41.4	15.5	66 0	6.33	0.05	6.38
January, 1863	37.4	12.0	65.0	3.56	0.55	4.11
February, "	35.8	2.0	64 0	3.09	0.90	3.99
Winter of 1862–3	38.2	2.0	66.0	12.98	1.50	14.48
Mean of Winter in 25 yrs.	33.6			6.02	1.67	7.69
Coldest Winters... 1855–6	26.4	Smallest quantity of Rain & snow in Winter.	1840–1	1.11	1.32	2.43
1834–5	29.7		1844–5	3.57	0.94	4.51
1856–7	30.2		1845–6	2.80	2 58	5.18
Warmest Winters.. 1847–8	38.2	Largest quantity of rain & snow in winter.	1846–7	12.79	3.81	16.60
1841 2	38.4		1858–9	15.24	0.95	16.19
1844–5	40.4		1862–3	12.98	1.50	14.48

* The last two winters have not changed these results (March, 1865).

Mr. G. C. Broadhead called attention to certain ancient walled graves, which he had discovered in Pike County, in this State. He observed, that, during the year 1859, while engaged in making geological explorations in that county, he had visited two ancient graves situated on the summit of a ridge 250 feet high, on the north side of Salt River, in the S.E. quarter of Section 11, Township 55, Range 3 W. The walls consisted of rough limestone, taken from the subjacent strata of the ridge, and they enclosed two vaults, each nine feet square, and from two to three feet high. These vaults were not exactly in the same line, but differed about five feet. Some of the stones had been removed. A few human bones were collected, and it was said that others had been found there. Similar burial-places existed at various places in the same county, but, as he had learned, their sites only remained, the works having been demolished and the stones removed for building purposes. A sketch of one of them is given by Peck in his Gazetteer of Missouri, published in 1823.

In the course of his connection with the Geological Survey, he had observed that the mounds occurred on the bluffs of all the larger rivers in Missouri, and sometimes, though rarely, near the smaller streams. He had found them nearly always on the tops of the highest bluffs, but sometimes, also, on low grounds. As far as he had seen, and from all the information he could procure, they were all graves, and appeared to have been constructed by the Indians; some apparently by the modern tribes, and others by the more ancient. The mounds were generally formed of earth; but when rock abounded, and earth could only be procured with difficulty, rock had been exclusively used. The constructors seem to have preferred using both earth and rock. He had seen rock mounds on the tops of high bluffs, were the nearest ledges of rocks were 75 feet below. Where earth and rock had been used, they had been constructed as in the following instance: at the farm of Mr. H. P. V. Block, three miles from Clarksville, Pike Co., on the Paynesville road, are three low mounds, raised but little above the natural surface of the ground, and around the outside of these stones had been set, inclining outwards, and forming a circle of ten feet in diameter.

In most instances, on digging into these mounds, he had found rocks, and, these being removed, bones, and sometimes stone hatchets, beads, and arrow-heads. The hatchets were generally made of syenite, and the arrow-heads of cherty flint. It seemed that when bodies were to be buried holes were dug, into which the bodies were placed, and stones were then piled around and over them. Near the circumference the stones sloped outwards, and the mound was covered to the depth of several feet with earth. The mounds are generally circular, or a little oblong. It was rarely that he found only one at a place; generally there were three or four, or six, or perhaps a dozen together, the base of one touching the base of the next; and they were arranged in nearly straight rows. Large earth mounds occur in Pike, Callaway, Cole, Osage, Franklin, and St. Louis Counties; they are generally from fifteen to forty feet in diameter, and from three to six feet high. Large trees, from two to three feet in diameter, are often found growing on them. He had observed mounds, of various sizes, in the following counties: in Ralls, four or five; in Warren, one; in St. Charles, five; in Pike, seventeen; in Montgomery, three; in Callaway, twenty-six; in Boone, several; in Howard, one; in Cole, twelve; in Osage, one; in Maries, one; in Franklin, two; in Greene, one; in Newton, one; in Iron, one; in Madison, one—in all, about eighty. There were many in these counties, and doubtless in others, which he had not seen. Pike and Callaway seemed to contain the greatest number. Much of interest might yet be developed concerning them, and it was to be hoped they might be carefully explored.

March 16, 1863.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

Letters were read as follows: from the Amer. Phil. Society, Philad., Mar. 11, 1863, announcing publications sent; from Wm. Lykins, Esq., Lawrence, Kansas, Feb. 4, 1863, ordering a copy of the Trans.; and from J. Kelly O'Neall, Esq., Lebanon, O., Feb. 20, 1863, ordering Vol. I. of the Trans.

The Corresponding Secretary laid upon the table the Bulletin de la Société Imp. zoologique d'Acclimatation, Paris, No. 1, Jan., 1863, *from the Society.*

Prof. R. L. Tafel read a paper on the Celtic ingredient in the English language, the same being an abstract of Part II. of his forthcoming work, entitled "Investigations into the laws of English Pronunciation and Orthography."

Dr. Engelmann presented a preparation in alcohol of the genital parts of a female Opossum. When killed (March 14th), twelve young ones were found with it. Four had lost their hold when the mother perished, and were found crawling about; the eight others continued to adhere to the teats in the pouch, but soon died, though some of them still remained attached. The young ones were, like an embryo, entirely naked; the head disproportionately large; the eyes and ears covered by a membrane; the very small nostrils open; the mouth, a small round orifice, enclosing the apex of the teat, which was not drawn in deeply; the body with the head was 9 lines long; the crooked tail, 3 lines long; weight, 21 to 23 grains. Their position in the pouch was not in "clusters," but in two regular rows, the heads outward and the tail ends inward, and almost touching those of the opposite side. They could have been scarcely one week old, as Dr. Bachman states (Audubon & Bachman's Quadrupeds of N. Amer.) that new-born young weigh 3 or 4 grains, and, eight or ten days old, 22 or 23 grains. As the time of gestation is fifteen or sixteen days (according to the same authority), we may look for pregnant female Opossums, in our climate, about the month of March.

April 1, 1863.

The President, Dr. ENGELMANN, in the chair.

Nine members present.

Letters were read from the following Societies: Smithsonian Institution, Mar., 1863, announcing packages forwarded from foreign Societies; Verein für Vaterländische Naturk. in Württemberg, Stuttgart, Oct. 18, 1862; Offenbacher Verein für Naturk., Nov. 10, 1862; Schweitzerische Naturf. Gesellschaft, Bern, Sept., 1862; Verein für Naturkunde, Presburg, Mar. 20, 1859; K. K. Geologische Reichsanstalt, Wien, Sept. 29, 1862; Naturf. Gesellschaft, Nürnberg, Nov. 10, 1862;

Royal Society of Sciences, Upsal, Sept. 15, 1862,—acknowledging receipt of Trans. of the Academy, and announcing publications sent in exchange.

The following publications were received:

Amer. Phil. Society: Transactions, Vol. XII., N. Series, Pt. iii., 4to, 1853—*from the Society.* Journal of Education, Montreal, Vol. VI., 1–12, 1862; Vol. VII., 1–3, 1863—*from Maj. L. A. Huguet-Latour.* Roy. Society of London: Proceedings, Vol. XII., No. 51, 1862—*from the Society.* Roy. Horticultural Society: Proceedings, Vol. II., Nos. 9–12, Lond., 1862—*from the Society.* Württembergische Naturw. Jahreshefte, Jahrg. XVIII.. Heft 1–3, Stuttgart, 1862; Plates I. & II. of fossil Stag (*C. furcatus*) described by Dr. Praas; Pl. III. & IV. colored circular Spectrum—*from the Society.* De la Connaissance des Fruits et des Graines, par M. Charles Des Moulins, Bordeaux; Quartres Mémoires—Autonomie réelle du genre *Schufia*, Spach.; Notes sur une publication recente de M. D. Clos; Vrilles de la Vigne Vierge; Vites Boreali-Americanæ (par M. E. Durand) avec une introduction et des notes,—par M. Charles Des Moulins, Bordeaux, 1862—*from the Author.* Verein für Naturk. im Herzogthum Nassau: Jahrbücher, Heft xvi., Wiesbaden, 1861—*from the Society.* Verein für Beförderung des Gartenbaues: Wochenschrift, Nos. 17–49 incl., 1862, Berlin—*from the Society.* Del Calore prodotto per l'attrito fra Fluidi e Solidi in rapporto colle Sorgenti Termali e cogli Æroliti, del Prof. G. G. Bianconi, Bologna, 1862—*from the Author.* Naturw. Verein für Sachsen u. Thüringen in Halle: Zeitschrift, Band XVIII., 1861; Band XIX., 1862, Berlin—*from the Society.* Verein der Freunde der Naturg. in Meklenburg: Archiv, Jahrg. xvi., 1862, Neubrandenburg—*from the Society.* Offenbacher Verein für Naturk.: Bericht, 1862—*from the Society.* La Société Suisse des Sciences Naturelles: Compte-Rendu, 1861, Lausanne—*from the Society.* St. Gallische naturw. Gesellschaft: Bericht, 1861–2—*from the Society.* Würzburger Med. Zeitschrift, Band III., Heft 4–5, 1862—*from the Society.* L'Académie Imp. de Metz: Mémoires, Années 1860–1—*from the Academy.* La Société Géologique de France: Bulletin, T. XIX., Feuilles 33–45, 46–58, Paris, 1862—*from the Society.* Der Zoologische Garten, No. 7–12, July to Dec., 1862, Frankfurt—*from the Editor.* University of Christiania: Synopsis of the Vegetable Products of Norway, by Dr. F. C. Schübeler, Tr. by Rev. M. R. Barnard, 1862; Physichalische Meddelelser ved Adam Arndtsen, af Dr. C. Hansteen, 1858; Geometrische Repräsentation der Gleichungen zwischen zwei veränderlichen, reellen oder komplexen Grössen, von C. A. Bjerknes, 1859; Om Cirklers Beröring af C. M. Guldberg, udjivet af Dr. O. J. Brock (Universitats-Program), 1861; Beskrivelse over *Lophogaster typicus*, af Dr. Michael Sars, 1862; Geologische Undersögelser i Bergens Omegn af Th. Hiortdahl og M. Irgens, med et Tillaeg, af Dr. Theodor Kjerulf, 1862; Meteorologische Beobachtungen, Lief I. & II., Christiania, 1862; Kometbannernes Indbyrdes Beliggenhed, af H. Mohn, 1860; Akad. Collegiums Foranstaltnung, af G. Fearnley, 1861—*from the University.* La Soc. des Sciences Naturelles de Strasbourg: Mémoires, T. V., Liv. 2–3, 4to, 1862, *from the Society.* Verein für Naturk., Presburg: Verhandl., Jahrg. II., Heft 2, 1857—Jahrg. III., Heft 1–2, 1858—Jahrg. IV., 1859; Populäre naturw. Vorträge von Prof. Albert Fuchs, 1858; Meteor. Beobachtungen zu Presburg, 1858–9, von Dr. G. A. Kornhuber; Klimatische Verhältnisse Presburgs, von Dr. G. A. Kornhuber, 1858—*from the Society.* K. K. Geographische Gesellschaft: Mittheilungen, Jahrg. V., 1861, Wien—*from the Society.* K. K. Geologische Reichsanstalt: Jahrbuch, Band XII., No. 3, 1862, Wien—*from the Society.* I. R. Istituto Veneto: Atti, T. VII., Serie iii., Disp. 7–9, 1861–2—*from the Institute.* Reg. Soc. Scientiarum: Nova Actæ, Vol. IV., Fasc. 1, 4to, 1862, Upsaliæ—*from the Society.* K. bayerische Akad. de Wissenschaften: Sitzungsberichte, Heft II., 1–4, 1861—Heft III., 1–4, München; Annalen der königl. Sternwarte bei München, Band XI., 1862; Rede 28 Nov., 1861, von J.

von Liebig; Rede 28 Nov., 1861, von Dr. J. H. Plath; Zum Gedächtniss an Jean Baptiste Biot (28 März, 1862) von C. F. P. von Martius; Parthenogenesis Vortrag (an 28 Marz, 1862) von Dr. C. Th. F. von Siebold—*from the Royal Academy.*

Mr. Holmes called the attention of members to a paper of Prof. Pliny Earle Chase, contained in the Transactions of the Amer. Phil. Society (Vol. XII., Pt. iii.), laid upon the table this evening, entitled "Intellectual Symbolism: A Basis of Science." He thought it a very important contribution to metaphysical science. It attempted to find a kind of algebraic symbolism for the expression of the faculties and powers of the mind and their relations to one another, indicating by letters as symbols the broadest possible generalizations. The author claims to have been the first to point out Place (for which he uses the term *Position)* as being (together with Time and Space) the third relation of Form, and a necessary condition of the existence of form, whether of body or thing in nature, or of idea or conception in the mind, and as furnishing a proof that Nature itself is a subjective product. But, like most writers on the subject, the author appeared to use the terms *Time* and *Space* (as well as *Position)* in both an infinite and a finite sense. In this, he thought there was error and a source of confusion, and he would submit his own views as follows:

1. Eternity consists merely in the possibility of time, or times in succession.
2. Immensity consists merely in the possibility of space, or spaces in succession.
3. Infinity (in reference to Time, Space, and Position) consists merely in the endless posslbility of Times, Spaces, and Places.
4. Eternity, Immensity, Infinity, can be predicated of the Absolute Mind only, conceived as Thinking Power, and only as possibilities of such thinking existence.
5. Time, Space, and Position, are in themselves merely necessary laws of all possible thinking, divine or human, giving the forms of ideas, conceptions, things, or acts, and the place and the correlation of places of the things created.
6. Position (or rather mathematical point) may express the exact point of beginning of creation of an idea, conception, thing, or act, where the finite begins to be bounded out of the infinite into time, space, and place, which are always finite.
7. Personality may be conceived as constituted in the totality of the thinking subject; but neither Time, Space, nor Position, can be at all predicated of the absolute thinking subject (the Divine Mind) otherwise than as such laws of thought, and only of the finite thinking person, when considered as an individual physical object, or as a specialized and limited metaphysical subject.
8. To employ the terms *time, space, position,* in any sense of infinity, as to say *infinite time, infinite space, infinite position,* is simply an irrational and absurd use of words.

Dr. Shumard presented from Major F. Hawn a paper, entitled "Surface Geology in Kansas." Referred to a committee.

Dr. Engelmann communicated some meteorological observations which he had received from F. M. Case, Surveyor General of Colorado Territory, made by him at Denver City during last January.

He said, the striking feature in the meteorology of that place, as developed in the tables (and, no doubt, of the whole region at the eastern base of the Rocky Mountains), is, that the changes of temperature are very much more excessive there than they are here, though the mean temperature for January last is nearly the same, thus :

Mean temp. Jan., 1863,	at St. Louis,	37.4°	At Denver,	36.8°	Diff.	–0.6°
" at 7 A.M.	"	33.1	"	26.1	"	–7.0
" at 2 P.M.	"	41.8	"	51.2	"	+9.4
" at 9 P.M.	"	37.4	"	33.3	"	–4.1

Therefore, the mean temperature of night and morning is much lower there than here, and that of the middle of the day is much higher; the difference of the extremes being on an average 8.7° here, and 25.1° at Denver. What the difference is in other months of the year, and what the mean difference of the whole year, further observations must develope. The few results published by the Smithsonian Institution as obtained by Mr. D. O. Collier at the same place, in the year 1859, fully bear out the above propositions as far as they go.

The second interesting feature of the climatic changes at the foot of the Rocky Mountains, which, indeed had already been indicated by Dr. Parry's observations of last summer, was the lesser fluctuations of the mean atmospheric pressure and mean temperature there, compared with the same at St. Louis. In the diagram (which was here exhibited) our curve was found to be much more wavy, the atmospheric ocean more stormy, than that representing the similar data at Denver. The diagram elucidated a third very important feature, in this, that the atmospheric changes at Denver occurred invariably one, often two, and rarely three days in advance of ours; just as they generally take place, one or one and a half days sooner here than on the Atlantic coast. This is true in regard to barometrical as well as thermometrical changes. In thirty-one days of the month, I have noted seven rises of the mean daily temperature and seven falls, at Denver, corresponding with similar changes here. Sometimes the changes were greater at Denver, but usually they are more marked here. Dr. Parry's observations of last summer indicate (as stated on a former occasion) a different law. His results make the changes often simultaneous, and not rarely a day later, in the Rocky Mountains than here, and only in a very few instances earlier; so that, if we may venture to draw deductions from the very limited number of observations at our disposal, we may come to the conclusion, that, in winter, the atmospheric changes in the Rocky Mountains, or at their base, precede those in the Mississippi Valley, and that in summer they are simultaneous or even earlier there than here. The facts being once established, the causes remain to be ascertained.

Mr. Broadhead presented some fossils from the Hudson River Group of Ohio.

April 20, 1863.

The President, Dr. Engelmann, in the chair.

Letters were read from the Smithsonian Institution, April 2, 1863, concerning the transmission of exchanges, and from the Königl. Bayerische Akad. des Wissenschaften, Munich, Nov. 6, 1862, announcing publications sent.

The Corresponding Secretary laid upon the table the Jour. of the Acad. of Nat. Sciences, Philadelphia, Vol. V., Part iii., from the Academy.

Francis M. Case, Esq., of Denver, Colorado Terr., and Mr. Albert Bunsen, of Belleville, Ills., were elected Corresponding Members.

May 4, 1863.

The President, Dr. ENGELMANN, in the chair.

Letters were read from Dr. John M. Bigelow, Detroit, April 28, 1863, and from Francis M. Case, Esq., Denver, Colorado Terr., April 29, 1863, severally acknowledging their election as Corresponding Members.

The following publications were received: Ann. Report of the Trustees of the Museum of Comparative Zoölogy for 1862, Boston, 1863—*from the Trustees.* Check List of N. Amer. Shells (Smithsonian Misc. Coll.): Unionidæ, by Isaac Lea—*from the Smithsonian Institution.* Atti della Società di Acclimazione e di Agricoltura in Sicilia, T. II., No. 2, 1862, Palermo—*from the Society.*

May 18, 1863.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

Letters were read from the Museum of Comp. Zoölogy, Cambridge, May 12, 1863; from A. F. Bandelier, Jr., Highland, Ills., May 16, 1863; and from W. C. Flagg, Alton, Ills., May 16, 1863,—acknowledging receipt of Transactions.

The Corresponding Secretary laid upon the table the Am. Jour. of Science, No. 145, May, 1863, New Haven; the Jour. of Education, Vol. VII., No. 4, Montreal, 1863,—*from Major L. A. Huguet-Latour;* and, also, No. 1 of Vol. II. of the Trans. of the Academy, lately issued.

Prof. R. L. Tafel read a paper on English Orthography and Pronunciation.

Mr. Holmes presented from the Smithsonian Institution a box containg a collection of fresh-water shells from various parts of the United States, labelled according to the Catalogue of the Institution; and also, from Mr. G. F. Filley, a globular concretion of sandstone, 15 inches in diameter, from Cannonball River.

Dr. Engelmann exhibited a self-registering maximum and minimum thermometer, made by J. Green, of New York, of new construction, which he considered a valuable improvement.

June 1, 1863.

The President, Dr. ENGELMANN, in the chair.

Nine members present.

Letters were read as follows: from the Librarian of the University of Michigan, Ann Arbor, May 20, 1863; Librarian of Harvard College, Cambridge, May 18, 1863; U. S. Naval Observatory, Washington, May 19, 1863; the Essex Institute, Salem, May 21, 1863; Senckenbergische naturf. Gesellschaft, Frankfurt a. M., Feb. 3, 1863; Ærztlicher Verein, Frankfurt a. M., 1863; Verein für Naturkunde, Wiesbaden, Oct., 1862; Université Catholique de Louvain, Dec. 10, 1862; the Royal Academy of Sciences, Amsterdam, Oct. 23, 1862; Smithsonian Institution, May, 1863; Washington University, St. Louis, May 28, 1863; Major L. A. Huguet-Latour, Montreal, May 16, 1863,—acknowledging receipt of Transactions, and announcing publications sent in exchange.

The following publications were received:

Boston Soc. Nat. Hist.: Proc. Feb. & April, 1863—*from the Society.* U. S. Naval Observatory: Astronomical and Meteorological Ovservations during 1861, by Commander J. M. Gilliss, U. S. N., 4to, 1862—*from the Institution.* Acad. Nat. Sciences, Philad.: Proc., No. 2, March, 1863—*from the Academy.* Univ. of Michigan: Catalogue for 1863—*from the University.* Royal Society of London: Proc. Vol. XII., Nos. 52–54—*from the Society.* Royal Horticultural Society: Proc. Vol. III., Nos. 1–4, 1863, London—*from the Society.* Algemeine Bibliographie von F. A. Brockhaus in Leipzig, No. 11 & 12, 1862—*from the Publisher.* Senckenbergische Naturf. Gesellschaft: Abhandl., Band IV., Abth. 2, 4to, 1863, Frankfurt a. M.—*from the Society.* Ærztlichler Verein: Jahresbericht, IV. Jahrg. 1860, Frankfurt a. M., *from the Society.* Société Linnéenne de Normandie: Bulletin, Vol. VII., année 1861–2, Caen, 1863—*from the Society.* L'Acad. Imp. des Sciences, Arts et Belles-Lettres de Caen: Mémoires, 1863; Prix Le Sauvage: Rapport, 26 Fevrier, 1858, par M. Roulland, 1862—*from the Academy.* Société Géologique de France: Bulletin, T. XIX., Feuilles 59–68, 1862, et T. XX., Feuilles 1–5, 1863; Notice sur la Vie et les Travaux de M. Cordier, par M. le Comte Jaubert, Paris, 1862—*from the Society.* Verein für Naturkunde: Jahrbucher, Heft XVI., 1861, Wiesbaden—*from the Society.* Naturk. Verein: Bericht XV., Augsburg, 1862—*from the Society.* Zoolog.-mineral. Verein: Correspondenz-Blatt, Jahrg. XVI., Regensburg, 1862—*from the Society.* K. Akad. der Wissenschaften: Sitzungsberichte, Abth. I., 3–7, Abth. II. 5–8, 1862, Wien—*from the Society.* Verein für Erdkunde: Notizblatt, Folge III., Heft 1, No. 1–12, Darmstadt, 1862—*from the Society.* Verein zur Beförderung des Gartenbaues: Wochenschrift, Nos. 51–52, 1862, Berlin—*from the Society.* Würzburger Med. Zeitschrift, Band III., Heft 6, 1862; Band IV., Heft 1, 1863, *from the Society.* Université Catholique de Louvain: Annuaire, 1862; De Sepultura et Cœmeteriis—Syntagma Doctrinæ Theol. Adriani Sexti, Pont. Max.; Theses—Theol. Nos. 233–264, Med. 56–58, Droit 6; Programme des Cours 1862–3—*from the University.* Natur. hist. Verein: Verhandl., Jahrg. XIX., Heft 1–2, Bonn, 1862—*from the Society.* K. K. Geologische Reichsanstalt: Jahrbuch, Band XII., No. 4, 1861–2, Wien—*from the Society.* I. R. Istituto Veneto: Atti, T. VII., Disp. 10; T. VIII., Disp. 1–2, 1862–3—*from the Institute.* Royal Academy of Sciences, Amsterdam: Verhandelingen, Afd. Naturkunde, Dl. VIII., 4to; Verslagen, Med. Naturkunde, Dl. XIII.–XIV.; Letterkunde, Dl. VI., 8vo; Jaarboek, 1862—*from the Royal Academy.* Société Imp. zool. d'Acclimatation: Bulletin, T. X., 4, Avril, 1863, Paris—*from the Society.* Journal of Education, Montreal, Vol. V., Nos. 1–6, 1861; Annales du Cabinet de Lecture Paroissial de Montreal, 1857; Annual Rep. of the Nat. Hist. Soc., Montreal, 1858–62; Constitution and By-laws of same, 1859—*from Major L. A. Huguet-Latour.* Bulletin of the Museum of Comp. Zoölogy, Cambridge—*from the Director.*

June 15, 1863.

The President, Dr. Engelmann, in the chair.

Seven members present.

Letters were read from the Librarian of Dartmouth College, Hanover, N. H., May 28, 1863; H. Engelmann, Esq., Springfield, Ills., June 13, 1863; New York State Library, Albany, June 6, 1863; and the Pharmaceutical Association, St. Louis, May 28, 1863.

The following publications were received:

Report of the Case of Dartmouth College *vs.* Woodward, by Timothy Farrar, Counsellor-at-Law, 8vo, Portsmouth, N. H., 1819—*from the College.* Proc. of the California Acad. of Nat. Sciences, Vol. III., April, 1863, San Francisco—*from the Academy.* Jour. of Education, Montreal, Vol. IV., No. 1, Jan., 1860—*from Major Huguet-Latour.*

Dr. Engelmann presented specimens of *Pyrophorus* (a phosphorescent insect), a Tarantula, and a Scorpion, from Cuba.

July 6, 1863.

The President, Dr. Engelmann, in the chair.

Six members present.

Letters were read from B. Westerman & Co., New York, June 18, 1863, concerning subscription for the Transactions, and from Brig. Gen. G. K. Warren, U. S. A., acknowledging receipt of Trans. of the Academy.

Publications received were laid upon the table as follows:

Journal of Education, Montreal, Vol. VII., No. 5—*from Major Huguet-Latour.* Proc. Amer. Phil. Soc., Vol. IX., No. 69, Philadelphia, 1863—*from the Society.* Proc. Amer. Antiq. Society, Boston, 1863—*from the Society.* Questions concerning the Coal Formations of the United States, by Leo Lesquereux (July, 1861)—*from the Author.* Bulletin de la Société Imp. zool. d'Acclimatation, Paris, T. X., No. 5, May, 1863—*from the Society.* Canad. Jour. of Ind. Sci. & Art, Toronto, No. XIV., May, 1863—*from the Canadian Institute.*

Dr. Hilgard exhibited several genera of *Fungi*, and offered some remarks upon their distinctive characters.

Dr. Engelmann exhibited diagrams showing the results of his observations on temperature and fall of rain during the month of June for several years past.

Mr. William S. Fayel was elected an Associate Member.

July 20, 1863.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

The following publications were received:

Amer. Jour. of Science & Arts, New Haven, No. 106, July, 1863; Proc. Amer. Geographical & Statistical Society, New York, Vol. I., Nos. 1 & 2, 1862–3—*from the Society*. Proc. Acad. Nat. Sciences, Philad., No. 3, April & May, 1863—*from the Academy*. Proc. Boston Soc. of Nat. History, May & June, 1863—*from the Society*.

Dr. Sander presented specimens of *Sarracenia purpurea*, with remarks upon its supposed medicinal properties as a preventive or curative of smallpox.

Dr. Engelmann exhibited several species of the genus *Sarracenia*, and explained their botanical peculiarities and geographical distribution.

August 3, 1863.

The President, Dr. ENGELMANN, in the chair.

Five members present.

The Secretary laid upon the table the Canadian Journal, Toronto, No. 46, July, 1863, *from the Canadian Institute*; Bulletin de la Société Imp. zool. d'Acclimatation, Paris, T. X., No. 6, June, 1863, *from the Society*.

Dr. T. C. Hilgard read a paper on *Fungi*.

Dr. Engelmann exhibited very complete and instructive specimens of *Pinus Banksiana*, and *Picea alba* and *nigra*, sent by Mr. E. P. Austin from Green Bay, Wisconsin, and made some remarks upon their peculiarities.

Dr. Engelmann made some observations upon the importance of the phenomena of hydro-electricity in the study of the physics of the globe.

August 17, 1863.

The President, Dr. ENGELMANN, in the chair.

Five members present.

Letters were read from Dr. W. A. Gordon, Louisville, Ky., Aug. 5, 1863, ordering a copy of the Trans.; the Royal Society of Sciences, Göttingen, May 7, 1863; Naturf. Gesellschaft, Altenburg, March 19, 1863; Société des Sciences Naturelles de Neuchatel, Dec. 31, 1862; the Overyssel Society of Sciences, Zwolle, Mar. 17, 1863; Naturk. Gesellschaft der Wissensch., Prag, Mar. 28, 1863; Naturf. Gesellschaft, Halle, March 10, 1863; Smithsonian Institution, August, 1863,—announcing publications sent, and acknowledging receipt of Transactions; and from the Smithsonian Institution, Aug. 8, 1863, sending a donation of Amer. Tertiary and Cretaceous shells for the museum of the Academy.

The following publications were received:

Overysselsche Vereenigung tot Ontwik. van Prov. Welvaart: Jaarlijksch Verslag; Register van Charters en Bescheiden van Kampen, 1863, Zwolle—*from the Society*. Königl. Gesellschaft der Wissenschaften: Nachrichten, No. 1–27, Göttingen, 1862—*from the Society*. Mittheilungen aus dem Osterlande, Band XVI., Heft 1, 1862, Altenburg—*from the Society*. Société geologique de France: Bulletin, T. XX., Feuilles 6–12, 1862–3, Paris—*from the Society*. Société des Sciences Naturelles: Bulletin, T. VI., cah. 1, 1862, Neuchatel—*from the Society*. Würzburger Med. Zeitschrift, Band IV., Heft 2, 1863—*from the Society*. Royal Hungarian Academy of Sciences: Közlonye, 1862, Pesth—*from the Academy*. Naturk. Gesellschaft: Jahresbericht XII., Hanover, 1863—*from the Society*. K. Böhmische Gesellschaft der Wissenschaften: Abhandl. 1863, 4to; Sitzungsberichte, 1862, Prag—*from the Society*. Naturf. Gesellschaft zu Halle: Abhandl., Band XVII., Heft 2, 1862—*from the Society*. Proc. Royal Horticultural Society, Vol. III., No. 5, May, 1863, London—*from the Society*. On Californian Mosses, by Leo Lesquereux, 1863—*from the Author*.

The Corresponding Secretary presented as a donation from the Smithsonian Institution a collection of Amer. Tertiary and Cretaceous shells, labelled as per catalogue of the Institution.

Dr. Hart presented a specimen of copper ore from Portage Lake, consisting of quartz, dog-tooth spar, and native copper.

Dr. Engelmann made some remarks upon the comparative mean temperature of the month of July, at St. Louis. The warmest July experienced here within thirty years past was in 1856, when the mean temperature was 83.5° Fahr.; the coldest occurred in 1848, with 73.7°. The mean temperature of this last month was 76°, the minimum 55°, and the maximum 94°. In 1860, the maximum reached, in the afternoon of the 21st, 104°, and in 1856, at noon on the 17th, 102.5°; in nine years, of the thirty observed, it rose over 100°. The lowest temperature noticed in July (53°) occurred on the morning of July 4, 1859. Thus the temperature of this month within the city has never been found lower than 53° nor higher than 104°; in every year it reached at least to 90°, and in some years never fell under 63 to 65°. The oppressiveness of the present season was owing to the moisture, and not so much to the heat. The quantity of rain in this month was 2½ inches, while the average is 4 inches; but the average humidity was found to be 68, while the average is only 64.

September 7, 1863.

The President, Dr. ENGELMANN, in the chair.

Ten members present.

Letters were read from Wm. Sharswood, Philadelphia, Aug. 14, 1863, proposing an exchange of publications, and from J. K. O'Neal, Lebanon, O., acknowledging receipt of Trans. ordered; from the Nat. Hist. Society, Dublin, Ireland, Aug. 5, '63, sending proceedings and proposing an exchange; and from the K. Böhm. Gesellschaft der Wissenschaften, Prag, April, 1863, sending publications.

Publications were received as follows:

Proc. of the Nat. Hist. Society, Vol. III., Pt. 2, Sept., 1860–2, Dublin, 1863—*from the Society.* Canadian Naturalist and Geologist, Vol. VIII., No. 1–3, 1863, Montreal—*from the Society.* Memoirs of the Amer. Acad. of Arts & Sciences, Vol. VIII., Pt. ii., 4to, 1863; Proceedings of same, Vol. VI., pp. 1–96, Boston—*from the Academy.* Sitzungsberichte der K. Böhmischen Gesellschaft der Wissensch., Prag, Jahrg. 1862; Andenken an Wauslaw Hanka in Prag, von Dr. Weitenweber; Personalstand, 1863, —*from the Society.* Atti della Società Ital. de Scienze Naturali, Vol. III., Fasc. 5, Milano, 1862—*from the Society.*

Dr. Pope presented a jar of reptiles in alcohol, collected in the vicinity of St. Louis.

Dr. Pollak exhibited a specimen of chalcedony from the Upper Mississippi; also, arborescent native copper, and earthy iron ore, from Colorado Terr.

October 5, 1863.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

The Corresponding Secretary laid upon the table the Canadian Naturalist & Geologist, Vol. VIII., No. 4, Aug., 1863, Montreal, *from the Society;* and the Amer. Journal of Science & Arts, New Haven, for Sept., 1863, No. 107.

Dr. Engelmann exhibited specimens of the cones and branches of the Himalayan Cedar and the Cedar of Lebanon, which, together with the Cedar of the Taurus and that of Mount Atlas, all seem to be geographical varieties of a single species. He also exhibited cones of numerous other Pines, Spruces, and Larches.

John J. Bigsby, M.D., F.G.S., of London, Eng., was elected a Corresponding Member.

October 19, 1863.

Vice-President, Dr. Wislizenus, in the chair.

Six members present.

Letters were read from the Royal Academy of Sciences, Lisbon, Aug. 8, 1863; Verein für Naturkunde, Presburg, Jan. 27, 1860; and the Verein der Krainischen Landes-Museum, Laibach, January 1, 1863,—acknowledging the receipt of the Trans. of the Academy, and announcing publications sent in exchange.

The following publications received were laid upon the table:

Studi stratigraphici e paleontologici sull' Infralias nelle Montagne del Golfo della Spezzia, del Prof. Giovanni Capellini, 4to, Bologna, 1862; Carta Geologica dei Dintorni del Golfo della Spezzia e Val di Magra inferiore, da Prof. Cav. G. Capellini—*from the Author.* Correspondenz-blatt des Vereines für Naturkunde zu Presburg, Jahrg. I., 4, 1862; Verzeichniss von Pflanzen-Doubletten—*from the Society.* Jahresheft des Vereines des Krainischen Landes-Museum, III., 1862, Laibach—*from the Society.* Journ. of Education, Vol. VII., Nos. 7–8, Montreal, 1863—*from Major L. A. Huguet-Latour.*

Mr. Holmes presented in the name of Mr. Edward Holden some quartz crystals from Herkimer Co., New York, one of which enclosed a drop of water.

Dr. Shumard presented specimens of Gold Fish and a small Turtle.

Dr. Engelmann said that, in a recent conversation with Prof. Jules Marcou, who had just returned from an exploration of Nebraska, he learned that the Professor had become satisfied that the strata there containing dicotyledonous leaves were clearly of the age of the Cretaceous period, and not of Tertiary origin, as he had hitherto supposed, misled by the apparent analogy of the leaves in question with European Tertiary fossil plants.

Dr. Shumard remarked that Messrs. Meek & Hayden had long since referred these Nebraska beds to the Cretaceous age. Dr. Newberry had discovered dicotyledonous leaves in well marked Cretaceous strata in New Mexico, and he had himself found them in Cretaceous strata in Texas.

November 2, 1863.

The President, Dr. ENGELMANN, in the chair.

Ten members present.

Letters were read from the Smithsonian Institution, Oct. 26, 1863, announcing publications forwarded from foreign Societies; and from the Royal Scottish Society of Arts, Edinburgh, Sept. 1, 1863, acknowledging receipt of Transactions.

The following publications were received:

Proc. of the Acad. Nat. Sciences, Philad., No. 4, 1863—*from the Academy*. Jour. of Education, No. 9, Sept., 1863, Montreal—*from Major L. A. Huguet-Latour*. Proc. of the Boston Soc. of Nat. Hist., Vol. III., Sept., 1863—*from the Society*. Proc. of the American Geographical & Statistical Soc., N. York, Vol. I., No. 4, 1862-3—*from the Society*. Atti della Società di Acclimazione e di Agricoltura in Italia, T. III., No. 3-6, Palermo, 1863 —*from the Society*.

The Corresponding Secretary read a communication from A. H. Worthen, State Geologist of Illinois, concerning a slab of sandstone, which was exhibited, containing markings supposed to be artificial, and which was said to have been found in excavating for a well, at a depth of 30 feet below the surface. An examination of the slab resulted in a pretty general opinion among the members that the markings had been recently made.

Prof. Giovanni Capellini, of Bologna, Italy, was elected a Corresponding Member.

November 16, 1863.

The President, Dr. ENGELMANN, in the chair.

Seven members present.

Letters were read from the Naturforschende Verein, Riga, April 18, 1863; Der Kongelige Danske Videnskabernes Selskab, Copenhagen, Feb. 1, 1863; L'Académie Royale des Sciences de Lisbonne, July 18, 1863; Naturf. Gesellschaft des Osterlandes, Altenburg, June 16, 1863; Naturf. Gesellschaft, Bern, April 8, 1863,—acknowledging receipt of Trans., and announcing publications sent; and from Dr. Moriz Hörnes, Vienna, May 7, 1863, accompanied by two specimens of meteoric iron.

The following publications were received:

Société Imp. zool. d'Acclimatation: Bulletin, T. X., No. 9, Sept., 1863, Paris—*from the Society.* Jour. of Ind., Science & Art, No. 47, Sept., 1863, Toronto—*from the Canadian Institute.* Naturf. Gesellschaft in Bern: Mittheil. No. 49–53, 1860—*from the Society.* Plantes Rares de la Gironde, par M. Ch. Des Moulins & G. Lespinasse, Bordeaux, 1863—*from the Authors.* Société Géologique de France: Bulletin, T. XX., Feuilles 13–20 & 21–30, 1863, Paris; Liste des Membres—*from the Society.* Royal Horticultural Society: Proc., Vol. III., No. 6–7, 1863, London—*from the Society.* Royal Society: Proc., Vol. XII., No. 55, London, 1863—*from the Society.* Geological Society: Journal, Vol. IX., Part 2, 1861–2, Dublin—*from the Society.* Versuch einer Aufzählung der Arten der Gattung Bithynia Leh und Nematura Bus., von G. Ritter von Frauenfeld, 1862; Lebensweise der Kolumbatscher Mücke, 1862, von G. Ritter v. Frauenfeld; Uber die von der K. K. Fregatte Novara mitgebrachten Orthopteren von Karl Brunner von Wattenwyl, 1862; Sägspansee von G. R. v. Frauenfeld, 1862; Vorläufige Uebersicht der Spinnen, etc., von Dr. Georg Böck, 1861; Beitrag zur Insektengeschichte, 1861, von G. R. v. Frauenfeld, 1862; Ueber ein neues Höhlen-Carychium und zwei neue fossile Paludinen, von G. R. v. Frauenfeld, 1862; Stelle aus einen Schreiben von Hern G. Haart in Neu-Seeland, von G. R. v. Frauenfeld, 1862; Auszüge aus Briefen des in Amboina verstorbenen Dr. L. Doleschall, 1862—*from Dr. G. Ritter von Frauenfeld.* Der Zoologische Garten: Jahrg. IV., No. 1–6, Frankfurt, 1863—*from the Editor.* Mittheil. aus dem Osterlande, Band XVI., Heft 1–3, 1863—*from the Society.* Verein zur Beförderung des Gartenbaues: Wochenschrift, No. 1–30, 1863. Berlin—*from the Society.* Academia Real das Sciencias de Lisboa: Memorias, N. S., T. II., Pt. ii., 4to, 1861—*from the Academy.* Roy. Danish Acad. of Sciences: Skrifter, Rakke V., Binds v., Hefte 2, 1861; Obersigt, 1861; Quæstiones, 1863—*from the Academy.* K. K. zool.-botan. Gesellschaft: Verhandl., Band XII., Heft 1–4, 1862; Personen Orts-& Sach Register, 1856–60, Wien—*from the Society.* Naturf. Verein: Correspondenz-blatt, Jahrg. XIII., Riga, 1863—*from the Society.* L'Académie Imperial de Dijon: Mémoires, année 1862—*from the Academy.* Jour. d'Agriculture de la Cote-d'Or, année 1862, Dijon—*from Prof. Ladrey.* California Acad. of Nat. Sciences: Proc. Dec., 1861; same, Vol. II., 1858–1862, San Francisco—*from the Academy.* K. Physikalisch-ökonom. Gesellschaft: Schriften, Jahrg. III., Abth. 1–2, 1862, Königsberg—*from the Society.* Geol. Reichsanstalt: Jahrbuch, Band XIII., No. 1, 1863; General Register, 1863, Wien—*from the Society.* Siebenburgische Verein für Naturw.: Verhandl. u. Mittheil., Jahrg. VIII., 1862, Hermannstadt—*from the Society.* I. R. Istituto Veneto: Atti, T. VIII., Ser. iii., Disp. 3–4, 1862–3—*from the Institute.* K. Preuss. Akad. der Wissensch.: Monatsberichte, 1862, Berlin, 1863—*from the Academy.* Vaterl. Museum Carolino-Augusteum: Jahresbericht, 1852–62, Salzburg—*from the Institution.* Proc. of the Geograph. & Statistical Society, Vol. II., No. 1, New York, 1863–4—*from the Society.*

The Corresponding Secretary presented from Dr. Hörnes, Director of the Imperial Cabinet of Mineralogy, Vienna, a beautiful piece of meteoric iron from a mass which fell on the 14th of July, 1847, at Braunau, in Bohemia, and another remarkable specimen, with olivine disseminated, from Rittersgrün, Saxony; for which he was directed to return the thanks of the Academy.

Dr. C. A. Pope presented in the name of James Robb, Esq., of Chicago, a fine copy of the Archæologia, published by the

Society of Antiquaries, London, in 30 Vols., 4to, handsomely bound, as a donation to the library. Voted, that the thanks of the Academy be returned to Mr. Robb for this valuable present, together with a bound copy of the Transactions.

Dr. Pope also presented some specimens of sulphuret of iron.

Mr. Daniel McGowan, of St. Louis, was elected an Associate Member.

December 7, 1863.

The President, Dr. Engelmann, in the chair.

Nine members present.

A letter was read from Cav. Prof. Giovanni Capellini, Nov. 12, 1863, acknowledging his election as a Corresponding Member; also, from the British Museum, London, Nov. 6, 1863, and the Geological Society, London, Nov. 4, 1863, acknowledging receipt of the Transactions.

The following donations to the library were received:—Time-Boundaries in Geological History; Homologies of Insects and Crustaceans; Parallel Relations of Classes of Vertebrates; Classifications of Animals, based upon the principle of Cephalization—by James D. Dana, New Haven, 1863,—*from the Author*. Amer. Jour. of Sci. & Art, No. 108, Nov., 1863, New Haven.

James Robb, Esq., of Chicago, Ill., was elected a Corresponding Member.

December 21, 1863.

The President, Dr. Engelmann, in the chair.

Five members present.

A letter was read from Dr. J. J Bigsby, London, Nov. 17, 1863, acknowledging his election as a Corresponding Member.

The Corresponding Secretary laid upon the table the Canadian Jour. of Industry, Science & Art, No. 48, Nov., 1863, Toronto, *from the Canadian Institute*.

Dr. Engelmann presented from Mr. E. Durand, of Philad., two publications, entitled "Enumeration of Arctic Plants, collected by Dr. I. I. Hayes, and described by E. Durand," and "Article on Tea, by E. Durand & S. Ashmead."

Dr. Engelmann exhibited plates of *Archæopteryx lithographica*, the lately discovered Saurian-Bird or Bird-Saurian of Solenhofen.

Mr. Broadhead exhibited several flint implements, found at Frederick, Ill. He observed that, some years ago, more than a hundred, of similar shape and size, were found beneath the surface of the ground, in Warren Co., arranged in a circle and set on edge with the plane surfaces in contact.

Frank W. White, M.D , of St. Louis, was elected an Associate Member.

January 4, 1864.

Vice-President WISLIZENUS in the chair.

Eleven members present.

A letter was read from the Società Italiana di Scienze Naturali, Milan, Dec. 3, 1863, acknowledging receipt of the Trans. of the Academy.

The Corresponding Secretary laid upon the table the Canadian Naturalist & Geologist, Vol. VIII., No. 5, Oct., 1863, Montreal, *from the Society of Natural History.*

Dr. C. W. Stevens exhibited, from a medical student, a preparation of an extra-uterine fœtal pig.

Dr. Engelmann reported the results of his meteorological observations at St. Louis for the year 1863, and presented diagrams constructed from the observations of T. J. Homer, Esq., City Engineer, showing the rise and fall of the Mississippi River during the year 1863, and the average stage of the river for the last three years. He was requested to furnish copies for publication in the Transactions.

Dr. Engelmann remarked that the temperature of New Year's morning was lower than he had before observed in St. Louis. On that day the minimum thermometer indicated 22½° below zero. At the Missouri Botanic Garden, five miles from St. Louis, the thermometer indicated (according to Mr. Fendler) 23° below zero.

Dr. Wislizenus reported the results of his observations on Atmospheric Electricity at St. Louis during the year 1863, with diagrams illustrating the same. He was requested to prepare an abstract of his observations for publication in the Transactions.

An amendment to Article III. of the Constitution was adopted as follows:

§ 12. The class of Associate Members shall consist of two sections. The first section shall be composed of Associate Members, as hereinbefore provided: the second section, to be styled Associate Life Members, shall be composed, firstly, of Associate Members who shall at any time pay into the Treasury the sum of fifty dollars, in commutation for all future regular dues, and, secondly, of persons hereafter to be elected as such who shall, within one month after the date of their election, pay into the Treasury the like sum of fifty dollars, in lieu of initiation fees and all other dues for life; and they shall be subject otherwise to the same regulations and have the same privileges as the first section.

The President read his Annual Report for the year 1863, as follows:

ANNUAL REPORT.

On this, the eighth anniversary of our Academy's existence, it is my duty to exhibit to the members and to an appreciative public a review of the progress made during the past year, and of our present condition.

In proportion to our limited pecuniary means (having to rely entirely on the contributions of members, and not being endowed in any manner), and to the small number of really active, laboring members, not one of whom can devote more than a few leisure hours to the pursuit of science and to the advancement of our Institution, we may well feel proud of what we have accomplished in the eight years of our existence, and especially in the year just closed.

We ourselves, and the public which takes an interest in our labors, are fully aware that we cannot pretend to rival the old and celebrated Academies of other lands, nor those of the older parts of our country. Bnt let not those who are unable to appreciate the difficulties in our path belittle our activity and our results; nor let us ourselves become discouraged when we admire the giant results obtained by well endowed and older institutions, situated in cities where long years of mental culture, often aided by pecuniary independence, and by the liberality of Governments, have produced a class of savans and amateurs, of which we, in our (comparatively speaking) infant community, cannot yet boast.

Do not be discouraged. It was the patient and unpretending labor of former times that has laid the foundation of those institutions which now loom up before our vision as bright and almost unattainable examples. Let us follow the leadership of those modest founders, and never tire, and we may confidently expect that those who come after us will be able to carry up our edifice to a height and proportions at once fair and grand, and make it such as the Academy of Science of St. Louis should be.

That we do not labor in vain is testified to by the rich and varied collections accumulating about us, by our library growing in importance, and by the numbers of our Transactions thus far published; and the same is kindly acknowledged by two hundred institutions of science in all civilized countries, which, with the liberal spirit of true science, bid us God speed, sending us their friendly greeting, exchanging their valuable publications for our transactions, though (many of them) vastly superior in intrinsic value as well as in volume.

In May last, we had completed the first number of the second volume of our Transactions, not inferior in interest and appearance to any previous number, and have sent it to those with whom we exchange, and to our subscribers.

The invaluable aid of the Smithsonian Institution, which, true to the purposes of its founder, most liberally assists scientific pursuits throughout the country, has enabled us to accomplish those exchanges; through them we have sent our publication to foreign countries, and have received from 151 foreign academies, societies, and individuals, their works in return, almost free of cost to us.

It is expected that another number of our Transactions can be published during this coming year. The scientific material is in course of preparation, but the pecuniary point seems to offer obstacles, we hope, not insurmountable. Our debt to the printers—almost the only debt we have—now amounts to about $600. Means will have to be found to cancel this debt, so that we may be able to start afresh. It is hoped that the institution of life membership, conferred in consideration of a contribution of $50, will furnish us with these means.

The number of our active members is at present sixty, four new ones having been added during the past year. To our Corresponding Members we have added six in that period, and they number now one hundred and twenty six. Our foreign exchange list includes one hundred and fifty-four names, and our home list amounts to seventy.

The members of our Academy have exhibited great activity and interest during the past year, in reading papers, discussing scientific subjects, and in working in our library and museum.

The museum has received valuable additions, especially through the liberality of the Smithsonian Institution, the Imperial Mineralogical Cabinet of Vienna, and a number of individuals here and abroad. The interest and value of our collections have been vastly enhanced by the zealous labor of several of our members who have undertaken to arrange a part of our collections, heretofore in confusion.

Our library has received an addition of 308 volumes and pamphlets from our correspondents, and about 60 from other sources. Among the latter stands pre-eminent the Archæologia, published by the London Society of Antiquaries, in 30 volumes, a donation from James Robb, Esq., of Chicago, made through our Vice-President, Dr. Pope.

Dr. Pope has also given us the use of the room adjoining our hall for the use of the library, of which we were much in need, to store the treasures accumulating upon us. The room has been furnished principally through the liberality of members, and our zealous Librarian has arranged the works on the shelves so as to make them accessible and useful.

Thus we are prepared to proceed in our efforts to cultivate science among ourselves, and to form a nucleus for scientific pursuits in the centre of the Mississippi Valley, which, we hope and expect, will attract the lovers and the well-wishers of science around us, and with their aid make the Academy worthy of our city.

An election of officers for the ensuing year resulted as follows:

President,	George Engelmann.
1*st Vice-President*,	Adolphus Wislizenus.
2*d Vice-President*,	Charles A. Pope.
Corresponding Secretary,	Nathaniel Holmes.
Recording Secretary,	Spencer Smith.
Treasurer,	Enno Sander.
Librarian,	F. E. Baumgarten.
Curators,	B. F. Shumard, G. C. Broadhead, C. W. Stevens, and S. Smith.
Com. on Publication,	G. Engelmann, B. F. Shumard, and N. Holmes.

The reports and accounts of the Corresponding Secretary and Treasurer for the last year were submitted, and, upon examination, being found correct, were approved.

January 18, 1864.

The President, Dr. Engelmann, in the chair.

Seven members present.

The following publications were received:

Bulletin de la Société Imp. zool. d'Acclimatation, T. X., No. 11, Nov., 1863 — *from the Society*. XI. & XII. Jahresbericht des Werner-Vereins, 1861–2, Brünn; Hypsometrie in Mähren und Schlesien, von Karl Koristka; Bericht uber einige im Norderen Gesenke und im Marsgebirge ausgeführte Höhenmessungen, von Karl Koristka, 1861 — *from the Society*. Der Zoologische Garten, von Dr. D. F. Weinland, Jahrg. IV., Nos. 1–6, Frankfurt a. M.—*from the Editor*.

Ordered, that the Horticultural Society of Missouri be placed upon the list of exchanges, and that a copy of the Transactions be sent to them.

L. D. Morse, M.D., of St. Louis Co., was elected an Associate Member.

February 1, 1864.

The President, Dr. Engelmann, in the chair.

Thirteen members present.

A letter was read from Prof. Jules Marcou, Cambridge, Mass., Jan. 22, 1864, announcing the sending of publications for the library, together with a box of fossils as a donation to the museum, and proposing an exchange of other fossil specimens. The matter of the proposed exchange was referred to a Committee for further consideration.

The Corresponding Secretary laid upon the table the Journal of the Acad. of Nat. Sciences, Philad., Vol. V., Pt. iv., 1863, and Proceedings of same, Nos. 5 & 6, Aug.–Nov., 1863, *from the Academy*.

Dr. Pollak introduced Prof. Robyn, of the Missouri State Asylum for the Blind, who gave a detailed account of his method of teaching the blind to read and write, following the system of Braillé, and showing that this system was applicable also to musical notation and the expression of mathematical quantities.

On motion, the thanks of the Academy were voted to Prof. Robyn for his instructive communication.

Dr. Shumard exhibited a specimen of meteoric iron from Denton Co., Texas, and another from Dacotah Territory. He stated that the original mass from which the latter specimen was cut weighed 100 lbs., and that it had been described by Dr. Charles T. Jackson.

Dr. Shumard read a paper containing a report of a recent examination made by him of the Fourche-à-Courtois Mines, situated in Township 36 N. Range 1 E. of the 5th Prin. Merid., in Missouri.

Dr. Engelmann remarked that the variation of temperature in the month of January past had been greater than he had observed in thirty years before. While the lowest range of the thermometer was 22.5° below zero on New Year's morning, the highest above had reached 72° in the afternoon of the 27th; the mean for the whole month (28.5°) ranging 4° below the average for January.

February 15, 1864.

The President in the chair.

Five members present.

Letters were received from the following Societies and Institutions:

The Smithsonian Institution, Washington, Jan. 22, 1864; Naturf. Gesellschaft in Emden, Oct. 8, 1863: Naturf. Gesellschaft, Halle, Oct. 30, 1863; Naturh. Gesellschaft, Nurenburg, Sept. 30, 1863; Leeds Philosophical & Lit. Society, Aug. 31, 1863; K. Sächsische Gesellschaft der Wissensch., Leipzig, Aug. 22, 1863; Royal Horticultural Society, Kensington, Oct. 17, 1863; Nat. Hist. Society of Northumberland, Durham, and Newcastle-upon-Tyne, Oct. 10, 1863; Verein der Freunde der Naturgeschichte, Neubrandenburg, Aug. 29, 1863; K. Sächsische Bergakademie, Freiberg, Sept. 6, 1863; Naturf. Gesellschaft, Basel, Sept. 25, 1863; Naturf. Gesellschaft, Danzig, Ang. 8, 1863; K. Akad. der Wissenschaften, Wien, Aug. 25, 1863; K. K. patriotisch-ökonom. Gesellschaft, Prag, July 21, 1863; Naturf. Gesellschaft Graubündens, Chur, Aug. 1, 1863; Oberhessische Gesellschaft für Natur-und Heilkunde, Giessen, Aug. 27, 1863; Museum Francisco-Carolinum, Linz, Oct. 20, 1863; Naturh. Verein, Augsburg, Aug. 28, 1863,—

severally acknowledging the receipt of the Transactions of the Academy, and announcing publications sent in exchange.

The following publications were received:

Proc. of the Boston Soc. Nat. Hist., Vol. IX., July–Dec., 1863—*from the Society*. Amer. Jour. of Science & Arts, No. 109, Jan., 1864, New Haven. Royal Society: Proc., Vol. XII., Nos. 56 & 57, 1863, London—*from the Society*. Royal Horticultural Society: Proc., Vol. III., No. 8, London, 1863—*from the Society*. Catalogues of Frederick Muller, Amsterdam—*from the Publisher*. Naturh. Verein: Bericht XVI., Augsburg, 1863—*from the Society*. Naturh. Verein: Jahresbericht V., 1861–2, Passau, 1863—*from the Society*. I. R. Istituto Veneto: Atti, T. VIII., Ser. iii., Disp. 5–7, 1862–3—*from the Society*. Société Vaudoise des Sciences Naturelles: Bulletin, T. VII., No. 50, Lausanne, 1863—*from the Society*. Museum Francisco-Carolinum: Bericht XXIII., Linz, 1863—*from the Institution*. Oberhessische Gesellschaft: Bericht X., Giessen, 1863—*from the Society*. K. Akad. der Wissenschaften: Sitzungsberichte, Jahrg., 1862, Abth. I, Nos. 8-10; Abth. II., Nos. 9 & 10, 1863; Abth. I., Nos. 1-3; II., Nos. 1-4—

from the Academy. Offenbacher Verein für Naturk.: Bericht IV., 1863—*from the Society.* Der Dr. J. C. Senckenbergischen Stiftung Denkschrift, Aug. 18, 1863—*from the same.* Nederlandisch Meteor. Jaarboek, 1862, Utrecht—*from the Royal Meteor. Institute.* Zeitschrift für die Gesammten Naturw., Halle: Band XX.-XXI., 1862-3—*from the Editors.* Naturf. Gesellschaft Graubündens: Jahresbericht, Jahrg. VIII., Chur, 1863—*from the Society.* K. K. Geol. Reichsanstalt: Jahrbuch, Band XIII., No. 2, Wien, 1863—*from the Institute.* L'Académie Imp. des Sciences: Mémoires, T. IV., Nos. 10 & 11, 1862; Bulletin, T. IV., Nos. 7-9; T. V., Nos. 1 & 2, St. Petersburg—*from the Royal Academy.* K. K. patr.-ökonom. Gesellschaft: Centralblatt 1861 und 1862, Prag—*from the Society.*

Dr. Edward Lawton, of St. Louis Co., was elected an Associate Member.

March 7, 1864.

Vice-President WISLIZENUS in the chair.

Thirteen members present.

A letter was read from the Deutsche Geol. Gesellschaft, Berlin, Nov. 5, 1863, acknowledging receipt of the Transactions; and from the Bibliothèque Impériale Publique de St. Petersbourg, Jan. 10, 1864, proposing an exchange of publications direct.

The following publications were received:

List of Polyps and Corals, with Annotations by A. E. Verrill—*from the Museum of Comp. Zoölogy.* Notes on the described species of *Holoconoti* from the Western Coast of N. Amer., by A. Agassiz; On *Arachnactis brachiolata* from Nahant, by A. Agassiz; List of *Echinoderms* sent in exchange, with Annotations by A. Agassiz; Embryology of *Asteracanthion berylinus*, Ag., and species allied to *A. rubens*, M. T., and *A. pallidus*, Ag., by A. Agassiz—*from the Author.* Journal of Industry, Sci. & Art, No. 49, Jan., 1864, Toronto—*from the Canadian Institute.* Bulletin de la Soc. Imp. zool. d'Acclimatation, T. X., No. 12, Dec. 1863, Paris—*from the Society.* Astronomical & Meteor. Observations, U. S. Naval Observatory, 1862, Capt. J. M. Gilliss, U. S. N., Sup't, 4to, 1863—*from the Institution.* Proc. Acad. Nat. Sciences, Philad., No. 7, Dec. 1863—*from the Academy.*

Dr. Boisliniere introduced Mr. Pratviel, who explained and illustrated his method of teaching Perspective in Drawing, with an apparatus prepared for the purpose, whereby the principles of the science were made visible to the eye and easy of comprehension. The thanks of the Academy were voted to Mr. Pratviel for his highly interesting illustration of the subject.

Voted, that the proposed exchange of publications with the Imperial Library of St. Petersburg be accepted.

Mr. G. C. Seymour, of St. Louis, was elected an Associate Member.

April 4, 1864.

The President in the chair.

Six members present.

Letters were read from the Royal Academy of Sciences, Lisbon, Nov. 25, 1863, announcing publications sent; from Prof. Jules Marcou, Cambridge, Mass., acknowledging receipt of fossils sent in exchange; and from Prof. Henry Shimer, Mt. Carroll, Ills., March 29, 1864, requesting a copy of the Transactions, and announcing a donation of specimens in Natural History from the County of Carroll, Ills.

The following publications were laid upon the table:

Memorias da Acad. Real das Ciencias de Lisboa, T. III., Pt. i., Classe de Sciencias Moraes, Politicas e Bellas-Lettras, 4to, 1863; T. III., Pt. i., Classe de Sciencias math., phys. e naturales, 4to, 1863—*from the Academy.* Proc. California Acad. Nat. Sciences, Nov.-Dec., 1863, and Jan., 1864—*from the Academy.* Canadian Naturalist & Geologist, and Proc. Nat. Hist. Society, Montreal, Vol. VIII., No. 6, Dec., 1864—*from the Society.* Proc. Boston Soc. of Nat. History, Vol. IX., Jan.-Feb., 1864—*from the Society.* Fossils from the Potsdam of Wisconsin and Lake Superior, by Prof. A. Winchell—*from the Author.* Classification of Animals based on the principle of Cephalization: No. II., Insects; No. III., Herbivores, and Note on the Position of Amphibians among Vertebrates, by James D. Dana, New Haven—*from the Author.* Amer. Jour. of Sci. & Arts, New Haven, No. 110, March, 1864. Bulletin de la Société Imp. zool. d'Acclimatation, T. I., serie ii., No. 1, Jan., 1864, Paris—*from the Society.*

The Corresponding Secretary read a paper, presented for publication by Mr. Rau, on Indian Antiquities. Referred to the Committee on Publication.

Dr. Shumard reported that he had made a selection of fossils as directed, to be sent in exchange to Prof. Jules Marcou, and that the same had been duly forwarded.

April 18, 1864.

The President, Dr. ENGELMANN, in the chair.

Five members present.

Letters were read from the Smithsonian Institution, April, 1864, announcing the transmission of publications from various Societies in Europe; and from the K. Bayer. Akad. der Wissenschaften, Munich, Nov. 20, 1863; Bataafsch Genootschap der Proef. Wisbegeerte, Rotterdam, October 19, 1863; Genootschap van Kunsten en Wetenschappen, Utrecht, Oct., 1863; Royal Society of Sciences, Upsal, Oct. 15, 1863; U. S. Naval Observatory, Washington, Dec. 7, 1863; Smithsonian Institution, April 12, 1863; Naturf. Gesellschaft, Bern, Sept.

1, 1863; Naturf. Gesellschaft, Danzig, October 2, 1863; Naturf. Gesellschaft, Freiburg, I. B., October 19, 1863; Royal Swedish Academy of Sciences, Stockholm, November 18, 1863; Naturf. Verein, Brünn, Dec. 12, 1863,—severally acknowledging receipt of the Transactions, and announcing publications sent in exchange; and from Prof. Henry Shimer, Mt. Carroll, Ills., concerning donation of specimens in Natural History.

The following publications were received:

Revue Critique de Bibliographie, publiée par Aug. Durand, Paris, 1864—*from the Editor.* Société Imp. zool. d'Acclimatation: T. I., No. 2, Fevr., 1864, Paris—*from the Society.* Royal Society: Proc., Vol. XIII., Nos. 58–9, London—*from the Society.* Royal Horticultural Society: Proc. Vol. III., Index; Vol. IV., Nos. 1–3, London, 1864—*from the Society.* Geol. & Polytechnic Society of Yorkshire: Proc., 1861 & 1862, Leeds—*from the Society.* Philosophical & Lit. Society: Ann. Report for 1861–2 & 1862–3, Leeds; An Essay on the Relations of Science to Modern Civilization, by Prof. Henry Hennessey, F.R.S., Leeds, 1862; Inaug. Address, by Prof. Owen, F.R.S., Dec. 16, 1862, Leeds—*from the Society.* Königl. Akad. gemeinutziger Wissensch. zu Erfurt: Jahrbücher, Heft 3, 1863; Theorie des Quartzes, von Bergrath Dr. Jenzsch, Erfurt, 1861—*from the Society.* Verein zur Beförd. des Gartenbaues: Wochenschrift, No. 31–52, 1863–4—*from the Society.* Geolog. Soc. of Dublin: Jour., Vol. X., Pt. 1, 1862–3; On the Direction and Force of the Wind at Leopold Harbor, by Rev. Samuel Haughton, F.R.S., Dublin, 1843; Rainfall and Evaporation in Dublin in 1860, by same; Experimental Researches on the Granites of Ireland, Pt. III Granites of Donegal, by same, Lond., 1862; Form of the Cells made by various Wasps and by the Honey Bee, with App'x on the Origin of Species, by same, Dublin, 1863; On the use of Nicotine in Tetanus, and Cases of Poisoning by Strychnia, by same, Dublin, 1862; Experiments on Velocities of Rifle Bullets, by same, Dublin, 1863; Diabetes Mellitus, by same, Dublin, 1863; Comp. Petrology, by M. J. Durocher, trans. by Rev. Samuel Haughton, M.A., F.R.S., Dublin, 1863—*from the Society.* Der Zoologische Garten, Jahrg. IV., No. 7–12, 1863; Jahrg. V., No. 1, 1864, Frankfurt a. M., von Dr. C. Bruch—*from the Editor.* Naturf. Gesellschaft: Schriften, Band I., Heft 1, 1863, Danzig—*from the Society.* Royal Scottish Society: Trans., Vol. VI., Pt. iii., Edinburgh, 1863—*from the Society.* Würzburger Med. Zeitschrift, Band IV., Heft 3–4, 1863—*from the Society.* Naturf. Gesellschaft zu Freiburg, I. B.: Berichte, Band III., Heft 1, 1863—*from the Society.* University of Christiania: Det Kongelige Norske Fredericks-Universitets Stiflelse, af M. J. Monrad, Christiania, 1861; Zoologische Reise af O. G. Sars, Christiania, 1863; Halohundredaars-Fest, 1861; Graptolitherne af C. Boeck, 1851; Der Oldnorske Verbum, af C. A. Holmboe, 1848; Siphonodentalium Vitreum, af Dr. Michael Sars, 1861; Norske Voegtlodder, af Prof. Holmboe, 1863; Index Scholarum, 1863—*from the University.* Schweizer Naturf. Gesellsch.: Verhandl., 1862, Luzern—*from the Society.* Verein der Freunde der Naturg.: Archiv., Jahrg. XVII., Neubrandenburg, 1863—*from the Society.* Nova Acta Reg. Soc. Scientiarum Upsal, Vol. IV., Fasc. ii., 1863—*from the Society.* Aus der Heimath, von Dr. E. A. Rossmässler, Jahrg, 1863, No. 1–52, Leipzig; Thiere des Waldens, Lief 1–3, von Brohm und Rossmässler, Leipzig, 1863—*from the Authors.* K. Bayerische Akad. der Wissenschaften: Sitzungsberichte, 1862, II. Heft 2–4; 1863, I. Heft 1–4; II. Heft 1, München—*from the Academy.* Rechtzustände unter den Ureinwohnern Brasiliens, von Dr. C. F. Ph. von Martius, München, 1852; Glossaria Linguarum Brasiliensium, von Dr. C. F. Ph. v. Martius, 1863; Die Fieber-Rinde der China-Baum, von Dr. C. F. Ph. v. Martius—*from the Author.* Stettiner Entomologische Zeitung, 1860–63, Stettin—*from the*

Society. Royal Swedish Academy of Sciences: Handlingar, Band III. 1–2, IV. 1; Ofversigt, 1860–62; Meteorologiska Iaktagelser i Sverige, Bd. 2, 3; Eugenies Resa omking jorden, H. 8–11, Stockholm—*from the Academy.* Naturf. Verein in Brünn: Verhandl., Band. I., 1862—*from the Society.*

Voted, that Dr. E. F. Baumgarten, Librarian of the Academy, be authorized to take with him on his contemplated visit to Europe such number of copies of the Transactions as he may deem proper for purposes of exchange with other Societies.

May 2, 1864.

The President, Dr. Engelmann, in the chair.

Eight members present.

The Corresponding Secretary laid upon the table the Smithsonian Report for 1862, *from the Institution;* Canadian Jour. of Ind., Science & Art, No. 60, March, 1864, Toronto, *from the Canadian Institute;* Plants of Buffalo and Vicinity, by Geo. W. Clinton, Buffalo, N. Y., 1864, *from the Author.*

Dr. Engelmann submitted an abstract from his meteorological journal as follows:

Though February had been milder than usual, March and April were much colder than these months generally are; thus the spring was unusually backward, and vegetation was retarded nearly three weeks. The Peach and wild Plum trees are commonly in bloom about the end of the first week of April; this year, owing to the cold on New-Year's night, we had no peach blossoms; the first Plum trees he observed in bloom April 25; similar late springs were those of 1843 and 1857. By far the earliest season observed by him was that of 1842, when Peach trees were in bloom, March 19, and Apple trees, March 28. The mean temperature of March and April together he had found to be 50°.2; in the years of latest spring it was 5° to 9° less; in 1843, 41°.4; in 1857, 42°, and in this spring 45°.3; while in the year of earliest spring, in 1842, it rose to 59°.9.

Prof. Henry Shimer, of Mt. Carroll, Ills., was elected a Corresponding Member.

May 16, 1864.

The President, Dr. Engelmann, in the chair.

Five members present.

A letter was read from the Smithsonian Institution, May 10, 1864, acknowledging receipt of packages sent for foreign distribution; and from Mr. A. Petermann, Gotha, Germany, April 21, 1864, concerning exchange of publications.

The Corresponding Secretary laid upon the table the Proc. of the Essex Institute, Salem, Vol. IV., No. 1, 1864, *from the Institute;*

Bulletin de la Soc. Imp. zool. d'Acclimatation, Paris, T. I., No. 3, Mars, 1864, *from the Society*; Atti della Società di Acclimazione e di Agric. in Sicilia, T. III., Nos. 11 & 12, Palermo, 1864, *from the Society*.

June 6, 1864.

The President, Dr. ENGELMANN, in the chair.

Four members present.

A letter was read from Prof. S. F. Baird, Ass't Sec'y S. I., Washington, May 14, 1864, requesting an exchange of publications with the Zoölogical Society of London; and it was ordered that the Zoölogical Society be placed upon the list of exchanges, and that a copy of the Transactions as far as published be sent to them.

The following publications were laid upon the table: Proc. of the Amer. Philosophical Society, Vol. IX., No. 70, Philad., 1863, *from the Society*; Geol. Survey of Canada to 1863, by Sir Wm. E. Logan, LL.D., F.R.S., Director, 8vo, Montreal, 1863, *from the Director*; Charter, Const. & By-laws of the Lyceum of Nat. History, N. York, 1864, *from the Society*; Canadian Journal of Ind., Sci. & Art, April, 1864, Toronto, *from the Canadian Institute*.

June 20, 1864.

The President, Dr. ENGELMANN, in the chair.

Five members present.

A letter was read from the Smithsonian Institution, June 15, 1864, announcing publications from foreign Societies.

The Corresponding Secretary laid upon the table the Proc. of the Acad. Nat. Sciences, Philad., No. 2, March–April, 1864, *from the Academy*; Ann. Rep. of the Trustees of the Museum of Comp. Zoölogy, Cambridge, 1864, *from the Institution*; Bulletin de la Soc. Imp. zool. d'Acclimatation, Paris, T. I., No. 4, Avril, 1864, *from the Society*.

July 18, 1864.

The President, Dr. ENGELMANN, in the chair.

Five members present.

A letter was read from Prof. Adolph Weiss, Vienna, 1864, acknowledging his election as a Corresponding Member; and from La Soc. Imp. des Naturalistes de Moscou, Dec. 28, 1863; K. Leopoldinisch-Carolinische Deutsche Akad. der Naturf., Dresden, Sept. 7, 1863; Verein für Vaterl. Naturkunde, Stuttgart, Dec. 1, 1863; Königl. Gesellschaft der Wissenschaften, Göttingen, Feb., 1864; Université Catholique de Louvain, Dec. 1863; K. K. Geologische Reichsanstalt, Wien, Aug. 27, 1863; K. K. Geograph. Gesellschaft, Wien, Aug. 22, 1863; Dr. Adolph Senoner, Wien, Sept. 2, 1863; Senckenbergische Naturf. Gesellschaft, Frankfurt a. M., Jan. 30, 1864; K. Leopoldinisch-Car. Deutsche Akad. der Naturf., Dresden, Mar. 1, 1864; and the Naturf. Gesellschaft zu Halle, Feb. 16, '64,—severally acknowledging receipt of the Transactions, and announcing publications sent in exchange; and from Messrs. Trübner & Co., London, July 2, 1864, ordering copies of the Transactions.

The following publications were received: Smithsonian Report for 1863—*from the Hon. B. Gratz Brown, U. S. Sen.* Royal Soc. of London: Proc., Vol. VIII., Nos. 60–62—*from the Society.* Royal Horticultural Society: Proc., Vol. IV., Nos. 4–7, London, 1864—*from the Society.* Nat. Hist. Society of Dublin: Proc., Vol. IV., Pt. 1, 1862–3—*from the Society.* Ueber ein neues Vorkommen der Spalt-öffnungen, von Dr. Adolph Weiss, Wien, 1857-8; Die Florescenz der Pflanzenfarbstoffe, 1862; Separat-Abdrücke botan. Abhand. aus Wissensch. Journalen, 1861–2; Fundorte von Tertiär-Versteinerung an der Westküste des Peloponnesus, 1863; Die Fortpflanzung u. Refruchtung blüthenboser Pflanzen, 1862—*from the Author.* Mannheimer Verein für Naturkunde: Jahresbericht XXIX., 1863, *from the Society.* La Soc. des Sciences Nat. de Neuchatel: Bull., T. VI., Cah. 2, 1863—*from the Society.* Verein für Vaterl. Naturkunde: Jahreshefte, Jahrg. XIX., Heft 1, 1863, Stuttgart—*from the Society.* Naturf. Verein in Brünn: Verhandl., Band I., 1862—*from the Society.* Zool. mineral. Verein in Regensburg: Correspondenzblatt, Jahrg. XVII., 1863—*from the Society.* L'Acad. Imp. de Caen: Mémoires, 1864—*from the Academy.* Royal Society of Sciences, Göttingen: Nachrichten, 1863, Nos. 1–24—*from the Society.* Soc. Geologique de France: Bulletin, T. XX., Feuilles 31-48, 1862–3, Paris—*from the Society.* Soc. Linnéenne de Normandie: Mémoires, T. XIII., ann. 1862–3, 4to, 1864; Bull., T. VIII., ann. 1862–3, Caen—*from the Society.* Soc. Imp. des Sciences Naturelles: Mémoires, T. IX, Cherbourg, 1863; Liste des Algues Marines de Cherbourg, par Aug. Le Jolis, Paris, 1863—*from the Society.* Université Catholique de Louvain: Annuaire, 1863; Theses—Theol. 265–278, Med. 59, Phil. et Lettres et des Sciences 1, Droit 7; Programme des Cours, 1863–4—*from the University.* Siebenbürgischen Verein für naturw. zu Hermannstadt: Verhandl. u. Mittheil, Jahrg. XIV., Nos. 1–6, 1863—*from the Society.* K. K. Geol. Reichsanstalt: Jahrbücher, Band XIII., 1863, Wien—*from the Institute.* Die Sammlungen der K. K. Geol. Reichsanstalt in Wien, von Adolph Senoner; Jahrbuch, Band XIII., 1863; Sopra tre Lichenè della Nuova Zelanda del Dr. A. B. Massalongo, 1863; Skizze über die Allgemeine Oesterreichische Israelitische Taubstummen anstalt in Wien—*from Dr. Adolph Senoner.* I. Reg. Istituto Veneto: Atti, T. VIII., Disp. 8–10, 1862–3; T. IX., Disp. 1, 1863–4—*from the Institute.* Senckenbergische Naturf. Gesellschaft: Abhandl., Band XV., Heft 1, 4to, 1864, Frankfurt a. M.—*from the Society.* Acad. C. L. C. G. Naturæ Curiosorum: Acta, Vol. XXX., Dresdæ, 1864, *from the Academy.* Naturf. Gesellsch. zu Halle: Abhandl., Band VIII., Heft I, 4to, 1864—*from the Society.* Recherches sur les Bdellodes ou Hirundinées et les Trémalodes Marins, par P.-J. Van Beneden et C. E. Hesse, 4to, Bruxelles, 1863—*from the Authors.* Amer. Geograph. & Statistical Society: Proc., 1863–4, New York—*from the Society*. Smithsonian Institution: Contr. to Knowledge, Vol. XIII., 4to, 1863; Miscellaneous Collections, Vol. 5, 8vo, 1864—*from the Institution*. Amer. Journal of Science & Arts, No. 112, July, 1864, New Haven.

Mr. Edwin Harrison presented a collection of sea animals, preserved in alcohol, from the coast of Massachusetts, collected by himself.

August 15, 1864.

The President in the chair.

Four members present.

A letter was read from M. Le Vasseur, French Vice-Consul at St. Louis, Aug. 17, 1864, enclosing a circular from the Society of Acclimation, Paris, making inquiries concerning indigenous living animals and plants which might be in any way useful for economical, medicinal, or ornamental purposes. On motion, the communication was referred to a Committee to examine and report upon the subject at a future meeting.

The Corresponding Secretary laid upon the table the Canadian Jour. of Industry, Science & Art, No. 62, July, 1864, Toronto, *from the Canadian Institute*.

Mr. Holmes presented in the name of Prof. Henry Shimer, of Mt. Carroll, Ills., a collection of numerous species of mounted birds from Carroll Co., Ills., and vicinity, already described, and labelled and numbered, according to the Catalogue of the Smithsonian Institution, prepared by Prof. S. F. Baird. (Vol. IX. Pacific RR. Survey.)

September 5, 1864.

The President, Dr. Engelmann, in the chair.

Seven members present.

The Corresponding Secretary laid upon the table the Proc. of the Amer. Philosophical Society, Vol. IX., No. 71, Philad., 1864, *from the Society*; Proc. of the Amer. Antiq. Society. Boston, 1864—*from the Society*; Atti della Società di Acclimazione e di Agricoltura in Sicilia, T. III., No. 9–10, Palermo, 1863, *from the Society*.

Dr. Engelmann reported some abstracts from his meteorological journal showing that the second and third days of the present month had been very remarkable for dryness and heat.

An arid south-west storm, a true Sirocco, continuing from September 2d to the 4th, raised the temperature in the streets of St. Louis to 100, 102, or even 103°; while in some places in the country the heat in the shade rose to 106 and 107°. The dryness of the atmosphere on the memorable 2d of September was at one time such that the air contained only 19 per cent. of aqueous vapor or relative humidity. A thunderstorm on the afternoon of the 4th terminated this abnormal condition.

Dr. Wislizenus remarked, that the positive electricity of the atmosphere during the month of August had been less than he had ever before observed, and that though the barometer might fail to give any indication of a storm, the electrometer was much more sensitive to atmospheric changes; and he thought a few stations in different parts of the country would give much better indications of the direction of approaching storms than the barometer.

Prof. Richard Owen, of Indiana, gave an account of his late visit to the newly discovered deposit of rock-salt, near New Iberia, on the Gulf coast, in the State of Louisiana.

He stated that, having heard various accounts of the rock-salt in Louisiana, he had naturally felt very anxious to examine the deposit personally. At New Iberia, La., in November last, he resigned his commission as Colonel of the 60th Indiana Regiment to accept the chair of Natural Science in the Indiana State University. Learning that the distance from New Iberia to the salt works was not great, he delayed his departure for three days for an opportunity to visit them. This was afforded him through the courtesy of Major-General Franklin; and, although the day proved very rainy, he was enabled to make a satisfactory examination of the entire locality, under the polite guidance of Mr. Henshaw.

Fifty years before this period, Mr. Marsh, the father-in-lawof Mr. Henshaw, had sunk a well on his plantation, "La Petite Ance," distant in a south-west direction from New Iberia about twelve miles, and only two or three miles from the Gulf of Mexico. The water from this well proving a good brine, Mr. Marsh boiled it down and made considerable quantities of salt. When, however, the demand for salt became greater, at the breaking out of the war, Mr. Marsh's son requested permission to sink other wells, hoping to obtain a stronger brine. After digging fifteen feet, one of the negroes employed struck a hard substance with his pick-axe, and was desired by the owner to go on and throw out some of the supposed rock. On washing off the excavated mass, it proved to be pure, hard rock-salt.

The area found, at which, by probing to the depth of from 15 to 18 ft., rock-salt was struck, indicates that the deposit underlies several square acres, perhaps four to six. The materials passed through, to reach it, are chiefly bluish clay, sand and gravel, with some lumps of micaceous sandstone. At the above depth, within that area, under every place at which they have bored or dug down, they reached the solid rock-salt. Through this solid stratum they bored twenty-six feet, and still found the salt deposit.

In getting it out for sale, it was found necessary to blast in the usual manner for obtaining building rock; and, even after purchasing moderate sized lumps, the consumer has considerable difficulty in reducing them to a size fit for use. This compactness seems also to protect the salt from deliquescence, and even to enable it for a long period to resist solution when immersed in water. He was assured that large lumps, packed in barrels, had been sunk in creeks and ponds for concealment, and taken up, weeks afterwards, scarcely at all diminished in bulk.

The accumulation of 15 to 18 feet of clay, sand, and gravel on the deposit had evidently been the result of comparatively recent washings from the adjoining hills; and the deposit has, no doubt, been worked by the aborigines, as, at more than one place, on reaching the rock-salt, Indian relics were found. He saw, at Mr. Henshaw's, a basket, obtained from the surface of the rock-salt, 15 feet below the surface of the soil, made of split cane; and was informed they also found pieces of charcoal, apparently the remnants of fires or torches. A rope of bark, wooden hooks, stone axes, and pottery, were likewise obtained.

Before he visited the locality, the citizens of New Iberia told him the formation was volcanic, and that several similar, crater-shaped eminences existed along the Gulf shore. Upon close examination, however, he not only found no volcanic, or other angular rock, whatever, but saw, at several natural washes, and at cuts in the semicircular hill, or ridge, distinct depositions of successive layers of sand and gravel; the latter entirely rounded by attrition, and chiefly quartzose. That thrown out at the old salt openings was of the same character.

The highest point of the ridge is 160 feet above the water in the Gulf at low tide. The sea, occasionally, from the combined influence of spring tides and a wind blowing strongly from the south, rises in this region to a considerable height, inundating the low lands and leaving salt marshes; which circumstance almost renders the plantation an island, although it is strictly peninsular. Formerly they reached it through canals in the marsh by boats; but when salt became valuable, a causeway, or raised road of dirt from the marsh, covered with plank, was constructed; and wagons came many miles to carry it off, at a cent and a half per pound, delivered at the mouth of the excavation.

After an inspection of some hours, made, as remarked, rather unfavorably on account of rain, but still sufficiently in detail to be certain of the facts, and, after having obtained and closely inspected numerous specimens of the rock-salt, gravel, lumps of sandstone, and one very fine crystal, over two inches cube and nearly transparent, all of which are now in the Indiana State University, he felt assured that the whole phenomena must be referred to aqueous action.

In all probability, the semicircular deposit of sand and gravel, thrown to the height of 160 feet and conforming generally to the contour of the sea coast, resulted from the combined action of the winds and the waves of the ocean. In a similar manner, sand-ridges of nearly the same height have formed on the south shore of Lake Michigan, conforming to its coast outline; the latest and most northerly being close to the water's edge, and having formed since the settlement of the country by the white man.

As the result of similar causes, he conceived that these sea-beach ridges on the Gulf, after being thrown up some height, permitted the high waters to flow round and into the basin shaped depression left on the landward side, but impeded the return of the waters thus arrested. The heat of the sun would be sufficient to evaporate the water, leaving the saline deposit; and thus, through a succession of ages, a repetition of like causes and results might readily give rise to the deposit just described. We have vegetable deposits which formed coal at various geological periods, although chiefly in the true Carboniferous Era; and so we may also have saline deposits, greatest, as in Europe, during the New Redsandstone or Saliferous Period, yet taking place also during the Quaternary Epoch.

When, however, these ridges on the Gulf coast became high enough to have their materials frequently washed down by rains, the interior basin would readily fill up, and the detritus gradually cover any articles left by the aborigines. The salt and exclusion from air are sufficient to account for the preservation of the relics from decay for a long period.

The great inundation which, a few years since, destroyed so many families, who had visited Lost Island as a watering-place, was of the character above alluded to, and took place only about fifteen miles from the salt locality just described.

Whether or not the explanation here offered of the interesting phenomena exhibited at La Petite Ance is or is not correct, the facts are important; and the evidences remain there to be examined at any time by those interested. The locality can be reached by railroad travel of 80 miles from New Orleans to Brashear City; thence, crossing Berwick Bay, the traveller, taking horseback or other conveyance for about 40 miles, reaches New Iberia; thence it is 10 miles more to the causeway of the plantation and 2 to the salt-boring; which is, as stated, on a peninsula, with Marsh Island on the south and Vermillion Bay on the west.

The property has been sold by Mr. Marsh, and is now owned (he believed) by Mr. Avery.

It may not be irrelevant to remark, as a proof that, at no very distant period, saline inundations extended more than twenty miles inland from the present coast line of the Gulf, or at least impregnated the waters of the Bayous, that he had traced the Gnathodon (a genus of bivalves found abundantly around New Orleans, and peculiar to brackish water) along our route of march, by the Tèche, at least five miles north of Franklin, La.

He would also add, that although borings have been made to even more than 15 or 18 feet at other parts of the Gulf coast, which seemed similar in character, as yet no other considerable deposits had been found; notwithstanding that, in some places, as he understood, salt had been made from the brine springs or wells.

September 19, 1864.

The President, Dr. ENGELMANN, in the chair.

Six members present.

The Corresponding Secretary laid upon the table the Amer. Jour. of Science & Arts, No. 113, Sept., 1864, New Haven; Bulletin de la Soc. Imp. zool. d'Acclimatation, T. I., No. 7. Juillet, 1864, Paris—*from the Society.* Canadian Naturalist & Geologist, and Proc. of the Nat. Hist. Society of Montreal, Vol. I., Nos. 1 & 2, Feb.–April, 1864—*from the Society.* Report of the Secretary of the Navy on the Armor of Vessels, 8vo, Washington, 1864: Report of Agriculture to 1862, 8vo, Washington, 1863; Population of the United States in 1860, computed from the 8th Census Returns, by J. C. G. Kennedy, Sup't of the Census, 4to, Washington, 1860—*from the Hon. Samuel Knox, M.C.* Treatise on Mineralogy, by Charles U. Shepard, 3d ed., 2 Pts., New Haven, 1852 & 1857—*from the Author.* Proc. of the Essex Institute, Vol. IV., No. 1, Jan.–Mar., 1864—*from Mr. Edwin Harrison.* Abhandl. der Naturh. Gesellschaft zu Nürnberg, Band III., Hälfte 1, 1863—*from the Society.*

Dr. Shumard deposited in the library the following works belonging to the estate of the late Dr. H. A. Prout, viz.: Phillips' Geology of Yorkshire, 2 vols.; Geological Report of Londonderry, Tyrone, and Fermanagh, Ireland.

October 3, 1864.

The President, Dr. ENGELMANN, in the chair.

Six members present.

The Corresponding Secretary laid upon the table the Proc. of the Acad. Natural Sciences, Philad., No. 3, August., 1864, *from the Academy;* and the Proc. of the Essex Institute, Vol. IV., No. 2, April–June, 1864, *from the Institute.*

Dr. B. F. Shumard offered for publication a paper, entitled "A Description of a New Species of *Bryozoa*, from the unpublished MSS. of the late Dr. H. A. Prout," which was accepted, and referred to the Committee on Publication.

Dr. Shumard also read a paper, entitled "Notice of the Sour Lake of Texas," not intended for publication.

Dr. Engelmann presented an abstract of his observations on Temperature and Humidity for the month of September last.

Mr. Richard Hayes, of St. Louis, was elected an Associate Member.

October 17, 1864.

The President, Dr. ENGELMANN, in the chair.

Five members present.

The Corresponding Secretary laid upon the table the Canadian Naturalist & Geologist, and Proc. Nat. Hist. Soc. of Montreal, Vol. I., No. 4, Aug., 1864, *from the Society.*

Dr. Engelmann, from the Committee to whom was referred the communication of M. H. Le Vasseur, French Vice-Consul at St. Louis, relating to inquiries made by the Society of Acclimation in Paris concerning animals or plants in America that might be valuable for economical, medicinal, or ornamental purposes, made a report of answers to the same, which was accepted. He recommended the introduction of *Nelumbium luteum*, as an ornamental plant, in the milder parts of France, and of *Buchloë dactyloides*, the Buffalo grass, for pasturage, in arid parts of that country. A copy was ordered to be communicated to the M. Le Vasseur.

November 7, 1864.

The President, Dr. ENGELMANN, in the chair.

Six members present.

Letters were read from the Ills. State Horticultural Soc., Alton, Oct., 1864, requesting an exchange of publications; and from the Smithsonian Institution, Oct. 15, 1864, announcing packages by express; and from the Royal Society, London, May 16, 1864; Deutsche Geol. Gesellschaft, Berlin, June 25, 1864; Society of Nat. Sciences, Zurich, March 31, 1864; Naturf. Gesellschaft, Bern, May, 1864; Sweitzerische Naturf.

Gesellschaft, May, 1864; Naturw. Verein, Hamburg. Jan. 30, 1862; Naturh. Gesellschaft, Hanover, Ap. 8, 1864; Senckenbergische Naturf. Gesellschaft, Frankfurt a. M., June 7, 1864; Society of Natural Sciences, Blankenburg, 1864; K. K. zool.-botan. Gesellschaft, Wien, March 2, 1864; St. Gallischen naturw. Gesellschaft, March, 1864; Royal Hungarian Society of Nat. Sciences, Pesth, April 18, 1864,—severally acknowledging the receipt of the Transactions, and transmitting publications in exchange.

Publications were received as follows:

Canad. Jour. of Industry, Sci. & Arts, No. 53, Sept., 1864, Toronto—*from the Canadian Institute.* Une Réconnaissance Géologique du Nebraska, par M. Jules Marcou, Paris, 1864—*from the Author.* Illinois State Hort. Society: Trans. 1861, 1862 & 1863—*from the Society.* Museum of Comp. Zoölogy: Regulations, 1864, Cambridge—*from the Institution.* Royal Society: Proc. Nos. 63–66, Vol. XIII., London, 1864—*from the Society.* Royal Horticultural Society: Proc., Vol. IV., Nos. 8, 9 & 11, Lond., 1864—*from the Society.* Der Zoologische Garten: Jahrg. V., Nos. 2–6, Frankfurt a. M. 1864—*from the Editor.* I. Reg. Istituto Veneto: Atti, T. IX., Serie iii., Disp. 2–4, 5–8, 1863–4—*from the Institute.* Würzburger Med. Zeitschrift, B. IV., Ht. 5–6; B. 5, Ht. 1, 1863–4, *from the Society.* St. Gallische naturw. Gesellschaft: Bericht. 1862–3—*from the Society.* Royal Hungarian Society Nat. Sciences: Memoirs, IV., 1–2, 1857–9; Proc. Vol. I., Pt. 1–3; Vol. II., Pt. 1, Pest, 1860; Abhandl. aus Bd. 3 der Jahrb., Pest, 1858—*from the Society.* K. K. zool.-botan. Gesellschaft: Verhandl., Band XIII., 1863, Wien; Monographie der Oestriden von Frederick Braur, Wien, 1863; Reise durch Schweden und Norwegen in Sommer 1863, von Georg Ritter von Frauenfeld—*from the Society.* K. Akad. der Wissenschatten: Sitzungsberichte, 1863, Abth. I., No. 4–5, 6–7, 8, 9–10; Abth. II., No. 5, 6–7, 8, 9: 1864, Abth. I., No. 1; Abth. II., No. 1, Wien—*from the Academy.* Accademia delle Scienze Fisiche e Mat.; Atti, Vol. I., 4to, Napoli, 1863; Rendiconti, Anno II., Fasc. 8–11, 1863; Anno III., Fasc. 1, 1864, Napoli—*from the Academy.* Naturw. Verein zu Blankenburg: Bericht 1861–2—*from the Society.* Senckenbergische Naturforscher Gesellschaft: Abhandl., Bd. V., Heft 2, 4to, Frankfurt a. M., 1864—*from the Society.* K. Physikal.-ökonom. Gesellschaft: Schriften, Jahrg. IV., Ht. 12, Königsberg, 1863—*from the Society.* Verein für Beförderung des Gartenbaues: Wochenschrift, Nos. 1–30, Berlin, 1864—*from the Society.* Naturh. Gesellschaft: Jahresbericht XIII., 1862–3, Hanover—*from the Society.* K. K. Geol. Reichsanstalt: Jahrbuch, Band XIV., Nos. 1 & 5, Wien, 1864—*from the Institute.* K. K. Geograph. Gesellschaft: Mittheil., Jahrg. VI., Wien, 1862—*from the Society.* Pollichia naturw. Verein: Jahresbericht, XVIII.-XXI., 1861–3, Neustadt—*from the Society.* Naturw. Gesellschaft Isis: Jahrg., 1863, Dresden, 1864; Die Philosophie im Cyclus der Naturwissenschaften, von Dr. Adolph Drechsler, Dresden, 1863—*from the Society.* Naturw. Verein: Abhandl., Band III., 1856, Hamburg—*from the Society.* Naturf. Verein zu Halle: Abhandl., Band VII., Heft 3, 4to, Halle, 1863—*from the Society.* Naturf. Gesellschaft in Bern: Mittheil, No. 531–552, Bern, 1863—*from the Society.* Schweitzerische Naturf. Gesellschaft: Verhandl., Chur, 1863—*from the Society.* Naturh. Verein der Preuss. Rheinl. und Westphalens: Verhandl., Jahrg. XX., Bonn, 1863—*from the Society.* Naturf. Gesellschaft in Zurich: Jahreschrift, Jahrg. VI., Heft 1–4, 1861; Jahrg. VII., Heft 1–4, 1862; Jahrg. VIII., Heft 1–4, 1863—*from the Society.* Deutsche Geol. Gesellschaft: Zeitschrift, Band XII., Pt. iii.; XIII., 1–4; XIV., 1–4; XV., 1–4, 1860–63; Verzeichniss der Mitglieder, Berlin—*from the Society.*

Dr. B. F. Shumard presented a paper for publication in the

Transactions, entitled "A Catalogue of North American Palæozoic *Brachiopoda*," which was referred to the Committee on Publication.

Dr. Engelmann exhibited some beautiful colored drawings of *Nelumbium luteum*, executed by Mr. Rœtter for Prof. Caspary of Kœnigsberg, at present occupied with a monography of *Nymphæaceæ.*

November 21, 1864.

The President in the chair.

A letter was read from the Illinois State Horticultural Society, Nov. 19, 1864, and from the I. Reg. Istituto Veneto di Scienze, Lettere ed Arte, Venice, Oct. 3, 1864, acknowledging receipt of the Transactions of the Academy.

The Corresponding Secretary laid upon the table the Amer. Jour. of Science & Arts, No. 114, Nov., 1864, New Haven, and the Bulletin de la Société Imp. zoologique d'Acclimatation, Paris, No. 9, Sept., 1864, *from the Society.*

Dr. Engelmann presented a conic pouch or sac of vegetable tissue, being the sheath of the flowers of *Manicaria saccifera*, a Palm of the Isthmus of Panama.

George P. Herthel, Jr., Esq., of St. Louis, was elected an Associate Member.

December 5, 1864.

The President in the chair.

Seven members present.

The Corresponding Secretary laid upon the table the Canadian Naturalist & Geol., and Proc. Nat. Hist. Soc. of Montreal, Vol. I., No. 5, Oct., 1864, *from the Society.*

Mr. G. C. Broadhead presented a collection of fresh-water shells from Cass and Jackson Counties, in Missouri; also, specimens of Sandstones and Limestones from the Upper Coal Measures in the same locality.

Dr. B. F. Shumard presented a paper for publication entitled "The Lead Mining Region of Southeastern Missouri, containing a Notice of most of the important Mines, with Statistics of their yield since the period of their discovery." Referred to a Committee.*

William Dickinson, M.D., of St. Louis, was elected an Associate Member.

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* This paper, with the consent of the Publishing Committee, has been withdrawn by the Author for additions, and will appear in the next No. of the Transactions.

December 19, 1864.

The President, Dr. Engelmann, in the chair.

Five members present.

Letters were read from the Smithsonian Institution, Dec. 5, 1864, announcing publications sent by express ; and from the Overysselsche Vereenigung tot Ontwik. van Prov. Welvaart, Zwolle, May 17, 1864 ; K. K. Akad. der Wissenschaften, Vienna, Oct. 10, 1863 ; Real Istituto Lombardo di Scienze, Lettere ed Arti, Milan, Dec. 11, 1863 ; Prof. Dr. Adolph Weiss, Wien, 1864 ; Royal Danish Academy of Sciences, Copenhagen, June 9, 1864 ; Académie Royale des Sciences à Amsterdam, Oct. 28, 1863, & Aug. 4, 1864 ; Naturf. Gesellschaft zu Halle, Sept. 27, 1864 ; Société Royale des Sciences à Upsal, Sept. 1, 1864 ; Institut Météorologique des Pays-Bas, Utrecht, July 29, 1864 ; Naturf. Verein in Augsburg, Aug. 31, 1864 ; Accademia delle Scienze dell' Istituto di Bologna, April 16 & 18, 1864,—severally acknowledging the receipt of the Transactions, and transmitting their publications.

The following publications were received :

Amer. Geograph. & Statistical Society : Proc., Vol. II., Nos. 3 & 4, N. York, 1863–4—*from the Society.* Nova Scotian Institute of Nat. Science : Trans., Vol. II., Pt. 1, Halifax, 1864—*from the Institute.* Relazione di un Viaggio Scientifico fatto nel 1863 nell' America Settentrionale dal Prof. Cav. G. Capellini (con una carta), Bologna, 1864—*from the Author.* Royal Danish Academy of Sciences : Oversigt, 1 Aaret, 1862, & 1 Aaret, 1863 ; Programme de la Société Batave de Philosophie Expér. de Rotterdam, 1863—*from the Society.* Naturh. Verein in Augsburg : Bericht XVII., 1864—*from the Society.* Naturf. Gesellschaft Graübundens : Jahresbericht, IX., Jahrg. 1862–3, Chur, 1864—*from the Society.* Overysselsche Vereenigung tot Ontwik. van Provinciale Welvaart : Algemeen Jaarlijkich Verslag, 1863 ; Verslag van der Weekzaamheden, 1862 ; Programma van het xix. de Nederl. Landhuishoudkundig Congress te Haarlem, 1864 ; Register van Chartens en Bescheiden in het Oude Arcoief van Kampen, II. Deele. 1496–1528, Kampen 1863 ; Oversigt van de Bepalingen der Æquivalent-Gewigten van 13 Enkelvoudige Ligchamen, &c., door E. Mulder, Utrecht, 1853 ; Oversigt van de Bepalingen der Æquivalent-Gewigten van 24 Metalen, door E. Mulder, Utrecht, 1853—*from the Society.* Om Skjaevheden hos Flynderns og navnlig om Vandringen af def övre Oie fra Blindsiden til Oiesiden tvers igjennem Hovedet, af J. J. Steenstrup, Kjobenhavn, 1864—*from the Author.* Accademia delle Scienze dell' Istituto di Bologna : Memorie, T. I., 1862, 4to ; T. II., 1862, 4to : Rendiconti, 1860–1, 1861–2, 1862–3—*from the Academy.* Universität zu Kiel : Schriften, Band VIII., 1861—*from the University.* Naturf. Gesellschaft in Emden : Jahresbericht, XXIX., 1863 ; Witterungs-Beobachtungen zu Emden, 1862–3, von Dr. M. A. F. Prestel, Emden, 1864—*from the Society.* Royal Hungarian Soc. of Sciences : Transactions, Vol. II., Pt. ii., 1861, Pesth, 1864 : Proc. of same, 1860–1, Pesth, 1864—*from the Society.* R. Istituto Lombardo : Rendiconti, Vol. I., Fasc. 1–3, 1864, Classe di Scienze Mat. e Nat.. ; Vol. I., Fasc. 1–2, Classe di Lettere e Scienze Morale e Politiche, Milano, 1864—*from the Institute.* Société des Sciences Natur. du Grand-Duché de Luxembourg : Comptes Rendus, T. VII., année 1864—*from the Society.* Real Società Economica : Memorias, Serie 4, T. VII., 1862 ; T. VIII., 1–7 ; T. IX., 1–3, 1863–4, Habana—*from the Society.* Royal Meteor.

Institute of the Netherlands: Jaarboek 1863, Utrecht, 1864—*from the Institute.* Roy. Society of Sciences, Upsal: Nova Acta, T. V., Fasc. 1, 1864—*from the Society.* Naturf. Gesellschaft zu Halle: Abhandl., Band VIII., Heft 2, 4to, 1864—*from the Society.* Royal Academy of Sciences, Amsterdam: Verhandelingen, Afd. Letterkunde Dl. II., 4to; Verslagen & Meded. Letterk. Dl. VII., 8vo; Naturkunde Dl. XV.-XVI., 8vo; Jaarboek 1862; Giacolletti, de Lebetis materie, et cet., 8°—*from the Academy.* Acad. of Nat. Sciences, Philad.: Proc., No. 4, Sept.-Oct., 1864—*from the Academy.* Amer. Acad. of Arts & Sciences: Proc., Vol. VI., 2 Pts., 1864, Boston—*from the Academy.* Essex Institute: Proc., Vol. IV., No. 3, Salem, 1864—*from the Institute.* Canadian Jour. of Ind., Sci. & Art, No. 64, Nov., 1864, Toronto—*from the Canadian Institute.*

Dr. Sander exhibited the seeds of *Physostigma venenosum* (Calabar Bean), and made some remarks upon its medicinal properties.

Mr. G. C. Broadhead presented a collection of botanical specimens, made by himself in the western counties of the State of Missouri.

January 2, 1865.

The President, Dr. Engelmann, in the chair.

Thirteen members present.

A letter was read from the Real Academia de Ciencias, Madrid, Nov. 16, 1864, acknowledging receipt of Transactions.

The Corresponding Secretary laid upon the table the Bulletin de la Société Imp. zool. d'Acclimatation, No. 10, Octobre, 1864, Paris, *from the Society.*

The President presented his Annual Report upon the operations of the Institution during the year 1864, as follows:

ANNUAL REPORT.

For the ninth time the anniversary of our Academy brings us together in this Hall, and lays upon your President the duty to give you an account of the progress of our Institution during the year just closed.

You cannot but feel that our Academy is based upon a firm footing, and that its hopes of a permanent existence and increasing prosperity and usefulness have a solid foundation, when you learn that notwithstanding the evil times upon which we have fallen; notwithstanding this civil war with its influences disturbing the political, social and financial conditions of the country at large, and of our State especially; that notwithstanding these impediments and drawbacks, our members continue active and zealous; our Museum, and especially our Library, have had valuable and important additions made to them, and our financial affairs are, for the first time, I believe, since the beginning of the war, in a prosperous condition—or, not to say too much, that we are at least nearly free of debt.

Our prosperity, and even our existence at home, is based on the number of our active members, and on the interest they show in our cause by their attendance at the meetings, by their scientific labors, and by their regular financial contributions. Our name and our existence abroad, among the great fraternity of scientific men and scientific institutions, are founded on our published Transactions, their intrinsic scientific value, and the regularity with which we are able to issue them.

The number of our active paying members is, as the Treasurer's books show, forty six, six of whom have been added during this year. The names on the books, to be sure, number sixty-five, but several former members have formally withdrawn, and others have done so silently, by refusing to pay their contributions, and by abstaining from any participation in our affairs. A much smaller number are really active members, that is, such as frequent the regular meetings of the Academy, take part in the discussions, read papers, or contribute to our Transactions. It is gratifying to know that these do all they can, and successfully, too, to keep up the character of our Institution, at home and abroad; and it is desirable that all those of our citizens, who are able, should also be willing to co-operate with us, and help us to sustain our Academy, and in it the character and reputation of our city.

As an outward symbol of our scientific fraternity, and one which would bind us more closely together, we have resolved to have a diploma and a seal engraved; circumstances have as yet prevented this from being carried into effect, but it is expected that now it can and will be done, and will contribute to the desired result.

I have alluded to our now being almost free of debt. We have become so not through our regular income, but through the great liberality of a number of our members, who have, by subscribing fifty dollars each, relieved our treasury of an incubus which could not but cramp our energies. As another relief for our empty treasury and at the same time as a relief for those of our members who do not like to be troubled with the small and often returning regular contributions, the institution of *life membership* was resolved upon. Thus far the effect has been very limited, only one gentleman having become such life member, by paying into the treasury once for all the sum of fifty dollars. But, it is hoped that as soon as this arrangement shall become better known other gentlemen will follow.

Besides numerous minor communications, the following papers were read before the Academy during the meetings of the year just past, the most of them intended for publication:

Dr. Shumard on the *Fourche à-Courtois* mines. On new species of *Bryozoa*, a paper left unfinished by Dr. H. A. Prout, and completed after his death by Dr. Shumard. A critical catalogue of North American palæozoic *Brachiopoda*. On the Sour Lake of Texas. An historical, statistical and geological investigation of the lead mines of South-Eastern Missouri.

Mr. Rau on Indian antiquities in New Jersey.

Mr. Bandelier, on the Milk Sickness in Illinois.

Prof. Owen, on an important deposit of Rock Salt, on the coast of Western Louisiana.

Dr. Wislizenus, on Atmospherical Electricity.

Mr. Broadhead, on the Mineral Springs of Missouri.

Dr. Engelmann, on the Meteorology of 1863, and different meteorological communications; on the stage of the Mississippi in 1863; on the eccentric growth of the wood of several of our climbers; further investigations on coniferous trees; investigations on the genus *Callitriche;* further remarks on *Nelumbium luteum.*

Prof. Robyn gave us a lecture on Braillé's method of instructing the Blind, and

Mr. Pratviel on his method of teaching Perspective.

A new feature in the usefulness of our Academy was exhibited last winter and spring when several of our members lectured before the students of the Washington University, and such citizens as chose to attend, on different scientific subjects, materially aided by the exhibition of specimens from the collections of the Academy.

Our museum was enriched by an extensive collection of sea animals preserved in alcohol, presented by our member, Mr. Harrison.

Mr. Broadhead donated to the museum an instructive botanical collection, brought together by him in the western counties of our State; also fresh-water shells from the same region.

Prof. J. Marcou presented a valuable collection of geological and palæontological specimens, for which some of our Nebraska fossils were sent in return.

Prof. H. Shimer, of Mount Carrol Seminary, sent us a fine collection of mounted birds of Illinois; several other specimens were presented by members and friends of the Institution.

The additions to our library came principally through exchanges, partly from this continent but principally from abroad; the latter being facilitated, in fact made possible, through the valuable agency of the Smithsonian Institution, and, I must be permittted to add, through the faithful and efficient services of our Corresponding Secretary.

The operations of this officer, on whose report I am largely drawing, have been constantly increasing in extent and importance. To our foreign list of exchanges have been added, during the year, eleven academies or individuals, so that the whole number now amounts to 164. We have received last year for the first time exchanges from Havana, in Cuba, and Bologna, in Italy. Some of the Institutions send us all their publications; others communicate only their proceedings.

Our home list of exchanges now numbers 70 societies and individuals, nearly if not quite all in the United States and Canada, which issue publications. The only American addition made last year was the Nova Scotian Institute of Natural Sciences in Halifax.

We have received during the year, through our exchanges, nearly 400 volumes or numbers, some of them large and costly and full of plates.

The humble means to draw these literary treasures to ourselves, and to keep up this valuable and encouraging intercourse with the savants and their associations in other countries, consist in our printed Transactions. The distribution of number one of our Vol. II., issued in May, 1863, and sent abroad in 1863 and 1864, has been sufficient to keep alive this extensive system of exchanges, proving the kindly spirit and the great liberality animating men of science all over the globe. But it is apparent that if we fail to issue another number during the present year, we shall soon begin to draw rather too largely upon this liberality and the patience of our correspondents. Without doubt, however, arrangements can be made to begin with the printing of the second number of the second volume in the next week, so that we may be ready for the distribution by the Smithsonian Institution in May next.

You see, then, from this statement of our affairs, that, as I have assured you before, our present condition is as favorable as we possibly could expect; that we have gained a firm basis, and that we may go on increasing, and succeed better and better, but only under the condition that we remain true to ourselves and to our promises, and never lag and never falter in our endeavors to further our *Academy of Science of St. Louis.*

An election of officers of the Academy for the ensuing year resulted as follows:

President,	George Engelmann.
1st Vice-President,	B. F. Shumard.
2d Vice-President,	Adolphus Wislizenus.
Corresponding Secretary,	Nathaniel Holmes.
Recording Secretary,	Spencer Smith.
Treasurer,	Enno Sander.
Librarian,	F. E. Baumgarten.
Curators,	C. W. Stevens, B. F. Shumard. S. Smith, and J. S. B. Alleyne.
Com. on Publication,	N. Holmes, G. Engelmann, and B. F. Shumard.

The accounts of the Treasurer and Corresponding Secretary, having been examined and found correct, were accepted and approved.

January 16, 1865.

The President, Dr. ENGELMANN, in the chair.

The Corresponding Secretary laid upon the table the Proc. of the Amer. Antiquarian Society, Boston, 1864, *from the Society.*

A communication was read from Prof. Henry Shimer, of Mt. Carroll Seminary, Ills., dated January 2, 1865, in which he observes as follows:

That, early in June, 1863, he had obtained a specimen of *Icterus*, to which he had given much study, and was inclined to think it a new species; yet knowing the great variety of plumage in many birds, and from the want of access to a large museum and a complete library of ornithological works, he could not venture, without further advice, to pronounce upon it. He could find no description answering to it in Baird's Synopsis, or in other works within his reach. He would describe it as follows:

Form.—Bill attenuated, slightly decurved toward the top, shorter than the skull. Basal outline of culmen straight for about half the length; elevated into a narrow ridge at the base; compressed from middle to tip. Commissure gently curving throughout the entire length, but very slightly angulated at the base. Goneys more than half the culmen, slightly decurved; broader than high at the base. Nostrils oval, basal, lateral. Wing longer than the tail. Second primary longest, the third slightly shorter, the first equal to the fourth. Tail long; much graduated. Greatest difference of quills 0.65 inches. Tarsus longer than the head, and shorter than the middle toe; strongly scutellate, with 8 plates before; plated behind. Feet and legs robust; claws strong, sharp, and much curved; lateral toes equal, reaching the middle of the central claw. Hind claw heavier and more curved.

Color.—Head above greenish olivaceous; rump a brighter greenish yellow; back olivaceous brown, margined exteriorly with olivaceous, beneath paler; tips of the lateral feathers cinereous; shafts brown above, grayish white beneath. Primaries brown, inclined to cinereous towards the base of the inner ———, margined exteriorly with drab gray: wing-coverts brown, terminal edges forming two bands of white. Inner secondaries broadly edged with white exteriorly. Wing beneath and axillæ yellowish white. Throat to breast velvet black; cheeks buff yellow, encroaching upon and contracting the black of the throat in the middle. *Ceres* dusky gray, a small black line around the front and below the eye; beneath this dusky, fading insensibly into the yellowish cheeks. The black of the throat does not come up quite as high as the commissural line; breast all around and vent pale yellow, with a shade of greenish; belly paler; sides light olivaceous brown; shafts of primaries black. Bill above dark brown, black at tip; beneath light blue at the base, becoming darker to the tip. Legs blue; iris black.

Measurements.—Length, 6.87 inch.; stretch of wings, 10.75; wing, 3.03;

tail, 2.92; tarsus, 0.80; middle toe, 0.88; claw, 0.25; hind toe, 0.60; claw, 0.225; bill above, 0.68; along gape, 0.70; goneys, 0.40; head, 0.78. Male. *Habitat:* Carroll County, Illinois.

This bird very much resembles *Icterus spurius*, Bon.; but in several particulars does not correspond with either of the figures given by Wilson. The bill is not so much arched in the middle as there represented. The first quill is equal to the fourth, instead of being intermediate between the fourth and fifth. The legs and feet are decidedly blue in life, and in the dried specimen are black, instead of yellow as represented in the table at p. 548 of Vol. IX. Pacific RR. Report, as well as the lower jaw, which still retains at the base a blue cast. But then the coloration agrees with Wilson's description. The lateral toes are equal, and reach much beyond the base of the middle claw. The throat is as deep a black, and yet it does not extend to the upper mandible as represented in both of Wilson's figures.

Mr. Shimer further observes, that he had obtained among the common purple finches in Carroll County, one that corresponded with the *Carpodacus Californicus*, Baird; even the wing formula, upon which Prof. Baird places much stress, agreed exactly. He forwarded the specimen to Prof. Baird, who was inclined to think it accidental. But might not the descendants of such continue to possess these characters, and eventually many of them be found in particular localities, and thus new species be created out of those derived from the same parent stock, and still breeding together under circumstances of association, and being the same species in reality? Among the snow-birds (*Junco hyemalis*), he had found specimens of all shades and characters, some very similar to *J. Oregonus*, others more like *J. cinereus*, &c.; so he thought there were more species than could be sustained. The titmice were in the same condition. At the request of Prof. Baird, he had endeavored to secure for him a large suit of specimens for identification of their affinities; but he felt confident some specific names would have to be dropped. Having sent a large number of specimens of *Anser* to Prof. Baird, he had received from him an acknowledgment that his *Anser frontalis* is but an immature stage of *Anser gambelii*.

Mr. Shimer stated also, that, during the summer, he had made a thorough investigation of some enemies of the chinch-bugs. Chinch-bugs were very abundant in that region, destroying a great portion of the crops in many sections. He had found the larva of a species of *Chrysopa*, and of at least one species of *Hypodamia*, feeding on them in great numbers. Mr. B. D. Wash, of Rock Island, had supposed such was the case; but he had himself actually seen the larva feeding on them; and he had bred a number of them to the perfect state. He had also seen the larva of the cucumber-bug feeding on the root of the vines.

Dr. Engelmann presented the results of his meteorological observations at St. Louis for the year 1864, with a table and diagram showing the comparison with former years; and also a table and diagram of the stage of the Mississippi River for the year 1864, showing the comparison with former years, reduced from daily observations made by T. J. Homer, Esq., City Engineer.

Dr. Engelmann was requested to furnish an abstract, with tables and diagrams, for publication in the Transactions.

Dr. Wislizenus submitted a report of his observations on Atmospheric Electricity, Temperature, and Relative Humidity, for the year 1864, giving the results as compared with his observations of former years, illustrated by diagrams.

Dr. Wislizenus was requested to furnish an abstract, with tables and diagram, for publication in the Transactions.

February 6, 1865.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

A letter was read from Dr. Martin Mayer, Leavenworth, Kansas, ordering a copy of the Transactions; and from the Royal Dublin Society, (Dublin, Jan. 11, 1865,) acknowledging receipt of Transactions sent.

The Corresponding Secretary laid upon the table the Am. Jour. of Science & Art, No. 115, Jan., 1865, New Haven; Proc. of the Essex Institute, Vol. IV., No. 4, Salem, 1864, *from the Institute;* and the North Amer. Gaurinæ, by Joseph Tremble Rothrock, B.S., *from the Author.*

Dr. B. F. Shumard presented for publication a paper entitled "A Catalogue of the North American Palæozoic Echinodermata, together with a Bibliography of the same." Referred to the Committee on Publication.

Dr. A. Wislizenus read a paper, entitled "Thoughts on Matter and Force," which he offered for publication in the Transactions. Referred to the Committee on Publication.

Wm. S. Dyer, M.D., of St. Louis, was elected an Associate Member.

February 20, 1865.

The President, Dr. ENGELMANN, in the chair.

Five members present.

Letters were read from William Kahler, Wilmington, Ills., Jan., 1865, concerning a mathematical problem; from the Smithsonian Institution, Washington, Feb. 3, 1865, announcing packages transmitted from Europe; and from L'Académie Royale Suédoise des Sciences, Stockholm, Nov. 15, 1864; Naturf. Gesellschaft, Freiburg, I. B., Oct. 20, 1864; Naturf. Gesellschaft des Osterlandes, Altenburg, July 26, '64, —severally acknowledging the receipt of the Transactions of the Academy, and sending publications in exchange.

Publications were laid upon the table as follows:

The Dublin Quar. Journal of Science, No. XVI., Oct., 1864—*from the Editor.* Mittheil. aus dem Osterlande, Band XVI., Heft 4, Altenberg, 1864—*from the Society.* Naturf. Gesellschaft zu Freiberg, I. B.: Berichte, Band III., Heft 2., 1864—*from the Society.* Naturf. Verein für Sachsen u. Thuringen in Halle: Zeitschrift, Jahrg. 1863, Heft 7–12; Jahrg. 1864, Band XXIII., Berlin—*from the Societies.* Würzburger Med. Zeitschrift, Band V., Heft 2–3, 1864—*from the Society.* Museum Carolino-Augusteum: Jahresbericht 1863, Salzburg—*from the Institution.* L'Acad. Royale Suédoise des Sciences: Handlingar, Band IV., Häftet 2, 1862; Oversigt, Bd. 1863, No. 1–10; Ledamöter 1864, Stockholm—*from the Royal Academy.*

Dr. Sander presented a beetle found preserved in a mass of gum aloes from the Cape of Good Hope.

Dr. Engelmann exhibited diagrams showing the results of observations made, during the year 1864, on the Fall of Rain, and the stage of the Mississippi River. Ordered, that the diagrams be lithographed for publication in the Transactions.

Martin Mayer, M.D., LL.D., of Leavenworth, Kansas, was elected a Corresponding Member.

March 6, 1865.

The President, Dr. ENGELMANN, in the chair.

Seven members present.

A letter was read from Wm. H. Morgan, Glasgow, Mo., Feb. 14, 1865, concerning Dr. Comstock's System of Phonetics.

The Corresponding Secretary laid upon the table the Canadian Journal of Ind., Sci. & Art, No. 64, Jan., 1865, Toronto, *from the Canadian Institute;* Proc. of the Acad. of Nat. Sciences, Philad., No. 5, 1864, *from the Academy;* Embryology of the Starfish, by Alexander Agassiz, Cambridge, 4to, 1864, *from the Author;* Report of the National Acad. of Sciences for 1863, 8vo, Washington, 1864, *from Dr. G. Engelmann.*

Dr. Wislizenus presented for publication (as requested at a former meeting) an abstract of his observations on Atmospheric Electricity during the years 1861 to 1864, illustrated by diagrams. Referred to the Committee on Publication.

Dr. B. F. Shumard stated that he had lately visited the region of the oil springs in the counties of Ray and Carroll, in this State, and that he had found the surface indications of the presence of petroleum in those localities much more abundant than he had previously supposed. He had seen petroleum on the surface of springs and streams in many places. The formation belonged to the Middle series of the Coal Measures of Missouri. It was chiefly composed of sandstones, blue, green and dark shales, and some limestones; but the sandstone was the predominant rock. In one place the oil came up through a crevice in the sandstone; in another place, he saw a stream of oil of the size of a straw issuing from this rock. He had observed asphaltum also in many places where the oil springs occur; and the petroleum and asphaltum sometimes occurred together.

The greatest dip of the strata observed by him was about 10°. Where the rocks are nearly horizontal, there were not apt to be any fissures; where the oil occurs most abundantly, the rocks are generally upheaved, distorted, and full of fissures. He observed that it was the opinion of T. Sterry Hunt, of the Geological Survey of Canada, and others, that the oil was the product of a slow distillation from bituminous shales and coal at ordinary temperatures; and that was his own opinion also. The oil cavities more frequently occurred in fissures near anticlinal axes of upheaval; and sometimes the gas occupied the upper portion of the cavity, the oil the middle, and water the lower portion; and in boring either might be first struck. On the whole, he thought the surface indications and the geological conditions might be considered as affording a favorable prospect for the finding of oil in sufficient quantity to be of commercial value.

Dr. Engelmann reported the results of his meteorological observations for the months of January and February, 1865, as follows:

The temperature of January was never excessive, the thermometer only once (on the morning of January 26th) sinking 1½ degrees below zero, and never rising above 47°.5; but the month must be called a cold one, the mean temperature having been 5 degrees below the average for the month; February, on the contrary, gave a temperature two degrees higher than the average, though it never rose over 60°.5. December having been 3°.7 lower than the average, the whole winter from Dec. 1st to February 28th is characterized by its low temperature—two degrees lower than the average—and by less fluctuation in the temperature than that season usually exhibits with us.

Cloudiness and Relative Humidity were greater than usual through the winter, though the quantity of rain was about the same as the average.

March 20, 1865.

The President, Dr. Engelmann, in the chair.

Five members present.

Letters were read from Dr. Martin Mayer, Leavenworth, Kansas, March 7, 1865, acknowledging his election as a Corresponding Member; from the Smithsonian Institution, Mar. 6, 1865, announcing publications sent from foreign Societies; from the Albany Institute, Albany, N. York, March 11, 1865, concerning publications to be sent; from the Naturf. Verein zu Riga, Nov. 6, 1864; K. Leopoldin.-Carolinisch Deutsche Akad. der Naturforscher, Dresden, Nov. 28, 1864; and the Verein für Vaterl. Naturkunde, Stuttgart, Nov. 15, 1864,—announcing publications in exchange.

The following publications were received:

Lectures on Science, Morals, Politics, & Society, by Edward Lawton, M.D., St. Louis, 1862—*from the Author.* Société Imp. zool. d'Acclimatation: Bulletin, No. 12, T. I, 1864, Paris—*from the Society.* K. L. C. D. Akad. der Naturf.: Abhandl., Band XXXI., 4to, Dresden, 1864—*from the Academy.* Acad. Impériale des Sciences: Mémoires, T. V., No. 2–9, 1862–3; T. VI., 1–12, 1863; Bulletin, T. V., No. 5–8; T. VI., No. 1–5; T. VII., No. 1–2, St. Petersburgh—*from the Imperial Academy.* Société des Sciences Naturelles: Bulletin, T. VI., Cahier 3e, 1864, Neuchatel—*from the Society.* Société Impériale des Sciences Nat. de Cherbourg: Mémoires, T. X., 1864—*from the Society.* Württemburgische naturw. Jahreshefte, Jahrg. XIX., Heft 2–3, 1863; Jahrg. XX., Heft 1, 1864, Suttgart—*from the Society.* Naturf. Verein zu Riga: Correspondenzblatt, Jahrg. XIV., 1864—*from the Society.* Royal Scottish Soc. of Arts: Trans., Vol. VI., Pt. iv., Edinburgh, 1864—*from the Society.* Royal Society: Proc., Vol. XIII., Nos. 68 & 69, London, 1864—*from the Society.* Royal Hort. Soc.: Proc., Vol. IV., No. 12, London—*from the Society.* Amer. Jour. of Sci. & Arts, No. 116, March, 1865, New Haven.

Dr. Engelmann exhibited a diagram of the fall of rain in the year 1861, so constructed as to show at a glance each single fall of rain, and its amount.

Dr. Engelmann exhibited a specimen of the peculiar sac or hood-shaped sheath of a New Granada Palm, the *Manicaria saccifera*, resembling a coarse elastic cloth fabric of artificially interwoven fibres. He also exhibited from his herbarium specimens of other palms, showing a similar (in some coarser, in others finer) structure of the sheath of the leaf.

April 3, 1865.

The President, Dr. Engelmann, in the chair.

Six members present.

Letters were read from the Smithsonian Institution, March 23, 1865; K. bayerische Akad. der Wissenschaften, Munich, Jan. 2, 1865; Naturf. Verein, Hamburg, April 26, 1863,—acknowledging receipt of Transactions of the Academy, and sending publications in exchange.

Publications were received as follows:

Table of Mean Temp. at Milwaukie, Wisconsin, from 1837 to 1864, by C. J. Lynde, Esq., E. S. Marsh, M.D., Charles Winkler, M.D., and I. A. Lapham, LL.D., and a Map of Wisconsin, with lines showing the effect of the Lake in elevating the temperature in January and depressing it in July, by I. A. Lapham, LL.D., 1865—*from the Authors.* Amer. Phil. Soc.: Proc., Vol. IX., No. 72; List of Members, 1865, Philad.—*from the Society.* Albany Institute: Trans., Vol. IV., 1858–64; Trans. of the Soc. for Promotion of Useful Arts, Vol. IV., Pt. ii., Albany, 1819—*from the Institute.* Der Zoologische Garten: Jahrg. V., Nos. 7–12, 1864, Frankfurt a. M.—*from the Editor.* K. K. Geol. Reichsanstalt: Jahrbuch, Band XIV., No. 3, 1864, Wien—*from the Institution.* Offenbacher Verein: Bericht V., 1864—*from the Society.* Verein der Freunde der Naturg.: Archiv. Neubrandenburg, 1864—*from the Society.* Royal Acad. of Sciences of Munich: Annalen der Königl. Sternwarte bei München, Vol. XIII., & Supp. Band IV., 1864; Buhl, Stellung; Dollinger, Kœnig Maximilian II.; Reihl, Begriff; Thomas, Stellung; Sitzungberichte, Vol. II., Heft 2–4, 1863; Vol. I., Heft 1–5; Vol. II., Heft 1–2, 1864—*from the Royal Academy.* Royal Norse Univers. of Christiania: Meteor. Beobacht. Lief. III. & IV., 1848–55; Sneebraeen Folgefon af S. A. Sexe, 1864; Geol. Forhold, af M. Irgens og Th. Hiortdahl, 1864; Te Deum à le Fête 4 Nov., 1864—*from the University.* Naturw. Verein: Abhandl., Band IV., Abth. 3, Hamburg—*from the Society.*

Dr. Pollak exhibited some very fine specimens of native silver and copper from Lake Superior, and other minerals, collected by Major J. F. Meline.

Dr. Wislizenus presented the palate bone and teeth of a fish, found in the bluffs of the Mississippi in Iowa, and supposed by the finder to be a fossil bone. It appeared to be a recent bone of the White Perch (*Corvina oscula*), of the Mississippi River.

Dr. Engelmann read a paper, presented for publication by Dr. C. C. Parry, entitled "Notice of some additional observations on the Physiography of the Rocky Mountains, by C. C. Parry, M.D." Referred to the Committee on Publication.

Dr. Engelmann submitted some remarks upon the Fall of Rain at St. Louis:

The heavy rains of the 29th and 30th of March last have induced me to examine my meteorological records, in which every fall of rain since January 1, 1838, is noted. As the result of these investigations, I lay before the Academy the following table of the heaviest falls of rain in every year, and of all the rains over 4 inches. It will be seen that the maximum in one year (1842) was not quite 2 inches; in 7 years (1838, '39, '43, '53, '57, '61, and '64) it was between 2 and 3 inches; in 7 years (1840, '43, '49, '51, '56, '60, and '63) it reached between 3 and 4 inches; in 8 years (1841, '44, '46, '50, '54, '55, '62, and '65), between 4 and 5 inches; in 2 years (1852 and '58), between 5 and 6 inches; in 1847, between 6 and 7 inches; and twice (in 1848 and 1859) over 7 inches.

In 13 years, therefore, more than 4 inches of water were precipitated in a single fall of rain; generally only once in one year, but in 1858 twice; and four times in the memorable wet year of 1848.

Of the 32 heavy rains recorded in the table, one-fourth (or 8) fell in June; 5 in May; as many in August; 3 in March; 2 each in April, July, October, and December; one only in January, February, and November; and none in September: 17, therefore, or over one half, fell in our rainy season of three months, from the middle of April to the middle of July;* 5, or nearly one sixth, fall in the month of August, and the other 10 are distributed through the other eight months of the year.

Heaviest Rains in St. Louis in every year from 1838 *to* 1865, *and all Rains over four inches during that period of* 28 *years.*

Date.		Hours within which the Rain fell.	Amount of Rain in inches.
1838.	January 6–7	14	2.07
1839.	June 7–8	30	2.81
1840.	October 18	21	3.73
1841.	August 22	5	4.78
1842.	June 30	16	1.96
1843	June 9	2	2.30
1844.	May 15–16	33	4.37
1845.	May 22	11	3.70
1846.	June 3–4	15	4.00
1847.	October 20–22	49	6.59
1848.	May 6	3	5.22
"	June 2	5	6.17
"	June 21–22	29	7.55
"	August 15	1	5.05
1849.	July 5–6	30	3.88
1850.	November 26–27	26	4.38
1851.	August 2–3	21	3.95
1852.	March 11–13	53	5.54
1853.	May 2–3	35	2.88
1854.	April 26–27	22	4.34
1855.	August 15	8	4.19
1856.	April 30	5	3.80

* The true rainy season generally extends only over about six weeks, which fall between the limits above assumed.

1857.	February 6	9	......	2.91
1858.	July 11	10	......	4.18
"	December 4	15	......	5.00
1859.	June 18–20	30	......	7.83
1860.	June 2–3	12	......	3.73
1861.	March 31	10	......	2.34
1862.	December 13–14	30	......	4.47
1863.	August 9–10	26	......	3.86
1864.	May 10	10	......	2.34
1865.	March 29–30	40	......	4.90

These heavy rains are often local, and can then have but little influence on the general humidity of the season, or on the stage of the river; it is only when they extend over a large district of country, that they materially swell such a large river as the Mississippi; and the rains of March 29th and 30th last must have been such, as the river at this point rose between five and six feet by April 1st. On the other hand, we find the river not unusually high in 1848, when, here in St. Louis, such enormous quantities of rain fell; while during the high floods of 1844 and 1851 no extraordinary rains visited us; the rains in those years must have more uniformly extended over a large tract of country.

A few remarkable facts in connection with the falls of rain were noted in examining my records. The heaviest rains and most of them fell in the year 1848, between May 6th and August 15th, when 24 inches descended within 38 hours, distributed over five days.

The severest fall of rain in the shortest time took place on August 15, of the same year, when in 75 minutes 5.05 inches of rain descended.

The longest continued wet weather I ever observed here occurred in 1845, when it rained every day from June 15 to June 28, fourteen days, but altogether not more than 7.91 inches.

Major James F. Meline, U. S. Army, was elected a Corresponding Member.

April 17, 1865.

The President, Dr. Engelmann, in the chair.

Mr. Holmes announced the death of Abraham Lincoln, President of the United States, and moved that the Academy adjourn without proceeding to any business, as a proper mark of respect on their part for the memory of the deceased Chief Magistrate, and in sympathy with the universal feeling on this very extraordinary and melancholy occasion.

The motion was unanimously carried, and the Academy adjourned.

May 1, 1865.

The President, Dr. ENGELMANN, in the chair.

Seven members present.

Letters were read from the Smithsonian Institution, April 7, 1865, announcing publications from foreign Societies; from the Amer. Phil. Soc., Philadelphia, April 12, 1865, announcing Transactions sent; and from L'Académie Royale des Sciences, des Lettres et des Beaux Arts de Belgique, Brussels, Sept. 18, 1863; and the Société Linnéenne de Bordeaux, Jan. 29, 1865, acknowledging receipt of the Transactions of the Academy, and sending publications in exchange.

The following publications were received:

Canadian Jour. of Ind., Sci. & Art, No. 56, March, 1865, Toronto—*from the Canadian Institute.* Soils and Subsoils of Michigan: An Address by Prof. Alexander Winchell, A.M., Lansing, 1865; Notes on *Selandria cerasi,* (Harris,) by Prof. A. Winchell—*from the Author.* Geological Survey of Canada, Sir Wm. E. Logan, F.R.S., Director; Figures & Descriptions of Canadian Organic Remains, Decade II.; Graptolites of the Quebec Group, by James Hall, 8vo, Montreal, 1865—*from the Director.*

Dr. Engelmann presented, in the name of Mr. G. C. Broadhead, a large collection of Plants made by the donor during last season in the counties of Jackson and Cass in this State, and which he had himself examined and labelled.

May 15, 1865.

The President, Dr. ENGELMANN, in the chair.

Five members present.

Letters were read from the Smithsonian Institution, April 25, 1865, announcing packages forwarded from foreign Societies; from the Royal Geological Society of Ireland, Dublin, June 17, 1864, and the Museum Francisco-Carolinum, Linz, Dec. 20, 1864, acknowledging the receipt of the Transactions, and announcing publications sent in exchange.

The following publications were received:

Notes on the Habits of some species of Humble Bees, and on the Leaf-cutting Bee, by F. W. Putnam; and the Humble Bees of New England and their Parasites, by A. S. Packard, Jr., Salem, 1864–5—*from the Authors.* Royal Horticultural Society: Proc., Vol. V., No. 2, London, 1865 —*from the Society.* Royal Dublin Society: Jour., Nos. XXXII. & XXIII., 1864, Dublin, 1865—*from the Society.* Royal Geol. Soc. of Ireland: Jour., Vol. X., Pt. 2, 1863–4, Dublin—*from the Society.* Dublin Quar. Jour. of Science, ed. by the Rev. Sam'l Haughton, M.D., F.R.S., No. XVII., Jan., 1865—*from the Editor.* Leeds Phil. & Lit. Society: Ann. Report, 1863–4; Early History of Leeds, by Thos. Wright, Esq., M.A., F.S.A., &c., Leeds, 1864—*from the Society*. Geol. & Polytechnic Society of W. Rid. of Yorkshire: Proc., 1863–4, Leeds—*from the Society*. Royal Society of Sciences: Nachrichten aus dem Jahre 1864, Göttingen, 1865—*from the Society*. I. Reg. Istituto Veneto: Atti, T. IX., Ser. iii., Disp. 9, '63-4—*from the Institution*. Museum Francisco-Carolinum: Bericht. XXIV., Linz, 1864—*from the Institution*. Würzburger Med. Zeitschrift, Band V., Heft 4–5; Band VI., Heft 6, 1864—*from the Society*. K. K. Geol. Reichsanstalt: Jahrbuch, Band XIV., No. 4, Wien, 1864—*from the Institution*. Società di Acclimazione: Atti, T. IV., 3–6, Palermo, 1864—*from the Society*. Société Imp. zool. d'Acclimatation; 2e. Série, T. II., No. 2–3, Paris, 1865—*from the Society*. Acad. of Nat. Sciences: Proc., No. 1, Jan.–March, 1865, Philad.—*from the Society*. Essex Institute: Proc., Vol. VIII., 1860–1863, Salem—*from the Institute*.

Dr. Engelmann presented the following botanical papers for publication in the Transactions: "A Revision of the Genus *Callitriche*, with plates," and "More about Pines," being a continuation of his paper published on page 205 seq. of this volume.

He then made some remarks about the fruit and seed of different species of *Viburnum*. Unfortunately botanists too frequently neglect to gather the ripe fruit, and the herbaria that he consulted furnished but scanty material for the interesting investigations he had instituted, and which he intended to prosecute. The fruit, he stated, was described as an oval drupe or berry, red, dark blue, or black, with a juicy and edible pulp, and a crustaceous stone containing the minute embryo in a fleshy albumen. He found the berries of different sizes and generally more or less compressed, but, on the whole, offering no useful diagnostic characters, as might be expected of such a pulpy fruit. The pulp contains, as is well known, saccharine matter (especially in our common "black haw," *Viburnum prunifolium*), or it is more or less acidulous (e. g. in the "tree-cranberry," *V. Opulus*); but he had found as a remarkable exception one species, the rare *V. scabrellum*, specimens of which, collected in Mississippi by Prof. E. Hilgard, were examined, with a pulp as oily as that of any *Nyssa* or of *Olea* itself.

The most important diagnostic characters are found in the stone and the albumen. The stone is either flattened or it is thick, even, or marked with longitudinal grooves and ridges; the albumen is described as fleshy, but he would rather call it horny, and it contains some oil; it is even and uniform, principally in the flat-seeded species, or more or less folded, or (as it is termed) ruminated, especially in the thick-seeded species.

In the following table are enumerated all the species the fruits of which he could examine.

Viburnum.

A. Stone flattened, oval, or orbicular; albumen even.

a. Stone without distinct markings.

1. *V. prunifolium* (St. Louis and Texas),	10	mm.	long,	8½	mm. wide.
2. *V. Lentago* (Pennsylvania) -	10–11	"	"	8	" "
3. *V. obovatum* (Georgia) - -	6½–8	"	"	4½–6	" "
4. *V. nudum* (N. Hamp. & Mississippi),	5½–6	"	"	4½–5	" "
5. *V. Opulus* (Germany, Illinois) -	7–8½	"	"	5–7½	" "
Var. *edule* (Wisconsin) - -	6½–7½	"	"	7½–8	" "

b. Stone with 3 more or less distinct grooves on flat or ventral, and 2 on convex or dorsal surface.

6. *V. pauciflorum* (Rocky Mountains),	5½	mm.	long,	5	mm. wide.
7. *V. acerifolium* (Wis., N. Hamp., Ga.)	6½–7	"	"	5½–6½	" "
8. *V. pubescens* (Wisconsin, Louisiana)	6–7	"	"	5½	" "
9. *V. dentatum* (Wisconsin, unripe)	8	"	"	4½	" "

B. Stone thick, much longer than wide.

a. Stone somewhat compressed; albumen not (in 10) or slightly (in 11) ruminated.

10. *V. scabrellum* (Mississippi), with one wide ventral groove, - - -	7	mm. long,	$4\frac{1}{2}$ mm. wide.
11. *V. lantanoides* (Massachusetts), with six distinct grooves, - - -	7	" "	5 " "

b. Stone oval or subglobose, not compressed.

α. Stone with a narrow and deep ventral groove; albumen deeply excavated, slightly ruminated.

12. *V. microcarpum* (Mexico) - -	4	mm. long.	$3\frac{1}{2}$ mm. wide.
13. *V. odoratissimum* (India) - -	8–9	" "	$5\frac{1}{2}$ " "

β. Stone with very slight grooves, albumen oval, not excavated, very deeply ruminated.

14. *V. Tinus* (Southern Europe) -	$6\frac{1}{2}$–8	mm. long,	5–$5\frac{1}{2}$ mm. wide.
15. *V. rugosum* (Canary Islands), -	8–9	" "	5–6 " "

The stones of *V. prunifolium* and *Lentago* he was unable to distinguish, and he almost felt inclined to unite both, as, in our neighborhood at least, the former was a most variable plant with broad or narrow, obtuse, acute or acuminate, glabrous or rusty leaves, and larger or smaller flowers, growing in rocky woods or in deep bottoms, and with many approaches to the eastern *V. Lentago,* which, in its typical form, was not found here.

In *V. nudum* and still more in *V. obovatum*, the markings so characteristic of *V. acerifolium* are already present, though not very distinct.

The stones of the European and the American *V. Opulus* which he could examine, were all broadly oval and longer than wide; but a few specimens of what was labelled *V. edule* had stones broader than long and deeply emarginate at base; further investigation must show whether this is a constant character, perhaps with others sufficient to re-establish that species of Purshian. The only fruit of *V. dentatum* he could examine was unripe, and the stone was no doubt narrower than it would be in the ripe berry.

Among the fruits of *Viburna*, mostly from the East Indies, obligingly communicated by Prof. A. Gray, he found those of *V. punctatum* similar to *V. nudum*, though larger; *V. erosum*, of Japan, with a lenticular irregularly marked stone, might also belong here; *V. orientale,* of the Caucasus, was the representative of our *V. acerifolium;* the red-fruited *V. cotinifolium, premnaceum, stellulatum,* and perhaps *Colbrookianum,* had stones similar to our black-fruited *dentatum* and *pubescens,* though narrower. The stones of *V. plicatum,* of Japan, *V. Simonsii, erubescens,* and also of *grandiflorum,* were like those of our *V. scabrellum.*

For those species of *Viburnum,* he had more fully examined, he would suggest the following arrangement, in which he had been obliged to overlook the presence or absence of a radiated inflorescence, which heretofore constituted the principal character of the sections of this genus:

1. *Opulus* would comprise species 5–7 with lobed leaves, radiated or uniform cymes, red or black-red berries, and flat, smooth or marked stones.

2. *Lentago* with species 1–4; leaves serrulate or sometimes entire, glabrous or squamulate, cymes even, berries bluish-black, stones flat, not or scarcely marked.

3. *Lantana* with species 8–11; leaves finely or coarsely dentate, glabrous or often with stellate pubescence, cymes even or, rarely, radiate, berries bluish-black, stones strongly marked, compressed or tumid. This section might be subdivided according to the form of the stones above described.

4. *Tinus* with species 12–15; leaves perennial (always?), entire or minutely sinuate-toothed, cymes even, berries purple or black, often shining, stones tumid with ruminated albumen.

In explanation of the measurements given in the above table he would add, that he had, in conformity with the usage now almost universal among men of science, adopted the French decimal measure, and hoped it would supersede even in common life the inconvenient measure of feet, inches, and lines. For those not familiar with it, it will suffice to state that the millimetre is about equal to half a line.

Dr. Engelmann had observed similar, though not as strongly marked differences in the fruits and stones of the different species of *Cornus*. Thus, the stone of our common *C. asperifolia* (a small tree with us) is subglobose, small, nearly smooth, marked with very slight furrows; the eastern *C. circinata* has larger stones, marked by indistinct undulations; the low, shrubby *C. sericea* of our swamps bears a stone twice as large, and quite knotty, with thick ridges; our Dogwood, *C. florida*, has a larger and elongated stone, acute at both ends, and slightly grooved; the stone of the nearly allied Californian *Cornus Nuttallii* is still larger, obtuse at both ends, and scarcely grooved, and that of the northern *C. Canadensis* is from a rounded base elongated to a pointed tip, and is perfectly smooth. He solicited botanists to furnish him with ripe fruit of any species of *Viburnum* and *Cornus* within their reach, so as to enable him to prosecute these investigations.

Notice of some additional observations on the Physiography of the Rocky Mountains, made during the Summer of 1864.

By C. C. Parry, M.D.

The large collection of indigenous plants made in the summer of 1862 by the joint labors of E. Hall, J. P. Harbour, and the writer, comprised the characteristic Flora of a considerable section of the Rocky Mountains, extending from Pike's Peak on the south to the head waters of Clear Creek on the north. Wishing to ascertain more fully the peculiar features of the country lying north of this district, I was induced to revisit this section a third time, during the past season, having Dr. J. W. Velie of Rock Island for my associate, who was especially devoted to Zoölogy.

Leaving the settlements in May, we experienced the usual vicissitudes of climate on this exposed upland, in occasional storms of wind and rain. Coming in sight of the Rocky Mountains, we had a still stronger intimation of the severity of storms that had burst over the mountain slopes, by a very unusual rise in the Platte River, which in many places overflowed the wide bottom land, driving settlers to take refuge on the adjoining bluffs. Arriving at Denver City, on the 2d of June, the ravages of the severe flood of Cherry Creek, on the 19th of May, were still apparent, though the subsiding waters were then flowing barely six inches deep over a wide bed of sand. Still subsequent to this, deluges of rain visited the mountain region, towards the sources of the Platte, flooding large sections of bottom land along its lower course, changing the beds of creeks and sweeping away a large portion of the then growing crops. This unusual and unexpected occurrence, in which heavy rains and melting snows combined to swell all the mountain streams, proved especially disastrous to the roads traversing this district, bridges being swept away, and roads and embankments washed and gullied to such an extent as to render the usual avenues of travel impassable. Owing to this condition of things, unusual difficulty and delay were experienced in making the proposed mountain explorations. These facts are still farther worthy of note as illustrating the peculiarities of climate pertaining to this entire mountain region.

The first point of attraction was an elevated district, known to abound with small lakes, lying near the upper waters of Left-hand Creek, one of the tributaries of the St. Vrains.

Our route lay through the excellent farming district of

Boulder Creek, and passed over a series of uplands adjoining the foot of the mountains. Owing to prolonged spring rains, an unwonted luxuriance of vegetation was spread over the entire district, including the most arid sandy tracts. The streams crossed on our route were high, and, in many instances, difficult of fording. The mountains were entered by a narrow cañon, two miles south of Boulder City. By a series of winding and steep ascents, this cañon penetrated the first range of mountains, which were composed of metamorphic rock, inclined at a very sharp angle with the horizon. Succeeding this, is the usual form of coarse-grained feldspathic granite, traversed at various points by veins of milky quartz. Thence by a series of moderate elevations, passing over rocky knolls, or winding through level uplands, agreeably diversified by pine groves and grassy swells, we reach the foot of Gold Hill, having thus in a distance of about seven miles attained an elevation of 1500 feet above the base of the mountains. To reach this higher elevation we are forced to make a still more abrupt ascent by numerous zigzags till we gain the commanding height occupied by the mining settlement of Gold Hill, being 8,636 feet above the sea. Following thence the divide between Fourmile Creek (a branch of North Boulder) and Left-hand Creek on our right, we come to a chain of small lakes mainly occupied by rushes and aquatic plants, emptying by several small outlets and by a steep descent into Left-hand Creek.

At this point, on the borders of one of these lakes known as Osborn's Lake, we made a stationary camp—a series of barometric observations showing its elevation to be 8,821 ft. above the sea and 3,300 ft. above the base of the mountains, ten miles distant. The region immediately adjoining is composed of mountain swells, alternating with depressions and open valleys, which latter, when assuming a basin shape, are occupied by small lakes; the ridges are mainly occupied by a growth of *Pinus ponderosa*, mostly of small size. The larger streams (such as Left-hand Creek) lie deep below the general level, and are reached by very steep descents. From elevated points there is a fine view of the Snowy Range, the main ridge being about ten miles distant. Farther north, Long's Peak is conspicuous, plainly exhibiting on its southeast slope the rugged features which subsequent explorations fully verified.

Among other conspicuous points, our attention was specially directed to a smooth rounded peak, apparently of easy ascent, at that time pretty uniformly covered with snow, but showing several bare spots on its more abrupt sides. After taking as thorough an observation as we could obtain from different points of view of the intervening country, we concluded to attempt the ascent as early in the season as the

14th of June. In order to devote as much of daylight as possible to the severe labor of accomplishing the ascent, which would need to be comprised within a single day's journey, we started with a pack animal on the afternoon of June 13th, and camped at the head of a small grassy valley where the heavy timber growth commences, having an elevation of 9,346 feet.

On the following morning we started at daylight, passing nearly due west over ridge and vale, through deep pine woods and intervening swells, encountering here and there masses of fallen timber, and again threading our way through dreary stretches of burned woods, rarely getting a near view of the snowy range which we were aiming to reach. Soon, occasional patches of snow lay along our path, rapidly melting under the warm rays of a summer sun; then, still farther on, continuous snow banks, in which the alpine forests were deeply imbedded, occupied our path, forcing us to make short turns to avoid heavy drifts, and occasionally requiring fatiguing efforts to extricate ourselves from sudden plunges into treacherous holes. Meanwhile our route was somewhat enlivened by the discovery of beautiful, clear, alpine lakes, bordered by sheets of ice, and reflecting from the clear waters the sombre forests of spruce by which they were surrounded. On one of these lakes, to the great delight of my zoölogical companion, an arctic loon was quietly sleeping. Still working our way westward, we encountered torrents of water, derived from melted snow, dashing and foaming over icy beds: across these we were forced to pick our way, glad to avail ourselves of a fallen tree, or slippery snag, to save a plunge into its chilly waters. Farther on, the unmistakable characteristic of an approach to that marked line, which terminates the growth of trees, is apparent; the country opens up; the bare snowy range stands before us in bold outline, and then commences the steep slope that leads directly to the snowy crest. Our observations here show a timber line considerably lower than that noted farther south, being here 11,325 feet above the sea level.

From this point, a steady and continuous climb calls out all our nervous and muscular energies. The wintry summer has not yet had time to unfold her floral beauties, and animal life is scantily represented by the Rocky Mountain ptarmigan, now just exchanging its garb of winter white for the mottled colors of summer. Occasionally, from an area of rough rocks, the mountain badger shuffles over sheets of snow to reach some more secure retreat, while here and there the diminutive Alpine hare utters his sharp bark. Slowly and steadily we move on toward the highest point, which almost seems to recede from our advance; but finally the last steep ascent is gained, and we stand on the narrow crest overlooking a vast scope of country.

Middle Park, with its irregular undulations and open valleys, is seen to the west, and the sea-like expanse of the Plains is visible to the east; just below us, on the north-west slope, lies a deep gorge, in which the smoothly scooped bottom and polished rocky sides plainly marked the bed of an ancient glacier. Through this chasm, which is seen to penetrate deeply into the mountain mass, flow some of the extreme sources of the St. Vrains, a sharp and abrupt divide separating it from a similar gorge on the western side, which leads towards the main valley of the Grand in Middle Park. By this route it seemed practicable by a short tunnel to connect the two mountain slopes, and, should the elevation on either side be found accessible by easy grades from the base of the mountain, the important problem of a direct railroad pass, through the principal range of the Rocky Mountains, would here find a practicable solution. From this elevation quite a number of lakes were brought distinctly to view, scattered at different points on the eastern slope of the mountains, while, ten or twelve miles distant, in a north-west direction, towers the rugged form of Long's Peak. The barometer was set up on the highest point of this snowy crest by means of a temporary tripod composed of the different parts of the portable case, and a series of observations were made with the following mean result: Barometer, 18.502; Thermometer attached, 42° F.; Thermometer detached, 35° F. This gives an elevation (according to the computation of Dr. Engelmann) of 13,402 feet above the sea level. We supposed, at the time, that we were on a peak which is laid down on recent maps as Mt. Edmonds, but finding, afterwards, that we were mistaken in the point thus designated, at the suggestion of my companion, Dr. J. W. Velie, we concluded to affix to this well marked elevation the name of the distinguished naturalist Audubon.

Having thus hastily completed the necessary observations, we commenced the descent at 3 P. M., and varying our route somewhat by selecting a more direct and abrupt slope, by a series of slips and plunges far from agreeable, we were overtaken by night before reaching the farthest limits of snow; and we arranged our night bivouac on the lee side of a precipitous rock. Here, before a blazing fire, we made an excellent supper of fresh ptarmigan, and enjoyed a somewhat rude repose from the labors of the day. Returning from this excursion to our permanent camp near Osborn's Lake, a few additional days were spent in exploring the adjoining country, and in securing specimens of its peculiar plants and animals. The Pond Lily of these alpine lakes was only yet in bud, but the characters were sufficiently apparent to determine it to be an undescribed species—to which, from its most characteristic feature, I have given the name *Nuphar* *pictum*.* A visit to this same locality in the month of August enabled me to collect full material for its description. It is apparently quite local in its distribution, as amid a great number of lakes, lying along our route, it was only met with in two, adjoining our stationary camp. Doubtless it will yet be found elsewhere in similar locations, but still it must be regarded as a rare plant, well worthy to be rescued from its obscurity, and from possible future extinction, by horticultural enterprise.

Returning to Boulder City in the latter part of June, we again essayed to penetrate the mountains by the ordinary route of travel up Clear Creek. Reaching Empire City in July, we again established a permanent camp in this delightful summer retreat, revisiting the various alpine peaks, over ground rendered familiar by two previous seasons of exploration.

In the latter part of July, the mountain passes having by that time become passable for pack animals, we made an excursion to the *Hot Sulphur Springs* of Middle Park, passing over the Vasquez trail on the route selected for a wagon road, which had been worked to near the foot of the range, on the east side, in the summer of 1863. The divide here (being a little more elevated than Berthoud's Pass) reaches just to the limit of timber growth, and, by a smooth open swell, passing on either hand steep rocky slopes, leads down on the western slope to the head waters of Dennis Creek. The valley along this route, being more open than the corresponding one by way of Berthoud's Pass, is better adapted for a wagon road, and the slope being more prolonged has an easier grade. Like the former, however, the lower part of the valley is much obstructed by beaver dams, though the greater width offers better facilities for road construction. The open Park is reached at nearly the same point as by the Berthoud trail, and thence by a succession of open meadows and sage plains, passing over various intervening ridges, we arrive at the main valley of Grand River. At the foot of a ledge of tilted rocks, where Grand River makes a sweep to enter a deep cañon, a surface of white rock is exposed, at the upper part of which, on a cool summer morning, a light cloud of vapory steam is seen to arise. This light-colored rock is formed from the gradually accumulated deposit of the Hot Springs, which, issuing from several orifices, formerly trickled over the rocky surface, leaving a white calcareous incrustation. Part of this issue has since been directed in a small stream, thence falling by a cascade of about ten feet into a natural basin; here it drops on a smooth pebbly surface,

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* Nuphar polysepalum, var. pictum, Engelm. See appendix to this article.

sending up a shower of glittering spray, and, passing through an arched cave, it reaches the waters of Grand River by a subterranean passage. The temperature of the water, at its several issues, is 112° F., and at the point where it falls into the basin 110° F. A smaller spring, less exposed to the external air, shows a temperature as high as 115° F. The water is clear, has an agreeable softness to the touch, and a distinct saline odor. Along the course of its several streams floats a slimy growth of feathery *Confervæ*, exhibiting a great variety of colors, including pure white, red, green, and blue. Animal life is also exhibited in these tepid waters, in a small molusk, of the genus *Lymnæa.* The sulphurous odor is not very perceptible, and to the taste, though disagreeably tepid, there is sufficient sparkle to render it not unpleasant.

The bathing arrangements are of the most primitive character. You stand under the falling stream as you are able to bear it, and allow it to fall with a dash on different parts of your body, till its diffusive warmth penetrates your system. The first impression is that of scalding, and you naturally spring away with a scream; by repeated trials, however, it becomes first supportable, and then delightfully agreeable. When not too long indulged in, its effects are both refreshing and soothing; but a prolonged stay is apt to beget lassitude. If a sweating process is desired, you wrap yourself up in a saturated blanket, and lie down in an adjoining cave, which keeps a uniform temperature of about 90° F.; here perspiration starts from every pore, till you are glad to emerge, and submit to the finishing process of brisk rubbing. There is no doubt that these springs possess valuable medical properties, which will be in due time appreciated: they are even now resorted to with benefit in cases of rheumatism, cutaneous eruptions, and other general disorders of the system arising from exposure, sedentary confinement, or intemperance. Doubtless no little of the benefits thus derived are due to the necessary exposure to out-door life, the excitement of travel, and changes of scene, as well as the too often neglected means of personal cleanliness; but hereafter, when experience and investigation shall have determined the actual value of these waters as a medical agent, this as well as the agreeable accessories connected with romantic scenery, clear atmosphere, and the various active amusements of hunting and fishing, will render this a place of fashionable resort.

The character of the geological formation, as exhibited through this entire section of Middle Park, furnishes a satisfactory explanation of the phenomena exhibited in these hot springs, of which many others will doubtless be discovered in different parts of this section of country. The numerous cañons of Grand River bring to view a great variety of geological sections, showing both granitic protrusions and highly inclined stratified rocks in different states of metamorphism. The adjoining hills and mountains are frequently capped with basaltic or vesicular trap, all showing a previous active condition of volcanic phenomena. The general surface of the country is thus rendered irregular and varied, and the existence of hot springs represents the present condition of the active volcanic forces, now nearly extinct. The usual variety of volcanic products is farther exhibited in the different qualities of soil, being in some portions coarse, arenaceous, and barren, while others exhibit a remarkable fertility, which is only checked by the severity of the seasons, in which killing frosts occur during every month in the year.

At lower elevations, however, more remote from the high Snowy Mountains, the valleys which can be irrigated are doubtless well adapted to agriculture; and in many other portions the uplands furnish an unlimited range for pasture. The character of the seasons is however quite variable, with occasional severe winters and heavy snows, burying up large tracts of country; while the summer rains, owing to the irregular distribution of high mountains, are uncertain and widely diverse in their continuance and in actual amount of precipitation. Still there is doubtless a large scope of habitable country, which, in the development of its true natural resources, will be able to support a permanent population, whenever it shall be made accessible by ordinary means of conveyance, especially should it eventually be found to lie along the main track of the great Continental Railway.

EXCURSION TO LONG'S PEAK.

By the middle of August the snow had so far disappeared from the higher peaks and ridges, and the heretofore swollen streams had so far contracted, that we concluded to attempt the ascent of Long's Peak. Our route in this direction took us again to the eastern base of the mountains; thence passing over the uplands adjoining and crossing the numerous valleys and streams, which, fan-shaped towards the mountains, converge in their easterly course to form the main stream of the St. Vrains. The cultivated crops in all these bottoms, where they had not been washed away by spring floods, exhibited unwonted luxuriance, most of the small grains being already harvested. Occasional *butes* of basalt formed prominent landmarks along our route, while at other points horizontal ledges of light-colored sandstone stretched in irregular mural bluffs along the borders of the principal streams. Associated with this loosely coherent sandstone we met with variable seams of lignite, in some localities attaining a thickness of five to eight feet. Where thus developed, these beds have been mined to some extent for fuel, the product finding a ready market at Denver City, thirty miles distant.

Passing thence towards a low break in the mountains where the main stream of the St. Vrains debouches on the upland plains, we follow up a somewhat broad valley, bounded by mural ridges of metamorphic rock, showing a strong dip to the eastward. The various exposures here brought to view exhibit a series of perpendicular escarpments to the west, while its eastern face presents a prolonged irregular slope. The valley here shows a very fertile soil, easily irrigated, but subject to occasional floods. The low bottoms were occupied by a dense growth of annuals, consisting principally of *Helianthus*, intermixed with a perfect maze of willows, intertwined and bound together by spreading vines of *Clematis.* These thickets were scatteringly occupied by clumps of wild cherry (*Prunus Virginiana*), at this season crowded with profuse clusters of its purple fruit. Besides this, we find in abundance and of excellent quality the ripe fruit of *Ribes aureum*, exhibiting several distinct varieties, including deep purple, light amber, and dull red. To each of these varieties there is a very distinct flavor, combining an agreeable mild acid with the peculiar aroma of wild currant; and the berries are often fully half an inch in diameter, and three-fourths of an inch in length. It is somewhat remarkable that this species, of which the cultivated product is considered worthless, should here in its wild state possess such desirable properties as a native fruit.

Proceeding onwards, following up the most northern branch valley, and crossing by frequent fords the rapid stream, bedded with rounded pebbles, we are forced by precipitous rocks, hemming in the valley on either side, to the adjoining hills; and thence, by a series of abrupt swells and sharp divides, we come upon the upper course of Little Thompson Creek. This creek, by a very rugged route, making a somewhat rapid ascent, terminates near its head sources in an open basin valley, quite picturesque in its surroundings, luxuriantly bedded with nutricious grasses, and agreeably set off on either hand by pine-clad mountains. Thence, by an easy divide, we pass down into the valley of Big Thompson Creek, where the valley spreads out in broad undulating swells to form Estee's Park. Through this beautiful upland park the main creek pursues its meandering course, its tributary waters flowing direct from the higher points of the Snowy Range, a short distance below entering a deep cañon to pursue its intricate course through the intervening mountains to the great Plains.

At this point is the last and only settlement on our route, being about twenty miles, by the trail followed, from the foot of the mountains. The elevation here is 7,000 feet above the sea, and 2,000 feet above the base of the mountains. Long's Peak is here plainly visible in all its rugged outlines, the highest summit bearing S.S.W. (magnetic) probably ten miles distant in a direct line. A series of lower peaks on the east connects with the culminating point by a sharp ridge, gashed by perpendicular chasms. A sheer precipice, partly hid from view by intervening mountains, forms the northern face, while on the west it connects with the main range by an irregular crest, forming a jagged descending ridge. With these unfavorable prospects for making the ascent of the main peak, we decided to vary from the route heretofore taken, which followed up a more gradual eastern slope to the lower range of peaks, and our course was directed toward the low ragged ridges lying on the western slope, in hopes that some of these might afford a foothold to scale the highest tabled summit; at least, we could reach its very base, and get a fairer estimate of its actual height above us than from a distant view.

To reach the timber line with pack animals and establish a near camp, from which our examination could be made of the main steep ridge, made up the first day's journey. We left the main valley of Thompson Creek, which bears more directly west, and, crossing two considerable divides, came on a small mountain stream leading direct towards the main peak. To follow this up through the obstructions of fallen timber, avoiding precipitous rocks, or working our way through tangled mazes of wooded thickets, required no small outlay of persistent and laborious effort. Catching occasional glimpses, through the open timber growth, of the high peak, whose near view showed its distinct outline, was encouraging; pausing meanwhile to gather the luscious berries of the mountain whortleberry, or to take a refreshing drink from the clear mossy brook that flowed in our direct course, we finally reached that sharp line where timber growth ceases, and established our camp at its upper edge. At this point we found needful shelter and firewood for ourselves, and a patch of alpine grass for our animals. A series of barometric observations shows here an elevation of 10,800 feet above the sea, with which to commence our climbing on the succeeding day.

Such elevations are not often attained in this country, at least for camping purposes, and the interval between daylight and dark was variously employed in investigating its peculiarities. Some of the more adventurous and eager ones made their way up the bare slope of rocks to the base of the main peak, to return at dusk with a discouraging account of its inaccessible character; others found amusement in noting the peculiarities of vegetation on this exposed locality, where, within a short distance, trees dwindle down to shrubs, or bend their matted foliage so as to make up in horizontal extension for the lack of height. There were rare alpine plants, growing in exposed places, and various mosses and lichens helped to add an Arctic character to the bald scenery.

The evening was devoted to a discussion of routes and probabilities for the following day, before a blazing camp fire; the night was rendered brilliant by twinkling stars in the serene atmosphere; and anon the advent of a nearly full moon cast spectral shadows through the sombre and blighted forest around us; and then followed a refreshing rest, undisturbed by dyspeptic nightmares, or outside intrusions, till the breaking morn roused us from slumber to prepare for the labors of the day.

Disposing of all unnecessary encumbrances, though protected by ample clothing and taking a pocket lunch, we commenced the first steep ascent. Extricating ourselves from the dense mass of bushy growth which lies above the timber line, we encounter the usual bare alpine exposures. The rocks, variously shaped by attrition and exposure to atmospheric agencies, lie either in loose fragments, or imbedded in a coarse granite sand. In favorable situations, vegetation acquires a foothold, forming dense patches of alpine sward, in the midst of which flourish the choice and variously tinted plants peculiar to this region. Trickling brooks, having their sources in banks of snow, form ribands of verdure, contrasting pleasantly with the dull colored rocky ridges down which they course. These again at other points expand into mossy morasses, supporting a rank growth of sedges and other water-loving plants. Passing amid such scenery, and gaining by steady climbing an elevation of 1500 feet or more above the timber line, we come upon a rock-paved table-land, where massive blocks strew the surface, varied here and there by patches of snow. This brings us to the base of the main peak still towering above us a thousand feet or more, but now plainly exposed in all its details of shape and position. On the side towards us, being the western face of the peak, there is a steep slope, partially faced by snow, terminating higher up in a perpendicular ascent, and then another steep slope reaching to the flattened summit. Its northern face shows a sheer smooth precipice of grayish colored rock, extending from the very summit to a bewildering depth of probably 3,000 feet, terminating in a rocky gorge, where snow fed lakes supply the head waters of the northern branch of the St. Vrains. Two of the party ventured down this gorge, clambering along the rough *talus* at the base of the precipitous peak, aiming by this difficult route of descent and ascent to reach the easternmost peak. In accomplishing this, they attained an elevation still considerably below the main summit, which was found inaccessible from this direction. Others, winding round the western face toward the south, came upon the jagged ridge that connects Long's Peak with the main range. On one of the highest points of this ridge, named (after one of the party) Velie's Peak, the barometer was set up, and a series of observations taken, giving an elevation of 13,456 feet above the sea. The estimated height of Long's Peak above this observed station was about 600 feet, which would give to this culminating point an elevation of 14,056 feet, which is thus seen to be somewhat lower than the more accurately determined height of Pike's Peak, which by barometric measurement in 1862 was found to have an elevation of 14,215 feet above the sea level.

Having thus tested to our satisfaction the inaccessible character of the highest tabled summit of Long's Peak, we made the best use we could, under the circumstances, of the elevated position we were enabled to attain. Below us, on the south, lay an open rocky gorge, where, in irregular basins, at various elevations, seven distinct lakes were counted; these go to form the head sources of Big Thompson Creek, which thus hugs round the mountain mass on the north and west, thence meandering through deep valleys and open parks till it reaches the wide plains below. To the southwest, Middle Park, with its meadows and undulating ridges, was plainly visible. The divide which separates the latter from North Park could be traced only as a confused range of irregular mountains, North Park itself being hid from view by a succession of mountain ridges. Long's Peak is thus shown not to lie, as represented on most maps, in the actual divide or water-shed of the Rocky Mountain Range, but, like Pike's Peak to the south, is an eastern offset, all its tributary waters flowing to the Atlantic slope.

Time is precious on these high elevations in noting the peculiarities of the vast region lying below and around us; but you are often in such places reminded still more forcibly of your elevated position by a chilly atmosphere, which, coming in irregular gusts, strikes you with the force of a literal blow, from which you are fain to beat a retreat to more sheltered localities.

Consoling ourselves for our failure to reach the main summit by the reflection that we had done the best we could, and that others equally sanguine and still more adventurous could do no more, we turned our backs upon the towering summit, and by a rapid descent gained our previous night's camp by noon, and at nightfall reached the hospitable roof of Estees, to enjoy a supper of delicious mountain trout and the luxury of a soft bed.

Appendix. By Dr. G. Engelmann.

I.

Nuphar polysepalum (sp. nov.): foliis late ovatis sinu angusto profunde cordatis; floris magni sepalis 9–12 concavis mediis maximis, petalis 12–18 spatulatis retusis, staminum numerosissimorum antheris apice truncato-appendiculatis filamenta demum recurva æquantibus seu eis brevioribus, ovarii urceolati striati radiis stigmatosis 13–21 disci umbilicati marginem crenatum fere attingentibus; bacca versus apicem constrictum nec rostratum sulcata.

In small lakes, in the higher Rocky Mountains, from the sources of the Platte, near Long's Peak, lat. 40, to those of the Columbia River, lat. 44. *Dr. F. V. Hayden* collected it in the then Capt. W. F. Raynold's Expedition, on June 20, 1860, in a small lake, between Henry's Fork and Snake Fork of the Columbia River, at an altitude of 6,500 feet. *Miss Merrill*, in the year 1862, brought from Gibson's Lake, near Long's Peak, some of the large reddish sepals, verifying her vague account of the plant; and, finally, *Dr. Parry* gathered ample material and full notes, which have been largely used in the following description, in Osborn's Lake, in the same region, at an altitude of 8,800 feet, where it grows with *Menyanthes trifoliata*, *Utricularia intermedia*, *Scirpus*, *Carex*, etc.; he found it in flower in August, the temperature of the water being, at the time, 58 degrees.

The leaves are more like those of *Nuphar luteum* of Europe than those of our *N. advena*, being oval in outline, not deltoid-orbicular, and with a narrower, more closed, sinus, the obtuse lobes more gradually separating from one another. In *N. advena* I find the sinus often of 75 degrees; the lobes are then triangular, with acutish points; but this form of the sinus, and shape of the leaf, is by no means constant, for whenever the substance of the leaf is more fully developed, the lobes become broader, more obtuse, and the sinus, of course, narrower, as I find it in specimens from Arkansas; while sometimes, as in specimens from Houston, Texas, the sinus becomes closed up and the lobes even overlap.

The leaves of our species were floating when observed; five of them were 8½–9½ inches long and 6½–7½ inches wide; these five leaves, and five of *N. luteum*, give each an average proportion of length to width as 10 to 8, while the same number of leaves of *N. advena*, from different parts of the United States, gives the proportion of 10 to 9. The difference seems small enough, but in the appearance of the leaf is quite striking. I notice, also, a difference in the venation of the leaves of these three species, there being, in our species, nearly three times as many veins connected with the midrib as issue from the base, while in both the other species I observe only about twice as many from the midrib as from the base. It may, in this connection, not be out of place to state that, as far as my observations extend, all the species of *Nuphar* can be readily distinguished from all those of *Nymphæa* by their venation, the former having by far the largest number of secondary ribs connected with the midrib, while in *Nymphæa* most ribs are basilar, and few only come from the midrib.

The flowers of our plant emerge a few inches above the surface of the water; they are the largest of any known *Nuphar*, and are composed of from 9 to 12 sepals, many more than we find in any other species, whence the name. The sepals being concave, and "the inner ones curved in, partially concealing the greater part of the dense mass of stamens," the flower becomes "globular cup shaped," and is about 3 inches in diameter, while when fully laid open it measures $4\frac{1}{2}$–5 inches. The sepals are arranged, not, as it was at first supposed, in 3 or 4 whorls of 3 sepals each, but in $\frac{5}{13}$ disposition, or, perhaps, the outer ones in $\frac{2}{5}$ divergence, gradually changing into $\frac{5}{13}$. The sepals increase in size and petaloid appearance from the outermost or first to the 7th or 8th, when they decrease again in size, but become of more delicate petaloid structure and color; the three outer ones are oval, $1\frac{1}{4}$–$1\frac{1}{2}$ inches long, green with yellowish margins; the 2 or 3 next ones are orbicular, 2–$2\frac{1}{2}$inches long, and of a yellowish green color; the following ones are the largest, $2\frac{1}{2}$ inches long, 3 inches in diameter, transverse in shape, broadly spatulate at base and retuse or truncate above; they are yellow, and often "tinged with the red of a deep peach blush, especially in fading;" and the innermost are smaller again, spatulate-orbicular, often emarginate, 1–$1\frac{1}{2}$ inches long, yellow, or, especially on the edges, reddish brown. Dr. Parry has repeatedly observed transitions between these inner sepals and the petals.

The petals themselves are spatulate, truncate, 12–18 in number, "9 lines long and 6 lines broad;" in the dried specimens I find them only 5 lines long and from 2 to 4 lines wide; in Dr. Parry's specimens they are "deep red in the middle and yellow at the base and tip."

The stamens, much more numerous than in the allied species, together with the anthers and the appendage, are deep red, relieved by the bright yellow color of the (oval, hispid, as in the genus) pollen, the outer ones broader and shorter, the inner ones narrower and longer; at maturity they are recurved.

The stigmatic disc is deeply umbilicate, and bears 13–21 (usually 16–19) stigmatic rays, which extend near to the irregularly crenate margin; it has a green or a deep red color or red, edged with yellow, and has, in the dried specimens before me, a diameter of 9–11 lines. In *N. luteum* the disc is similarly formed, while in all the western specimens of *N. advena* (I have no others at my disposal) I invariably find the disc entire or undulate, and the rays not extending to the margin.

The fruit found by Dr. Parry, only half ripe, is "smooth, glossy, deep green, and furrowed, especially towards the top;" dry, it is $1\frac{1}{4}$ inches long, and $1\frac{1}{2}$ inches in diameter.

The flowers of Dr. Parry's plant are more highly colored than that of Dr. Hayden's, and may preserve the name of var. *pictum*, which the discoverer has applied to the species; it seems to bear the same relation to the duller colored northern form that *N. luteum*, var. *rubro-petalum* (Caspary in Schriften der phys. œkon. Gesellsch. zu Kœnigsberg, vol. 2, 1861, tab. 1), does to the common European plant; in that variety the stamens as well as the disc are yellow, like the sepals, only the petals, and especially their upper surface, are "brown blood-red." On page 50, Prof. Caspary alludes to our *N. advena* as being more frequently found with red petals and points of stamens, than with yellow ones, a fact which will be new to many of our botanists, as, at least in the Western and South-western States, a red tinge has not been observed by them.*

II.

ALTITUDE OF LONG'S PEAK, AND OTHER POINTS IN COLORADO.

Dr. Parry has, in his recent expedition, continued the barometrical measurements commenced two years before, the results of which were published, p. 131 et seq. of this volume. I have calculated the altitudes, from his observations, in the manner detailed, p. 127, and, where the results of both years disagreed, have assumed the mean of both as nearest the truth, provided the different sets of observations were equally trustworthy. A number of new stations have also been added to the list. Thus, the following little table was obtained, which may serve as an addition and emendation of the former one.

It is due to Mr. L. Blodget to state, that in the United States Agricultural Report for 1853, pp. 429 and 431, he had already stated the fact, more prominently brought forward by Dr. Parry's observations, that the limits of cultivation and of forest growth, on the western plateau, is elevated far beyond what we would be led to expect from the effects of latitude and altitude combined. In his Climatology of the United States, published 1857, the same fact is incidentally alluded to.

	FEET.
1. *Western Plains.*	
Omaha (Library in State House)	1,211
Denver City	5,317
2. *Base of Mountains.*	
Franklin (St. Vrain's)	5,256

* After this was written, I received from Prof. A. Gray a specimen of *Nuphar advena*, found in Massachusetts, with a brownish-red tinge on the outer, and a red blush on the inner sepals red-tipped petals and reddish ovary and stigmatic disc; the outer stamens only showed a slight red tinge just *below* the polliniferous part.

Boulder City	5,536
Golden City	5,882
Golden Gate	6,226
Mount Vernon	6,479
3. Eastern Slope of Mountains, upper Plateau.	
Central City	8,300
Survey Station, No. 50, $1\frac{1}{4}$ miles above Empire City	8,739
Gold Hill	8,636
Osborn's Lake	8,821
Camp on last Grassy Park towards Mount Audubon	9,346
4. Timber Line.	
Mount Audubon, eastern slope	11,325
Long's Peak, northwestern slope	10,800
5. Peaks.	
Mount Audubon, west of Long's Peak	13,402
Velie's Peak, north northwest of Long's Peak	13,456
Long's Peak, approximately	14,056

It now appears, that the vague estimates of the elevation of Long's Peak were erroneous, and that in altitude it remains behind Gray's Peak, Torrey's Peak, and Pike's Peak; while Dr. Parry found that in ruggedness and inaccessibility it exceeded any of them. The expectation that any mountain in Colorado would reach beyond the highest points of the California mountains has not been verified; on the contrary, several points in the southern part of the Sierra Nevada have been measured last summer (1864), and found to exceed 15,000 feet. (See Preliminary Report in the American Journal of Arts and Sciences for January, 1865, p. 10.)

The elevations of the timber line in the Rocky Mountains have thus far been found to reach, going from south to north:

	FEET.
On Pike's Peak	12,000
On Snowy Range	11,700 to 11,800
On Mount Audubon	11,300
On Long's Peak	10,800
On Wind River Mountains	10,160

The abnormally low elevation of the timber line on Long's Peak, Dr. Parry ascribes to the more bleak and exposed situation of the northwestern slope of those mountains.

In connection with my former article on the altitudes in the Rocky Mountains, I wish to state, that Prof. Jules Marcou informs me that the top of the Sandia Mountains, in New Mexico, is bare of timber for about sixty feet.

Before the word "*feet*," in the first line of page 130, "2,200" has been left out. In tropical and sub-tropical climates the snow line is only reached at 5,000 to 6,000 feet above the timber line; in the Alps, the difference between them is but 2,600 feet; and it is not probable that in the Rocky Mountains it would be less than at least 3,000 to 4,000 feet; so that the top of the Wind River Mountains would probably not reach the real snow line.

ATMOSPHERIC ELECTRICITY. By A. Wislizenus, M.D.

YEARLY REPORT OF ATMOSPHERIC ELECTRICITY, TEMPERATURE, AND HUMIDITY, IN 1861, 1862, 1863 & 1864, AT ST. LOUIS, MO.

1.—*Monthly Mean of positive Atmospheric Electricity in* 1861, 1862, 1863, *and* 1864, *at St. Louis, Mo., based upon daily observations at* 6, 9, 12, 3, 6, *and* 9 *o'clock, from morning till night.*

YEAR.	JAN.	FEB.	MAR.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	MEAN OF YEAR.
1861	16.5	12.1	9.8	8.8	7.8	4.0	3.7	3.4	3.0	7.1	10.0	14.3	...... 8.4
1862	12.1	16.0	9.4	10.6	7.5	3.0	2.2	2.3	3.0	7.7	12.6	13.9	...... 9.4
1863	16.9	15.9	13.6	8.8	4.7	2.0	2.8	4.4	4.8	12.5	12.1	11.5	...... 9.2
1864	15.8	11.3	11.0	8.5	5.1	4.0	2.3	0.9	1.8	5.4	6.6	9.0	...... 6.8
Mean	15.3	13.8	10.9	9.2	6.3	3.2	2.7	2.7	3.1	8.2	10.3	12.2	...... 8.2

2.—*Monthly Mean of Temperature and Relative Humidity in* 1861, 1862, 1863, *and* 1864, *at St. Louis, Mo., based upon daily observations cotemporaneous with those of Atmospheric Electricity.*

TEMPERATURE.

YEAR.	JAN.	FEB.	MAR.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	MEAN OF YEAR.
1861	32.2	40.4	44.8	58.1	64.1	76.9	77.5	78.6	69.1	57.9	46.0	39.7	...... 57.1° F.
1862	28.9	30.2	43.2	55.0	69.7	75.1	81.2	80.7	72.1	57.3	42.6	41.3	...... 56.4
1863	36.8	35.7	43.6	57.4	65.5	71.9	77.2	77.5	69.2	48.0	43.7	35.9	...... 55.2
1864	29.2	38.3	40.7	51.4	69 4	78.9	83.5	78.8	72.9	53.1	44.9	30.4	...... 56.0
Mean	31.8	36.4	43.1	55 5	67.2	75.7	79.8	78.9	70.8	54.1	44.3	36.8	...... 56.2

RELATIVE HUMIDITY.

YEAR.	JAN.	FEB.	MAR.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	MEAN OF YEAR.
1861	72.2	63.3	64.5	61.5	66.3	70.8	66.3	69.6	77.3	76.6	69.0	74.3	...... 69.5
1862	85.3	73.9	70.8	67.0	57.3	67.0	66.8	64.3	74.2	67.2	69.5	74.6	...... 69.8
1863	79.2	81.7	68.1	57.2	59.4	67.7	68.6	70.7	68.2	74.4	67.4	79.5	...... 70.2
1864	75.6	62.7	70.0	69.8	56.4	61.5	62.8	69.0	64.1	67.9	74.2	75.5	...... 67.4
Mean	78.1	70.4	68.3	63.9	59.8	66.7	66.1	68.4	70.9	71.5	70.0	76.0	...... 69.2

3.—*Yearly Mean of positive Electricity, of Temperature, and of Relative Humidity of the Atmosphere, at the hours of* 6, 9, 12, 3, 6, *and* 9, *from morning till night, based upon daily observations at those hours, in* 1861, 1862, 1863, *and* 1864, *at St. Louis, Mo.*

ELECTRICITY.

	6 A. M.	9 A. M.	12 M.	3 P. M.	6 P. M.	9 P. M.
1861	8.5	9.9	9.0	7.7	8.5	6.8
1862	8.9	10.0	9.1	7.3	8.1	6.8
1864	10.5	10.6	10.0	7.5	9.1	7.4
1864	7.9	8.8	7.4	5.4	5.9	5.5
Mean	8.9	9.8	8.9	7.0	7.9	6.6

TEMPERATURE.

1861	48.9	54.9	61.6	63.6	59.3	54.3° F.
1862	48.9	55.0	60.9	62.3	58.0	53.6
1863	47.5	53.6	59.7	61.0	57.2	52.2
1864	48.0	54.1	60.5	62.2	58.1	53.0
Mean	48.3	54.4	60.7	62.3	58.1	53.3

RELATIVE HUMIDITY.

1861	86.4	71.3	60.3	57.2	65.1	77.3
1862	85.3	70.6	60.0	57.5	67.6	78.0
1863	86.8	71.4	60.2	58.0	66.7	77.9
1864	83.9	69.3	57.7	55.0	64.0	74.8
Mean	85.6	70.6	59.5	56.9	65.8	77.0

4.—*Direction and frequency of Winds in* 1861, 1862, 1863, *and* 1864, *at St. Louis, Mo.*

									PREV. WIND.
1861.	E.	N.	N.E.	S.W.	N.W.	S.	W.	S.E.	
	136	169	190	279	293	293	324	522	S.E.
1862.	E.	S.W.	N.	N.E.	W.	S.	N.W.	S.E.	
	112	191	211	230	259	265	351	550	S.E.
1863.	E.	N.	N.E.	S.	W.	S.W.	N.W.	S.E.	
	148	180	228	271	282	302	307	458	S.E.
1864.	E.	N.	N.E.	S.	N.W.	S.W.	W.	S.E.	
	53	176	234	245	319	327	330	492	S.E.
Mean :	E.	N.	N.E.	S.	S.W.	W.	N.W.	S.E.	
	112	184	220	268	275	299	317	505	S.E.

5.—*The observed Positive and Negative Electricity in connection with other Meteorological Phenomena.*

	POSITIVE ELEC.	NEGATIVE ELEC.	HIGHEST POS. ELEC.	NO ELEC. OR 0.
1861—January, was observed	179 times	3 times	40°	
February	162	6	34	
March	168	15	30	
April	157	12	33	1
May	171	17	25	1
June	162	5	16	8
July	183	3	14	1
August	176	5	15	6
September	169	1	18	10
October	162	4	33	20
November	172	2	42	6
December	175	5	37	6
	2046	78	42	59
1862—January	179	5	40	2
February	166	2	33	
March	179	8	48	
April	157	22	52	1
May	180	5	32	3
June	143	2	21	20
July	153	8	11	24
August	143	4	19	40
September	117	1	23	61
October	143	3	35	41
November	157	7	42	16
December	166	0	35	17
	1883	67	52	225
1863—January	173	7	55	6
February	150	9	54	8
March	165	11	50	6
April	144	12	31	26
May	116	6	25	59
June	81	5	12	93
July	95	6	16	85
August	124	13	23	49
September	138	5	25	37
October	151	6	40	25
November	146	3	36	30
December	144	5	43	37
	1627	88	55	461
1864—January	158	3	65	23
February	130	4	45	39
March	144	9	42	29
April	117	6	60	55
May	152	2	45	32
June	138	3	18	35
July	108	11	18	71
August	61	4	14	119
September	75	14	22	90
October	121	1	40	60
November	101	3	55	76
December	105	1	44	80
	1410	61	65	709

	POSITIVE ELEC.	NEGATIVE ELEC.	HIGHEST POS. ELEC.	NO ELEC. OR 0.
1861	2046 times	78 times	42°	59
1862	1883	67	52	225
1863	1627	88	55	461
1864	1410	61	65	709
	6966	294	65	1454
Mean per year	1741	73		363

Negative Electricity was connected in

1861.	1862.	1863.	1864.	
30	32	31	19 times,	with thunderstorms.
23	28	27	20 "	with rains without thunder and lightning.
20	4	21	20 "	with dry storms without rain, and without thunder and lightning.
2	3	5	.. "	with snowing.

Rain without Thunderstorm was accompanied with

	POS. ELEC.	NEG. ELEC.	NO ELEC. OR 0.
In 1861	50 times,	23 times,	15 times.
1862	36 "	28 "	34 "
1863	19 "	27 "	51 "
1864	19 "	20 "	65 "
	124 times,	98 times,	165 times.

Snowing was accompanied with

	POS. ELEC.	NEG. ELEC.	NO ELEC. OR 0.
In 1861	23 times,	2 times,	.. times.
1862	36 "	3 "	1 "
1863	34 "	5 "	5 "
1864	19 "	.. "	12 "
	112 times,	10 times,	18 times.

REMARKS.

The foregoing tables contain the numerical abstract of my observations on Atmospheric Electricity with other meteorological phenomena for the last four years. The observations have been made in the same locality and in the same manner as mentioned in my first report on the subject in Vol. II., No. 1, of the Transactions. One and the same glass thread has been used in all of them, proving thus its superiority over cocoon threads and other fibrous substances.

The first table and diagram No. 2 give the monthly mean of positive atmospheric electricity in the four years, and show a more or less regular descending and ascending line for every year from January to December. The monthly mean of the four years together exhibits a most regular descent from January to July and August, and a regular ascent up to December. The greatest quantity of positive atmospheric electricity corresponds with the coldest months of the year, and *vice versa*. Thus the six coldest months of the year, from October to March, give, during the four years, in temperature the average mean of 41.1° F., and in positive atmospheric electricity the average mean of 11.8 degrees of Dellmann's electrometer; while the six warmest months of the year, from April to September, give an average mean of 71.3° F. in temperature, and only 4.5 degrees in electricity. The same rule answers for the average mean of every single month, with the exception of a slight discrepancy between April and October, the temperature of April corresponding better with the electricity of October.

This coincidence in the inverse rise and fall of the temperature and electricity proves certainly some connection between the sun and atmospheric electricity. The light and heat of the sun seem to control the quantitative development and monthly periodicity of electricity in a negative way; that is, when the sun's rays are more powerful, electricity is diminished, and when less powerful, increased. This singular result is probably explained by the fact, that the very months which are our warmest in the year, April to September, constitute also the time of aphelion, or greater distance of the earth from the sun; and our colder months, from October to March, that of perihelion, or less distance from the sun. It appears, therefore, that the monthly periodicity of atmospheric electricity is not really caused by the sun's rays, by light and heat, but by the greater or less distance from the sun; and, as the same law holds good for terrestrial magnetism, it confirms my opinion, formerly expressed, that atmospheric electricity and terrestrial magnetism are closely allied emanations of the same force, derived in some way yet unexplained from the mass of the sun. Hence this increase in intensity by greater approach to the sun without regard to or notwithstanding the greater light and heat of the sun's rays. If, as I proposed in my former paper, regular observations of atmospheric electricity should be made in the southern hemisphere leading to the same result, this supposition of mine would then be established as a fixed fact.

Let us compare now the monthly mean of atmospheric electricity with that of relative humidity. The monthly mean of relative humidity is by far less regular than that of temperature and electricity, and is in all likelihood not a cause of electricity, but one of its modifying influences, distributing it through the atmosphere and conducting it to the earth. We find therefore, generally, high relative humidity corresponding with diminution of electricity.

It seems, also, that the direction and prevalence of winds has no direct causal connection with positive atmospheric electricity. The average mean of the numerical prevalence of winds was during these four years—

In the six warmer months, from April to September,

E.	W.	N.	S.W.	N.E.	S.	N.W.	S.E.
58,	100,	111,	133,	140,	143,	145,	259;

And in the six colder months, from October to March,

E.	N.	N.E.	S.	S.W.	N.W.	W.	S.E.
57,	72,	80,	125,	141,	172,	199,	247.

The principal difference between these two seasons is, that in the six warmer months the N.E. and N. winds were a little more prevalent, and in the six colder ones the W. wind; while in both of them the S.E. wind surpassed all the others in frequency, being our prevalent wind throughout the year. By summing up the N., N.E. and N.W. winds in one column, the S., S.E. and S.W. winds in another, and calling them northern and southern winds, we find that the northern and southern winds prevailed in the warmer and in the colder portion of the year in the following proportion:

IN THE SIX WARMER MONTHS OF THE YEAR,
395 northern and 535 southern winds.

IN THE SIX COLDER MONTHS OF THE YEAR,
324 northern and 513 southern winds.

This does not agree very well with the opinion of those physicists who ascribe the origin of positive or negative electricity to the prevalence of polar or equatorial currents of air.

Besides the monthly periodicity of positive atmospheric electricity, there exists yet a daily one, which is illustrated by diagram 4 and table 3. We see there, that two maxima and two minima of electricity appear in the twenty-four hours; the first and greater maximum about 9 A.M., the second lesser maximum about 6 P.M.; and the first and greater minimum about 3 P.M., the second lesser one about 9 P.M. Prof. Dellmann ascribes this daily periodicity to the direct action of the sun's rays, assuming that the first electric maximum appears soon after a minimum of heat in the morning, and the first electrical minimum soon after a maximum of heat in the evening. But this supposition does not correspond with the result of my observations made in St Louis. The first electrical maximum here appears about three hours after sunrise, and the first electrical minimum does not follow but coincides with the greatest heat of the day, about 3 o'clock in the afternoon; the second electrical maximum appears about sunset or soon after, and the second minimum about 9 o'clock in the evening and is prolonged till about 3 o'clock in the morning. I am unable to understand, how the increasing power of the sun's rays should produce successively during the day first a maximum and then a minimum in electricity, and how the decreasing power of the sun's rays should every evening and night cause at first a maximum and then a minimum in electricity. It seems to me, that there must exist some other cause for this daily periodicity. I suppose, that the daily periodicity of positive atmospheric electricity is the result of the daily contest going on between the sun's rays and the humidity of the atmosphere. At a certain daily period of this contest, when, as it were, an equilibrium is reached between the two contending powers, a maximum of electricity takes place; and, when either the one or the other power preponderates, a minimum ensues.

From table 3 and diagram 4 we perceive that temperature and relative humidity represent a daily curve with inverse direction. While temperature gradually rises from morning till 3 o'clock in the afternoon and falls in the night until morning, relative humidity falls gradually from morning till 3 o'clock in the afternoon and then rises through the night until morning. Now the point of equilibrium between temperature and humidity is reached, according to my observations, about 9 in the morning and about 6 in the evening, and a decided preponderance of temperature takes place at 3 P.M. and of humidity at 9 P.M. Hence the two maxima and two minima of electricity at those hours. A comparison between the yearly mean of temperature and humidity and the yearly mean of electricity at the hours of maxima and minima will make this still plainer.

The yearly mean of temperature is	56.2
" " " at 9 A.M. ..	54.4
" " " at 6 P.M. ..	58.1
" " " at 3 P.M. ..	62.3
" " " at 9 P.M. ..	53.3

The yearly mean of relative humidity is.....	69.2
" " " at 9 A.M.	70.6
" " " at 6 P.M.	65.8
" " " at 3 P.M.	56.9
" " " at 9 P.M.	77.0

TEMPERATURE.					RELATIVE HUMIDITY.				
9 A.M.	54.4	YEARLY 56.2 MEAN.	62.3	3 P.M.	9 A.M.	70.6	YEARLY 69.2 MEAN.	56.9	3 P.M.
6 P.M.	58.1		53.3	9 P.M.	6 P.M.	65.8		77.0	9 P.M.

It becomes thus apparent that temperature and humidity approach both at 9 A. M. and at 6 P. M. their yearly mean and come to a state of equilibrium, producing the maxima of electricity; while at 3 P. M. and 9 P. M. the divergence from the yearly mean becomes greater, producing the minima. The approach would probably be still nearer and the divergence greater if I could make my observations every hour in the daytime, and could continue them through the night till morning. But even the present defective observations seem to prove the causal connection of the daily two maxima and two minima of electricity with the equilibrium or divergence in temperature and relative humidity.

Is there, besides the daily and monthly, also an annual periodicity of atmospheric electricity? To determine this question, observations must be continued for a long series of years, and not in one single locality, but in many different parts of our globe. It may also be needed, for that purpose, to measure the negative atmospheric electricity developed throughout the year; to accomplish which is a far more difficult task, on account of the sudden appearance and disappearance and the great quantative fluctuations of negative electricity. No instrument but a self-registering one could acccomplish that; but since, to my knowledge, no practical instrument of the kind has been invented for the observation of the more regular positive electricity, the invention of one for negative electricity is still more doubtful.

The yearly mean of positive atmospheric electricity during the four years was in

1861.		1862.		1863.		1864.
8.4	....	8.4	....	9.2	....	6.8

The number of thunderstorms was in

1861.		1862.		1863.		1864.
32	....	50	....	40	....	26

We see, therefore, that the first two years were entirely equal in quantity of positive atmospheric electricity, the third somewhat higher, and the fourth considerably lower. What is the cause of this diminished electricity in 1864? The number of thunderstorms in 1864 was less than in the three previous years. This seems to indicate also a diminution of negative electricity during the year. The number of observations by which no electricity whatever was found has been on the increase every year. In 1861 it amounted only to 59, in 1862 to 225, in 1863 to 461, and in 1864 to 709. To some small extent this may be owing to my mode of observation. Before I was well acquainted with the delicate motions and notions of the instrument, I may perhaps have sometimes noted one or two degrees of electricity which in later observations I rejected; but this trifling discrepancy could not account for the wide difference in zero observations between the first and last year. It seems to me more likely that there was in 1864 a considerable falling off in electricity, both positive and negative, manifesting itself by a less quantity of positive electricity, by a less number of thunderstorms, and by a greater number of zero observations.

What other meteorological phenomena may stand in causal connection with this diminished electricity? There was no essential difference in the prevailing winds; the S.E. was our prevalent wind as usual and in about the same quantity. The temperature of the year answered the usual mean. Relative humidity was several degrees lower than usual, the year being uncommonly dry. But less humidity of the atmosphere ought rather to promote the accumulation of positive electricity, since less of it is carried by humidity to the ground. I have therefore come to the conclusion, that the local meteorological phenomena do not account for the less development of electricity in 1864. The cause for it may perhaps be found in the accumulation of electricity hundreds and thousands of miles distant from us, so that a local ebb here may corrrespond with a local flood in some other part of our globe. I had many times occasion to observe how easily the equilibrium in the quantity of the usual atmospheric electricity is disturbed. Quite distant rain-falls and thunder-storms often make the electricity here disappear at once; still more so snow-falls. In the winter, when strong positive electricity with fair and cold weather suddenly declines, or disappears entirely, without any appreciable local cause, I have often predicted a cotemporaneous considerable snow-fall at great distances, and the telegraph generally confirmed my supposition from such localities as Cairo, Cincinnati, Chicago, Buffalo, and even New York. The accumulation of positive electricity there, as is usual with snow-falls, seemed to have produced a vacuum here. The sensibility of the electrometer in such changes is far greater than that of the barometer. Dry storms, too, of no great violence and of more local extent, affect often the electrometer, while the barometer scarcely shows any fluctuation. But in strong gales, that are invariably accompanied by sudden depression of the barometer, the electrometer confirms and corroborates the barometer by a sudden change into most intense negative electricity, lasting during the gale. The electrometer becomes thus a most valuable aid to the practical purposes of the barometer. But, unfortunately, the practical application of meteorological instruments for predicting storms is too much overlooked in this country. While in England they have already established a Meteorological Bureau at the Admiralty, where they receive daily telegraphic reports of meteorological changes from all parts of the kingdom, and, at a threatening outbreak of a storm, send telegraphic warnings all along the sea coast, we, light-minded Americans, trifling with human life as well as property, wait quietly till the storm breaks upon us, injuring every year our immense shipping interest on the lakes and on the sea coast by gales that might have been foreseen and predicted. Generally these gales rise in the west or south-west, and progress in a curved line over the vast extent of our country to the north and the north-east, where they strike the sea shore. On an average, when such a gale passes here over St. Louis, it takes about 24 hours before it reaches the eastern sea shore. Ample time is thus given to forewarn and prepare all those who would be endangered by it. But, as this cannot be made an object of individual enterprise, it ought to be entrusted by government to some board of scientific men, as, for instance, to the Smithsonian Institution in Washington, with its distinguished physicist, Prof. J. Henry. But in the present distracted state of our country there is very little hope that any proposition of the kind would meet with favor from the proper authorities.

In regard to the action of atmospheric electricity, during an *aurora borealis*, I had no opportunity in the four years to make any observations myself; but Prof. Dellmann states, in a late publication, that he made, one evening, during an aurora, observations of atmospheric electricity for three hours, and that he found the electricity invariably positive, but regularly increasing and decreasing with the rise and fall of the aurora.

I had twice a chance to observe in what manner a dense mass of smoke acts upon electricity. On two occasions large fires from burning houses—one very near, the other half a mile distant—drove clouds of smoke to my place of observation. The atmospheric electricity, which up to that moment had been strongly positive, changed at once into highly negative, lasting as long as the smoke did, and disappearing with it, although the fire continued burning for sometime afterwards.

To ascertain the connection of electricity with ozone, I tried often most reliable ozone-paper; but it never showed any re-action, while the same paper used in the country gave the usual result.

METEOROLOGICAL TABLE FOR 1863—ST. LOUIS, MO.—By Dr. G. Engelmann.

MONTHS.	BAROMETER (English inches) Reduced to Freezing Point.				THERMOMETER (Fahrenheit).				Evaporation.*	Force of Vapor.	Relative Humidity.	Quantity of Rain and melted Snow in inches.	Prevailing Winds.	Proportion of Cloudiness.	No. of Thunderstorms.
	Mean of the observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.	Mean of the observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.							
Jan.	29.541	29.903	29.018	0.885	37.4	65.0	12.0	53.0	3.4	0.154	69.0	4.11	S.E. - - - -	**6.2**	1
Feb.	**29.624**	30.010	**28.899**	**1.111**	35.8	64.0	2.0	62.0	2.9	**0.152**	72.5	3.99	S.E., E. & W. -	**6.2**	—
Mar.	29.544	29.994	29.168	0.826	43.7	76.0	22.5	53.5	4.8	0.177	63.1	3.02	N.W., W. & S.E.	5.7	2
April	29.496	29.879	29.173	0.702	56.5	82.5	31.5	51.0	7.9	0.241	**53.8**	**1.55**	S.E., then W. -	3.9	2
May	**29.489**	**29.703**	29.134	0.569	67.0	89.5	39.5	50.0	**8.7**	0.371	57.8	2.68	S.E. & S., th. NW.	3.9	5
June	29.505	29.766	29.260	0.506	70.6	90.0	51.0	**39.0**	6.8	0.501	67.9	3.16	W., then S.E. & E.	5.0	5
July	29.494	29.753	**29.340**	**0.413**	**76.0**	94.0	**55.0**	**39.0**	7.4	0.601	68.1	2.51	S.E., N. & S.W.	4.8	4
Aug.	29.558	29.865	29.324	0.541	75.8	**95.0**	45.0	50.0	6.4	**0.635**	72.7	**6.93**	S.E., then S. -	3.7	11
Sept.	29.597	29.850	29.318	0.532	67.5	92.0	43.0	49.0	6.7	0.446	68.0	1.56	S.E. - - - -	**3.2**	4
Oct.	29.579	30.046	29.005	1.041	47.1	72.5	21.0	51.5	4.4	0.218	68.5	4.76	N.W., then S.E.	4.7	3
Nov.	29.605	**30.082**	29.116	0.966	42.9	71.0	5.5	65.5	4.6	0.173	64.2	2.15	W., then S.E. -	3.8	—
Dec.	29.588	29.969	29.044	0.925	**35.4**	**59.5**	**—7.0**	**66.5**	**2.5**	0.157	**75.8**	4.03	S.E. & S.W. -	6.1	—
1863.	29.552	30.082	28.899	1.183	54.6	95.0	—7.0	102.0	5.5	0.318	66.8	40.45	S.E., N.W. & W.	4.8	37

* Difference of dry and wet bulb Thermometers.

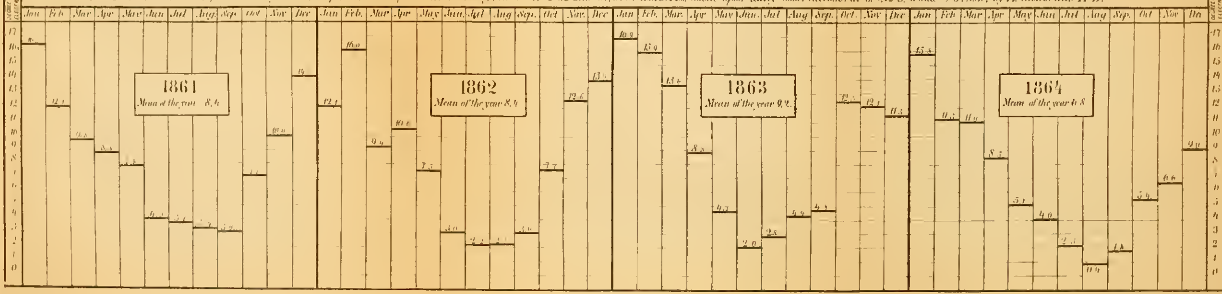
METEOROLOGICAL TABLE FOR 1864 — ST. LOUIS, MO. — By Dr. G. Engelmann.

MONTHS.	BAROMETER (English inches) Reduced to Freezing Point. Mean of the observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.	THERMOMETER (Fahrenheit). Mean of the observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.	Evaporation.*	Force of Vapor.	Relative Humidity.	Quantity of Rain and melted Snow in inches.	Prevaling Winds.	Proportion of Cloudiness.	No. of Thunderstorms.
Jan.	**29.644**	30.115	28.966	1.149	**28.5**	72.0	**–22.5**	**94.5**	**2.6**	**0.113**	72.2	2.74	S.E. & S.W. - -	4.2	2
Feb.	29.586	**30.224**	29.057	1.167	37.5	**66.0**	1.0	65.0	5.1	0.121	55.8	0.82	W., next N.W. -	3.6	1
Mar.	**29.404**	29.838	28.861	0.977	39.9	70.5	15.5	55.0	4.3	0.154	62.9	1.71	S.E., next W. -	4.8	1
April	29.418	29.775	28.971	0.804	50.7	78.5	34.5	44.0	4.5	0.255	69.8	**5.58**	N.W. & S.E. - -	**6.9**	3
May	29.435	29.664	29.114	0.550	67.8	92.0	37.0	55.0	9.3	0.369	**55.7**	3.90	N.W. - - - -	3.7	2
June	29.517	29.678	29.257	**0.421**	77.3	96.0	49.5	**36.5**	9.4	0.557	61.8	**0.41**	S.E., next S.W.	3.5	1
July	29.542	29.791	**29.333**	0.458	**80.9**	97.0	57.0	40.0	**9.7**	**0.634**	61.1	3.60	S.E. - - - -	3.3	4
Aug.	29.467	**29.662**	29.220	0.442	77.0	96.5	**58.0**	38.5	7.3	0.629	68.8	4.91	S.E., next N.W.	5.4	4
Sept.	29.481	29.763	29.131	0.631	71.1	**102.5**	45.0	57.0	8.2	0.468	63.8	2.82	S.E., next S.W.	**2.7**	5
Oct.	29.513	29.818	29.162	0.656	51.7	73.0	33.0	40.0	5.3	0.251	66.2	3.15	SW. & NW., n. SE.	3.7	2
Nov.	29.500	29.873	**28.856**	1.017	44.1	76.5	11.5	65.0	3.8	0.200	70.4	5.25	S.E. - - - -	6.4	3
Dec.	29.537	30.127	28.954	**1.173**	30.1	72.0	0.5	71.5	2.7	0.122	**73.7**	2.72	S.E. & N.W. - -	6.6	1
1864.	29.504	30.224	28.856	1.368	54.7	102.5	–22.5	125.0	6.0	0.323	65.2	37.61	SE, NW, SW & W	4.6	29

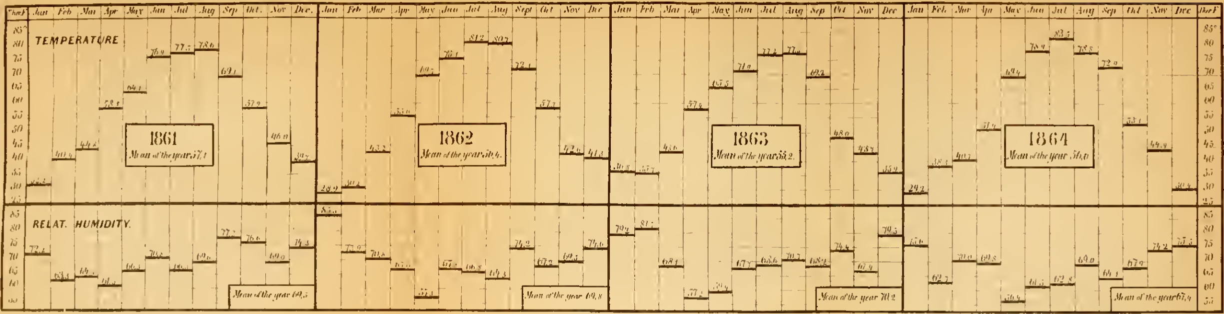
* Difference of dry and wet bulb Thermometers.

1st DIAGRAM, exhibiting the monthly quantities of Rain, and the Rise and Fall of the Mississippi River at St Louis, Mo., during the years 1861 till 1864, by G. Engelmann M. D.

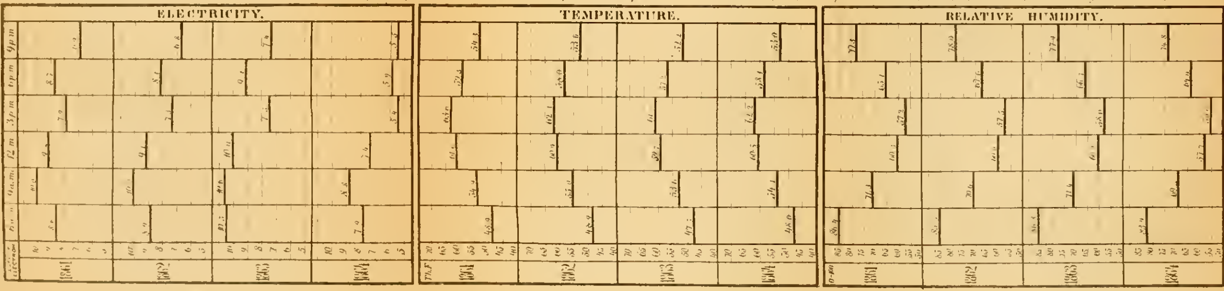
2d DIAGRAM, showing the monthly mean of positive atmospheric Electricity, in 1861, 62, 63 and 64, at St Louis, Mo., based upon daily observations, at 6, 9, 12, 3, 6 and 9 o'clock, by A. Wislizenus M. D.



3d DIAGRAM, *of the monthly mean of temperature and of relative humidity in 1861, 1862, 1863 and 1864, at St Louis Mo, based upon daily observations contemporaneous with those of atmospheric electricity, by A. Wislizenus M.D.*



4th DIAGRAM, *showing the mean of positive electricity, of temperature and of relative humidity of the atmosphere, at the hours 6, 9, 12, 3, 6 & 9, based upon daily observations in 1861, 62, 63 and 64, at St Louis, by A. Wislizenus M.D.*



Thoughts on Matter and Force.

By A. Wislizenus, M.D.

All the atomic substances in nature, that fall under the observation of our senses, we call *matter;* and certain constant actions and motions of matter are called *forces.* Matter and force exist in such a state of combination that we cannot separate them, except *in abstracto.* From this impossibility of separation, the materialists deduce their belief in matter alone, while the dynamists claim the supremacy of force. It seems to me most rational, to assume an original combination of the two. In what manner that happened, is as incomprehensible to human understanding as any other act of creation. Man was not invited into the laboratory of nature, but she kindly allows him to study her works, when finished, and to admire their form and wise design. We have to be contented, therefore, with created things as we find them, although their origin will forever be a mystery to us. We must be satisfied with the fact, that we meet at every step with such a combination of matter and force, that a certain dualism exists throughout nature, and that the law of polarity is one of the highest in the Universe. In things more sensual we are not so scrupulous as to deny a combination of two opposites, although we cannot separate them. Who, for instance, would deny the two poles of a magnet, or of a galvanic battery, although we cannot bring one pole into action without the other, and can never actually separate them? A separation of matter and force *in abstracto* seems to be a logical necessity, without which the laws of nature cannot be investigated, and has, therefore, been generally adopted by natural philosophers from the most ancient times to the present.

Matter and force are subject to general laws, common to both. One of them is, that both matter and force are indestructible, imperishable, everlasting, eternal; but their forms are constantly changing from simple to compound, and vice versa.

The quantity of matter and force on our globe is the same now as ever, although its forms are constantly changing, being never entirely at rest, always in action or re-action, composing or decomposing, destroying or building up. In regard to matter ample proof of this has been furnished by chemistry. In regard to force the same opinion has prevailed for a long time, but the proof positive was, on account of the less sensual nature of the subject, more difficult. But the indefatigable zeal of our physicists and natural philosophers, and their late researches into the "correlation of forces," have opened a vein of scientific gold, that promises to reward the explorers with the treasures of knowledge and truth. Since Mayer has calculated the mathematical formula for the mechanical equivalent of heat; since Tyndall, Joule, Faraday, Grove, Helmholtz, LeConte, and others, penetrated deeper into the laws of forces, and their mutual relations, and demonstrated how light, heat, electricity, magnetism, chemical affinity, and motion, are all convertible into each other, but never destroyed; there is scarcely a doubt left that the actual indestructibility, but changeability in form throughout nature, will soon be as firmly established of force as it has been proved of matter.

What are now the most general forms under which matter and force appear?

The most general forms of *matter* are its solid, its liquid, and its gaseous state.

The most general forms under which *force* appears, are:

1. Physical forces;
2. Vital force;
3. Reasoning force.

Of the *physical* forces I consider as the principal ones: Gravitation and chemical affinity, light and heat, magnetism and electricity; on which certain qualities of matter, such as inertia, molecular attraction, impenetrability, porosity, density, compressibility, expansibility, elasticity, etc., are more or less dependent.

The six principal physical forces mentioned might be condensed also into three groups, since every two of them are connected by some natural relationship. Thus, gravitation, with its centripetal and centrifugal force, and chemical affinity work both by molecular attraction and repulsion, though the first tends more to unite similar bodies, the latter dissimilar ones; the first acting more quantitatively and at immense distances, the latter more qualitatively and in close proximity. Thus, light and heat appear to be rather modifications of the same force, than distinct forces mutually dependent. The close relation between magnetism and electricity is still more striking, the essence of both being molecular polarization of matter.

Our present researches into the correlation of forces have thus far been mostly confined to the physical forces, with the result above stated, that all of them are convertible into each other but cannot be annihilated.

The following extracts (taken principally from *Tyndall's* Heat, a new mode of motion, and from *Grove's* Correlation of Forces) will give but a brief summary of our present knowledge thus acquired:

"Forces are causes, in which full application of the axiom must be found, that every cause must produce an effect which corresponds and is equal to the cause. Causa æquat effectum. All these causes as far as relates to their quantity, possess the property of indestructibility, and to their quality, of convertibility."—*Dr. Mayer.*

"We cannot create force any more than we can create matter; neither can we annihilate either of them.

"When a body falls to the ground by the force of gravitation, or if by some mechanical motion a body is thrown upon another, it was formerly supposed that the force of impact was lost by the fall, concussion, friction, or compression. We now admit no loss, but assume that it is simply a case of transference and not of annihilation—the mechanical motion is transferred into heat.

"When a weight falls down and strikes the earth, its motion is stopped, and partly reappears as heat in both earth and weight; partly it conveys away or continues the force expressed by the cohesion of the weight (its specific gravity) to the earth, by making the latter vibrate through its mass, and changing its position in the universe by increase of gravity.

"Whenever friction is overcome, heat is produced, and the heat produced is the measure of the force expended in overcoming the friction.

"The quantity of heat generated by the same amount of force is fixed and invariable. Vice versa, heat is thus converted into mechanical energy.

"The grand principle of conservation of force is well-illustrated in the steam engine. For every stroke of work done by the steam engine, for every pound it lifts, and for every wheel it sets in motion, an equivalent of heat disappears.

"Where the mutual impinging bodies are homogenous, heat alone is the result of friction and percussion. Where the bodies impinging are heterogeneous, electricity and heat are produced.

"Of the various forces of matter, either of them may mediately or immediately produce the others. Where at present no immediate relation is established, electricity generally forms the intervening link of middle term.

"A great number of bodies chemically combine in equal volumes, that is, in the ratios of their specific gravities. Here we have, to some extent, an equivalent relation between gravitation and chemical affinity.

"Faraday, Brücke, Airy, Chase, and others, have considered the mutual convertibility of gravitation and magnetism, and the latter has discovered numerical relations between these two forces.

"By chemical affinity we can directly produce electricity. There are few if any chemical actions which cannot be experimentally made to produce electricity.

"Voltaic action is chemical action taking place at a distance, and the Daltonian equivalent numbers are the exponents of the amount of voltaic action for corresponding chemical substances.

"Faraday established first the laws of equivalency between chemistry and electricity, and Oersted those between electricity and magnetism.

"Light and heat are but modifications of the same force.

"Heat is a mechanically repulsive force in matter, tending to move the particles of all bodies to separate them from each other. Heat is molecular motion.

"Of absolute rest nature gives us no evidence; all matter is ever in movement, not merely in masses, as with the planetary spheres, but also molecularly, or throughout its most intimate structure; thus, every alteration of temperature produces a molecular change throughout the whole substance, heated or cooled; slow chemical or electrical actions, actions of light, or invisible radiant forces, are always at play; so that as a fact we cannot predicate of any portion of matter that it is absolutely at rest.

"Light, for a long time recognised only in its visual effects, produces constantly changes in the earth and atmospere no less than in organized structures. Thus, every portion of light may be supposed to write its own history, by a change more or less permanent in ponderable matter."

"Are not gross bodies and light convertible into each other, and may not bodies receive much of their activity from the particles of light that enter into their composition? The changing of bodies into light and light into bodies is very conformable to the course of nature, which seems delighted with transmutations."—*Newton.*

"All the transformations of matter around us, the power exhibited in the growth of plants, in the functions and motions of animals as well as in the winds, are all referable to impulses received from the sun."—*Henry.*

"The power which is evolved in the combustion of coal is merely the equivalent of the force, which was expended in decomposing the carbonic acid which furnished the carbon to the primeval forests of the globe; and the power, thus stored away millions of years before the existence of man, is now employed for the comfort of our race."—*Henry.*

"We know, experimentally, that from electricity we can get heat, and from heat, as in the case of the thermo-electric pile, we can get electricity.

"Electricity produces motions directly by attraction and repulsion of bodies; it produces indirectly heat, light, and chemical action.

"Magnetism, when put in motion, will produce electricity, and magnetic effects are produced by electricity. Magnetism can, through the medium of electricity, produce heat, light, and chemical affinity.

"It appears, that in many cases, where one of the forces is excited, all the others are also set in action. Thus, when a substance, such as sulphuret of antimony, is *electrified*, at the instant of electrization it becomes *magnetic*, in directions at right angles to the lines of electric force; at the same time it becomes *heated* to an extent greater or less according to the intensity of the electric force. If this intensity be exalted to a certain point, the sulphuret becomes luminous, or *light* is produced; it expands, consequently *motion* is produced, (and its specific *gravity* altered,) and it is decomposed, therefore *chemical* action is produced.

"The great problem which remains to be solved in regard to the correlation of physical forces, is the establishment of their equivalents of power for each of them, or their measurable relation to a given standard."

All matter that is controlled exclusively by physical forces, is called inorganic. But there are numerous bodies, whose actions and motions cannot be satisfactorily explained by mere physical forces, and which exhibit, besides them, a new and higher force, to which physical forces are subordinate—the *vital force*. Such bodies are called organic, because they are possessed with many organs (instruments), by which their various functions and manifestations of life are executed.

Vital force is the force, which regulates the combined action of physical forces in a living body to organic formation, promoting thereby the natural, typical and individual, development of such bodies, and combating, as far as possible, the tendency of the unrestrained physical forces to the destruction of organic existence.

There was a time, when almost all the processes in living bodies were directly ascribed to vital force. The progress of physical sciences, especially chemistry, has destroyed this illusion. We know now that most of the processes in organic bodies, formerly unexplained, are carried on by means of uninterrupted chemical action of a far more compound nature than in inorganic bodies. The processes of digestion, of respiration, of animal heat, of assimilation, of elimination, etc., have all been reduced to chemical actions, by means of which external influences, such as food, air, water, etc., are made subservient to the support and maintenance of organic life. Chemical affinity, so far as physical forces are concerned, acts therefore the most important part in the processes of organic life. But besides chemical affinity, other physical forces, indispensable to organic life, must not entirely be overlooked, to wit: heat, light and electricity.

"Without the light of the sun (says Liebig,) plants cannot grow. Sunlight acts in living plants like electricity, which arrests the natural attraction of the elements of water, and separates them from each other. The living germ, the green leaf, owe to the sun their power of transferring earthly elements into living, vigorous structure. The germ may, indeed be evolved underground without the action of light, but only when it breaks through the surface of the soil does it first acquire the power, by the sun's rays, of converting inorganic elements into its own structure. Their power now becomes latent in the new products of the frame, which have been produced, under their influence, from carbonic acid, water, and ammonia. Man, by food, not only maintains the perfect structure of his body, but he daily lays in a store of power and heat, derived in the first instance from the sun. The rays of the sun add daily to the store of indestructible forces of our terrestrial body, maintaining life and motion."

The near relationship between the action of our nervous system and electricity has often been commented upon, and also experimentally proved by Matteuci and others. Though not identical, the two forces seem to be correlated. Nervous action can be induced by electricity, and electricity can be produced, as for instance, in the electric eel, by nervous influence. The phenomena, also, of catalysis, the processes of endosmosis and exosmosis, in the living body, are dependent upon voltaic action. But as the principal actor in the processes of organic life, so far as physical forces are concerned, we acknowledge at present chemical affinity.

Organic chemistry has, within this century, made wonderful progress; it has not only unravelled many mysteries inside the organic bodies, but it has succeeded even in fabricating, outside of them, in the chemical laboratory, some compounds, which nature produces only in organic bodies. This partial success has led some physiologists to another illusion, to wit: that chemistry has not developed to us a new mode of action in organic bodies, but the moving power itself; that organic chemistry has revealed the last cause of action in organic life, and that vital force is an absolute "humbug." Having discovered the hands moving over the dial plate, they imagine they comprehend now thoroughly the propelling force within. This, in my opinion, is as great a mistake as the first was. From all the various, complicated chemical processes in a living body no organic action would ensue, if there was not a higher power behind, that harmonized the isolated chemical processes for one great object, and united the scattered rays, as it were, into one focus, to wit: the development of the organism to its typical and individual destination, and its preservation, as long as possible, against hostile, external agencies. Such power is nowhere in nature bestowed upon any chemical process; there is nothing found in the laws of chemical affinity to warrant any such assumption. It must, therefore, be a new force, superior to physical forces, which controls and regulates them for the interest of organic life. This force is called vital force. It manifests itself from the first moment of germination up to the last moment of life, in a two-fold manner: 1. In directing the organic germ to such growth and development as is inborn to it—(*germinative force*). 2. By resisting all hostile influences as far as possible, and repairing injuries received in the best possible manner, (*vis medicatrix naturæ*). What chemical process is capable of uniting thus harmoniously the grand aggregate of actions in a living body to such a rational purpose, and by what chemical action has ever the most simple organism been produced? Organic chemistry may, in a laborious, circuitous way, produce yet many more organic compounds than heretofore; it might possibly fabricate in the retort gastric juice, bile, and even blood, but with all that it would never be able to form even the most trifling organism; it could never compose that most simple combination of matter and vital force, a primitive cell, the starting point of everything living. This primtive cell is no chemical mystery; its chemical constituents are very simple, and essentially the same in all organic bodies, and, nevertheless, what immense divergence in its development! If chemistry could ever construct the material form of such a cell, would it be capable, too, of imbuing it with the power of development in millions of different forms and lives? No man of sound mind will ever pretend such a thing; and no man of science acknowledges more openly and honestly that impossibility than the chemist *par excellence* of our age, Prof. Liebig, when he says: "In the living body the chemical forces are subordinate to the idea of vital force, and never will chemistry succeed in forming but a simple organic cell out of carbonic acid, ammonia, water, phosphorus, and lime (those principal constituents of the human body)." Let chemistry, therefore, be satisfied with the wonderful discoveries it has made, and with the future triumphs within its reach; but let us not expect impossibilities of that noble science. Chemical force will never supersede vital force, its superior and master, under whose control and supervision it has to work for the support of organic life. Vital force is the higher force, and superior to physical forces in the same degree that organic bodies are to inorganic.

Having thus demonstrated not only the existence of a vital force, but also its superiority to physical forces, let us ask, what becomes of vital force during the decline or decay and death of the organic body. The solution of this question is more difficult than in lower forces, because vital force cannot be measured and tested by scales and crucible, but must be judged only by its effects. Nevertheless, various ways are apparent, by which vital force is either changed into other forces, or preserved intact for future use. Thus it seems not unlikely, that, since organic life is accompanied by a continued series of chemical actions, a part at least of vital force may be gradually converted into chemical affinity, which in course of years becomes thereby so overpowering as to subdue vital force and cause death. The rapid destruction of an organism deprived of life, and its entire submission to chemical laws, seems to be better accounted for by the assumption of a partial and gradual conversion of vital force into chemical affinity. Vice versa chemical affinity may, during vigorous life, be partially converted into vital force. As organic life does not thrive without light, heat and electricity, we may be justified also in assuming a mutual conversion of these forces into each other. The sunbeam, that stimulates organic life to higher vital force, may also absorb and feed on equivalents of vital force.

But however hypothetical, in the present state of physical sciences, such speculations may appear, one plain fact is apparent to the eyes of all observers, viz: that the greater part of vital force in nature is constantly and carefully preserved intact, stored up, as it were, for future use in the form of seed. *Seed is vital force in the most compact, concentrated form.* Nature preserves in this way not only the vital force of the species and genus, but to some degree also that of the individual. When the plant after flowering runs into seed, its growth is arrested and its leaves begin to wither, because nearly all the vital force is turned into seed, and when the seed is matured, the plant may decay; the vital force stored up in the seed will after short rest restore its like ten-fold and a hundred-fold. In lower organizations this seeding process is necessarily connected with the death of the individual; in higher ones it can be often repeated during life and is generally confined to the most vigorous years of life. But, whatever modifications there exist in the seeding process, its general tendency is the same—to preserve the vital force of the organic world from destruction. Vital force is as imperishable and eternal as any other force.

After physical forces and after vital force, there is still another force left for our consideration, which is superior to them all—I mean the reasoning force, represented on our globe by the highest of organic beings, by man.

That physical forces cannot create a human soul, is self-evident; but how is it with vital force, that creates organic beings from the lowest to the highest, under the control of which physical man himself is introduced into the world? Should we not consider man's soul the last and highest manifestation of vital force, attached to the organ of human brain? A thing created cannot be greater than its creator. Let us compare now, what vital force can do and what reasoning force can accomplish. Vital force can, within certain time and space, develop the germ of a seed to its normal physical existence. Organic life, for *physical* purposes, is its beginning and end; and even the feeble traces of mental faculties, developed in animals, are but calculated for the benefit of their physical life. Higher animals, it is true, are endowed with some of the lower faculties of mind; they are capable of drawing single and simple conclusions by means of their memory for pleasant or unpleasant sensations; but there is no consciousness in them, no real reasoning, no following up conclusion after conclusion, no abstract thought, no free moral will, no desire for higher development and future life; in one word, they are not rational beings. Their glimpse of mental force seems but to foreshadow the kingdom above them. There lies a wide and deep gap between them and man's soul, an impassable chasm that neither the "Vestiges of Creation," nor "Darwin's Theory," will fill or bridge. On the one side grazes the animal, his eyes fixed on the ground, intent only upon physical existence and upon sensual gratifications; on the other side stands man, conscious, intelligent, moral, self-controlling man, whose thought is not confined within the narrow limits of physical and vital forces, but unbounded in time and space, rushing quicker than light and lightning from world to world, abstracting from sensual impressions an endless chain of conclusions, and creating thus a new world above the physical, the world of ideas, penetrating into the laws of the whole universe, overawing and controlling all the forces below him, connecting his destiny with the forces above him, and forming the first step in the ascending scale of rational beings from man up to that highest intellectual and moral power called Deity! Such a force, following different laws and pursuing higher objects, is of course superior to vital force, the sole object of which is physical organization.

After all these intrinsic evidences, showing the superiority of reasoning force over vital force, I will mention but one more, that has always struck me as most conclusive of the wide difference between the two forces. I refer to the progressive perfectibility of the human soul. Animals are born with instincts, (involuntary mental actions,) that develop themselves without instruction, remain stationary throughout life, and do not reach high perfection by education. Man alone, of all animals, is born physically and mentally the most helpless; but by physical care and by education his condition is raised from a state of utter helplessness to that of physical and mental superiority. But there is still a wide difference between this development of the body and of the mind in man. While his body, that assimilates him to the animal world, requires far more care than in animals to be developed to its highest animal perfection, it shares with all animal organization the common fate of gradual increase and decrease. The human soul, on the contrary, by which man initiates a new kingdom, that of rational beings, seems to be throughout life under constant progressive development. With every age of life the development of new faculties seems to correspond. Thus, for instance, is the power of imagination and poetical fiction more appropriate to younger years, while the far more complicated and higher power of abstract reasoning belongs more to riper years. Thus we see men, who throughout life have cultivated their minds by study, observation and self-thought, passing with the years through the stages of poetical fiction, philosophical reflection, and abstract mathematical reasoning, and preserving the richly developed faculties of their minds intact to the last of their physical existence. Socrates was near seventy, when he made his immortal defence before his worldly judges, and sealed, undaunted, a life of intellect and virtue by the death of a martyr for truth. Humboldt, as an octogenarian crowned a glorious life, spent in the most universal philosophical intuition of nature, with that everlasting monument—the Cosmos. Milton wrote his greatest work at the age of sixty. But, aside from such heroes, what man of ordinary mind, cultivating it throughout life, has ever found a limit to its progress? Having mastered some science, having discovered some truths, he penetrates constantly into new fields and new researches, and with every exertion the work grows easier, his mind becomes more universal, his prospect wider, until suddenly physical decay steps in and hurries to the grave what seemed to be destined for eternity. Is nature really such a spendthrift of her forces? Can she annihilate what she created with the germ of progressive perfectibility? By no means! The mysterious, intimate connection between body and soul, and their mutual influence upon each other, may often retard the progress of the mind, and the feebleness and decline of the body may partially affect the activity of its spiritual companion; but close observation will show the fallacy of the common opinion, that the mind is declining in years in proportion with the body. The mind has a life of its own, and is capable of progressive perfection from the cradle to the grave.

If reasoning has led us thus step by step to the conclusion, that the human soul is a force of its own, superior to physical forces and to vital force, we must believe too, that the human soul cannot be annihilated, or, as it is commonly expressed, that it must be immortal. When the lower forces are carefully preserved in nature, the higher ones certainly are not doomed to perdition, but ought to be still more carefully preserved.

The next question offering itself is, of course, in what manner is this force preserved? Is it converted incidentally during life into vital force, to return with it by the seeding process into new physical organization, or, in other words, is it to be preserved only by physical propagation from parents to children, and has it in every instance to begin again from the beginning? This would be a very limited and partial mode of preserving this force; it would leave its continuation to mere chance; it would not account for its sudden disappearance at the moment of death; it would destroy its marked individuality by abolishing its highest attributes, consciousness and free will; it would exclude the law of progress and constant perfectibility, inherent to the soul, and be in fact not much better than annihilation. Or is it preserved, according to the views of ancient philosophers, by continued transmigration of the souls, at the moment of death, from and into animal and human bodies on our globe? The low standing of many millions of our race, whose intellectual and moral qualities are scarcely elevated above the animal, has probably suggested this idea of consanguinity between animal and human souls; and I am free to confess, that I could not see any injustice in the return of the souls of men who, during life, have only brutalized themselves, into the very nature of brutes. But the hypothesis lacks all natural evidences and is at best but a philosophical dream. The ancients, when the greater part of our globe was still a terra incognita, located the abode of departed spirits in the "happy islands," far away in the Atlantic, in the fabulous west. But in our pragmatical age, every nook and corner of our earth has been so explored, that nowhere is a spot left for myth and tradition.

Now, if our soul is immortal and destined, after its disconnection with the body, to a new and progressive life in some other form, where in all probability shall we find it, if not on our globe? In heaven, is the general term used by religion, which by science is defined: on other celestial bodies similar to our own. Astronomy has disclosed to us an infinity of worlds, a few smaller, most of them immensely larger than this earth. The law of gravity controls them all; aërolites as well as the late discoveries in spectroscopy prove, that the same matter essentially and the same chemical laws exist there; with some of them our globe is in direct communication by the messengers of light, heat, and magnetism; on others, signs of an atmoshere, clouds, snow, volcanic mountains, etc., have been discovered. If our knowledge of their physical condition is still very imperfect, we know nothing at all of their organic life. But if we may draw some conclusions from the inexhaustible creative power on our globe, where earth, water and air are filled with countless myriads of organic life, past, present and future, we must suppose too, that organic life and rational beings exist no less on other celestial bodies. Neither must we expect, that life developed there should be entirely of the same form and character as found with us. Nature abhors such sameness. She creates no two things quite alike. She pursues with simple materials a general plan of creation in endless modifications and varieties, and is inexhaustible in resources to adapt different means to different ends. Whoever supposes, that nature has exhausted her creative power on our globe, which after all is a mere atom in the galaxy of the heavens, to leave all the rest of the universe a vast desert, has formed but a poor conception of the immensity of that Power and its eternal wisdom and foresight; neither has he understood the true meaning of the sublime and simple words—"In my Father's house there are many mansions."

Thus far and not farther does scientific reasoning lead us on a subject of the highest interest to mankind, the substance of which we may sum up in the words: Both matter and force are eternal, and the highest force in man is his immortal soul.

Coal Measures in Missouri.

By G. C. Broadhead.

[Read May 5, 1862.]

In the following pages I have endeavored to present some of the principal facts relating to the Coal Measures of Missouri, being the result of several years' careful observation of the Coal Series in Northern Missouri, obtained during my connection with the State Geological Survey.

Covered, as these rocks often are, with deep Bluff deposits and debris from sandstone and shale beds, the connection of sections is sometimes attended with difficulty. Notwithstanding these difficulties, I have succeeded in forming a connected section of 2,065 feet of Coal strata, based upon observations on the Missouri River, from the N.W. corner of the State to Glasgow.

Along the river bluffs in Atchison County a connected section was obtained, but in Holt for 18 miles, extending from the N.W. part of the county to near Forest City, the rocks are hidden by the Bluff Formation; but, by crossing the river at Yancton, observing the rocks there and above White Cloud, a connected section was formed with rocks at Forest City. Further down the river, connected sections can generally be obtained at the river bluffs, and when there is any doubt, the connection can generally be made by examining the bluffs along the small creeks.

The following is presented as a complete section of the rocks enumerated. From No. 172 to 275, I am indebted to notes of Messrs. C. G. Wheeler and H. A. Ulffers' sections in Ray and Carroll Counties.

SECTION ON MISSOURI RIVER.

No.	Thickness. ft. in.	Total Thick. ft. in.	Description.	Localities.
1	250		Bluff formation.	Atchison Co.
2	3+	3 3	Sandstone, soft and hard; coarse greenish gray.	
3	10	13	Slope. This may include the following section:	Rock Creek.
			No. 2—3 feet coarse and shelly bluish-gray limestone; contains *Chonetes*.	Barton's mill.
			No. 3—6 ft. argillaceous shales, drab and lead blue.	
			No. 4—1 ft. blue, argillaceous and pyritiferous limestone.	
			No. 5—4 ft. blue argillaceous shales.	

Section on Missouri River (continued).

No.	Thickness. ft.	in	Total Thick. ft.	in.	Description.	Localities.
					No. 6—Fossils on top of No. 7, including many *Crinoids. Iron pyrites* abounds. No. 7—2 feet blue limestone, weathers brown, with *Productus Calhounianus.*	
4	1		14		Somewhat greenish and dull lead-blue hard silico-ferruginous limestone.	Atchison Co.
5	8		22		Sandstone; the upper 3 ft. is irregularly bedded, and micaceous, green; lower part soft, brown.	
6	30		52		Shales and sandstone; red shales in upper part; thick-bedded sandstone at bottom.	
7	4		56		Shaly limestone, containing fossils.	
8	1	4	57	4	Blue concretionary limestone, traversed by veins of calcareous spar.	
9		2			Sandy shales.	
10		2			Impure coal and shales.	
11	3		60		Soft blue sandstone.	
12	20		80		Sandstone and sandy shales.	
13	1	6	82		Dark blue, shaly limestone.	
14	1	6	83	6	Red and green shales with limestone nodules.	
15	4		87	6	Limestone; upper part nodular, light blue, weathers brown, and abounds in *Fusulina.*	
16	28		115	6	Blue and drab argillaceous shales, mostly drab and olive, thick-bedded, some variegated and banded.	
17	2		117	6	Limestone; the upper 6″ is coarse, dark and shaly; below fine-grained, bluish-drab; contains *Bellerophon, Crinoid* stems, &c.	
18		10	118		Blue fossiliferous shales; *Pecten Broadheadi, Productus, Bryozoa,* &c.	
19	5	6	123	6	Sandstone, greenish at top; the lower 3′ is quite ferruginous, and contains sandy ferruginous nodules,	
20	6		129	6	Blue argillaceous shales.	
21	1		130	6	Tolerably fine grained blue limestone; perpendicularly jointed; weathers brown.	
22	11		141	6	Shaly slope.	
23	3		144	6	Nodules of limestone in clay, and decomposing limestone.	
24	8		152	6	Slope; at lower part is seen a buff limestone abounding in *Edmondia Hawni, Myalina, Pinna, Productus Rogersii,* &c.	North'n part of Holt Co.
25	2		154	6	Thick bed of ferruginous limestone, brown crusted on the outside; contains *Chonetes,* &c.	
26	5		159	6	3 ft. of greenish shales in the upper part, and 2 ft. of red shales below.	
27	14		173	6	Sandy shales.	

Section on Missouri River (continued).

No.	Thickness. ft. in.	Total Thick. ft. in.	Description.	Localities.
28	50	233	Slope, probably shale.	
29	9 6	232 6	Ferruginous limestone, mostly in even strata; weathers brown; contains very few fossils.	Yancton, in Nebraska, & above White Cloud.
30	3	236	Argillaceous shales.	
31	10	237	Bituminous coal.	
32	2	239	Sandstone and sandy shales.	
33	9	248	Argillaceous shales.	
34	8	249	Bed of ironstone, sometimes concretionary.	
35	45	293	Upper 6″ shales, as probably is all the remainder.	
36	34	327	Sandstone and sandy shales; the sandstone is soft, but shales are hard, thinly laminated, and somewhat calcareous.	Seen above White Cloud in Kansas.
37	17	344	Argillaceous shales; contains concretions of carbonate of iron.	
38	2	346	Blue, shelly, earthy limestone.	
39	2	348	Blue argillaceous shales.	
40	5	353	Slope, mostly shales.	
41	1 5	354 5	Mottled blue limestone, hard, evenly jointed, fracture conchoidal, weathers brown; contains *Edmondia Hawni*, *Euomphalus complanatus*, *Orthis hemiplicata*, &c.	Below White Cloud and above Forest City. Is the highest rock in the west'n part of Nodaway Co.
42	3 6	358	Blue argillaceous shales.	
43	2–4		Bituminous coal. In Nodaway Co. is 6″ to 16″.	This coal occurs on Nodaway River, near State line.
44	1	359	Ochreous and argillaceous shales.	
45	10	369	Sandy shales and sandstone.	
46	10	379	Slope.	
47	5	384	Deep blue limestone, containing *Lingula*.	Quitman, in Nodaway Co.
48	3	387	Dark greenish-drab or blue shales.	Rolling Bra., Holt Co.
49	4	391	Nodular limestone interstratified with shale; abounds in fossils: *Fusulina cylindrica*, *Spirigera subtilita*, *Productus Rogersii*, *Ceriopora(?)*, *Or. umbraculum*.	Smith's Mill, on Nodaway River.
50	1	392	Brown and drab limestone.—*Lowest range of Pr. Calhounianus.*	
51	10	393	Brown calcareous shales.	
52	1 6	394 6	Ashy-blue limestone; abounds in *Fusulina cylindrica*.	
53	10	395	Brown calcareous shales, very fossiliferous; contains *Spirigera subtilita*, *Spirifer Kentuckensis*, *Orthisina umbraculum*, *Coral*, *Bryozoa*, &c.	Forest City, and Smith's Mill, in Nodaway Co.
54	1 6	397	Blue and dark shales.	
55	1	398	Blue and drab limestone.	
56	6	404	Limestone and shales.	

Section on Missouri River (continued).

No.	Thickness. ft.	in.	Total Thick. ft.	in.	Description.	Localities.
57	5		409		Light blue thick-bedded shales, mostly argillaceous and micaceous.	
58	4	6	413	6	Sandstone and shales; upper 2½ feet is gray; useful for building and for making grindstones: 1 ft. shales in the middle, and 1 ft. hard sandstone at the base.	
59		6	414		Buff and earthy limestone.	
60	10		424		Slope, probably all shales and sandstone.	
61	5		429		Limestone, mostly blue and bluish-gray; good for building purposes.	
62	1	4	430	4	Bluish-gray limestone; hard and tolerably fine-grained; weathers with a rough, sandy appearance; contains *Orthisina robusta.*	
63	5		435	4	Green clay or shales; contains limestone nodules.	
64	7		442	4	Shelly ferruginous limestone; 1′ of brown limestone at top, and 2′ of brown and blue shales in the middle, with limestone at bottom; contains *Productus Rogersii, Pr. æquicostatus, Archæocidaris,* &c.	
65	8		450		Shales at top, limestone below.	
66	1		451		Bluish-drab limestone.	
67	10		461		Slope—limestone and sandy shales, the lower 5′ shales.	
68					Bed of *Tutenmergel,* from 1″ to 2½″.	
69	2	6	433	6	Ashy-blue limestone, divided thus: No. 1, 3″ thinly laminated brownish-gray limestone. No. 2, 10″ ashy-blue limestone; contains blue chert. No. 3, 4′ brown shales. No. 4, blue limestone somewhat mottled.	Four miles below Forest City, and on bluffs below, and capping the hills near Nodaway river as far up as Ohio Mills.
70	17		480	6	Limestone, mostly in irregular beds; ashy-gray and ashy buff, with occasional thin beds interstratified; abounds in *Orthis hemiplicata;* in the upper strata are beautiful univalves.	
71	5		485	6	Shales.	
72	1		486	6	Bituminous shales.	
73	2		488	6	Ashy grayish-drab limestone; is fine-grained and would look well polished; is often a uniform gray crystalline.	
74	8		496	6	Green argillaceous shales.	
75	10		506	6	Upper part thin-bedded brownish limestone; the middle brown and thick-bedded; below it is soft and whitish; the lower 3 feet very soft and decomposing.	
76	5		511	6	Ripple-marked sandstone and shales.	
77	13		524	6	Shales.	
78	10		534	6	Sandy and argillaceous shales.	

Section on Missouri River (continued).

No.	Thickness. ft.	in.	Total Thick. ft.	in.	Description.	Localities.
79	2		536	6	Dark, coarse, shaly limestone; abounds in *Myalina subquadrata*.	
80	6		542	6	Greenish-olive argillaceous shales.	
81	4	6	547		Drab limestone, slightly tinged with green near the surface; contains *Syringopora, Pinna, Bryozoa*, &c.	
82	1		548		Drab argillaceous shales.	
83	1	6	549	6	Blue and bituminous shales.	
84		2			Bituminous shale, passing into shaly coal.	
85		3	550		Dusky bituminous shale.	
86	1		551		Upper 2″ ashy calcareous shale, fossiliferous; below is an ashy-gray *Fusulina* limestone.	
87	2		553		Argillaceous shale.	
88	12		565		Buff limestone, mostly soft earthy; lower part shaly; a portion is cellular.	
89	3		568		Shales.	
90	4		572		Buff or brown limestone.	Highest rock in the western part of Platte Co.
	1		573		1′+ blue argillaceous shales. A trace of coal is seen ⅛ of an inch thick.	
91	19		592		Sandy and argillaceous shales.	Lincoln Crk. in Andrew Co.
92	2	6	594	6	Blue shelly limestone; contains *Bryozoa, Chonetes*, &c.	
94	9		603	6	Blue argillaceous shales.	
95	3		606	6	Sandy shales.	
96	8		614	6	Limestone in good even beds; is sometimes Oolitic; gray and bluish crystalline; is very good for building; in the western part of Platte Co. observed a thin bed of *Tutenmergel* in the upper part.	Landers' quarry, near Savannah.
97	4		618	6	Shales, argillaceous and calcareous—thins out.	West part of Platte Co.
98	20		638	6	Irregularly bedded bluish-drab, ash, and grayish-drab limestone; contains blue chert, which is mostly confined to the upper part and in lenticular beds: contains *Fusulina cylindrica, Pr. Rogersii, Spirigera subtilita, Syringopora*, &c.	Lowest rock at Dallas. Highest rock at Amazonia, and southw'd in Platte and Buchanan. At Wathena, in Kansas. Highest rock on Island Br. in Gentry Co.
99	4	6	643		Blue and bituminous shales.	At Whitesville.
100	2		645		Ash colored dull-looking limestone; bluish and dark mottled; has shaly partings, is even-bedded. Near Whitesville, Andrew Co., it contains beautiful univalves.	Half a mile below Iatan, in Platte Co.

Section on Missouri River (*continued*).

No.	Thickness. ft.	in.	Total Thick- ft.	in.	Description.	Localities.
101	1	6	646	6	Pyritiferous shale and pyritiferous limestone.	
102	8		655		Green argillaceous shale.	
103	7		662		Coarse greenish-drab limestone, weathers to drab, is sometimes shaly on top.	3′ thick at Whitesville, & 8 in south part of Buchanan.
104	16		678		Shales, green near the top.	
105	5		683		Even-bedded brownish-gray limestone.	Amazonia.
106	3		686		Green shales.	
107	5		691		Red shales.	
108	6		697		Green shales; sometimes sandy at the lower part. In the eastern part of Andrew Co. a bed of coal is seen varying in thickness from 4″ to 10″; towards the Missouri River this bed thins out.	Wathena, S. W. corner of Andrew Co., and below St. Joseph.
109	9		706		Ferruginous limestone, often appears like a conglomerate.	
110	60		766		Sandy shales; some argillaceous; contains concretions of carbonate of iron, and 20 ft. from bottom a 9″ bed of coal crops out.	
111		6′	767		Coarse grayish-blue limestone.	
112	1	6	768		Bituminous shales.	
113		5	768	6	Limestone like No. 111, but more shaly.	
114		4	769		Thickly laminated calcareo argillaceous shales; abounds in *Pr. æquicostatus.*	
115	17		786		Argillaceous shales.	
116	5′		791		Limestone, gray crystalline and tolerably fine-grained. In upper part are found many fossils—*Pecten, Pr. Rogersii, Spirigera*, &c.	Quarries below Saint Joseph.
117	32		823		Shales, part sandy and part argillaceous.	
118	1		824		Blue shaly limestone and shales; abound in fossils—*Bellerophon per carinatus, B. Urii, B. Meekii, B. Grayvillensis, Myalina subquadrata, Mytilus, Pinna, Machrocheilus, Pleurotomaria sphærulata, Murchisonia, Pr. Rogersii, Nucula, Arstarte vera, Nautilus nodoso-dorsatus, Crinoids,* &c.	6 miles north of Weston, near St. Joseph road. Mo. Bluffs above Iatan. Lowest rock in Andrew Co.
119	11		835		Shales, blue above; brown below, with some nodules of limestone,	
120		6	835	6	Dark gray limestone, resembles No. 118.	
121	13		848	6	Sandy shales; 5 ft. from bottom is an 8 inch bed of coal.	
122	18		866	6	Gray limestone; on exposure breaks into many small angular fragments; generally appears in one bed.	
123	56		922		Slope, probably all shales.	
124	12		934		Shales. On head of Todd's Creek, in Platte Co., observed 1—2′ blue limestone.	Weston.

Section on Missouri River (continued).

No.	Thickness. ft.	in.	Total Thick. ft.	in.	Description.	Localities.
					2—1′ calcareous sandstone, containing *Pecten* and *Myalina*. 3—10′ shales. (1½ miles above Brush Creek, on Mo. bluffs, is 16′ of sandstone, and Nos. 125 & 126 not seen.)	
125	2	9	936	9	Ashy limestone, containing *Bryozoa*, *Orthisina umbraculum*, &c.	
126	1	6	938		Ashy-green argillaceous shales.	
127	3		941		Ochreous brown and decomposing limestone.	Weston.
128	13		954		Gray limestone, sometimes reddish or fleshy gray, with specks of pellucid calc spar disseminated, in tolerably even beds; at top is found *Fusulina cylindrica*, *Archæocidaris* and *Crinoid* stems; springs abound at the base.	
129	5		959		Blue and bituminous shales.	
130	1	6	960	6	Argillaceous shales.	
131						
132	2	6	963		Blue limestone, even-bedded, fine-grained; abounds in *Productus Rogersii* and *Pr. æquicostatus;* has also *Orthis hemiplicata*, *Spirigera*, *Or. Missouriensis*, *Or. umbraculum*, and *Spirigera subtilita*.	14 miles below Weston it is 4′ thick.
133	13		976		The upper 1′ is sandy shales; below it, we have at Weston 10′ of hard blue, slightly calcareous, ripple-marked sandstone, which is often replaced by a sandy shale; lower part, sandy shales. At some places this bed almost thins out; at other places it is thicker.	
134	18		994		13′ to 23′ of limestone, distinguished in Note Book by the name of "Plattsburg limestone." Near Farley it is 13′ thick, and becomes thicker as we descend the river. Near Farley it is coarse gray and ashy-blue. In the eastern part of Platte and in Clay Co. we generally find at top from 2′ to 3′ of buff limestone, having a pot-metal ring; below, it generally appears thus: 1—8′ dark ash limestone; it weathers brown; contains *Pr. costatus*, *Pr. æquicostatus*, *Bryozoa*, &c. 2—2′ coarse gray and minutely cherty limestone. 3—6′ bluish-gray limestone, with numerous remains of fossils, leaving lines of calc spar. 4—2′ irregularly bedded blue limestone; weathers brown; contains chert, *Pr. costatus*, *P. Rogersti*, *Sp. cameratus*. 5—2′ soft decomposing brown limestone.	Plattsburg in Clinton Co.; Liberty, Smithville, and in Platte Co.; everywhere on Platte River, and more easily recognized than any other Coal Meas. rock.

Section on Missouri River (continued).

No.	Thickness. ft. in.	Total Thick. ft. in.	Description.	Localities.
.			6—1′ Brownish-gray limestone; weathers brown; contains *Sp. cameratus.* 7—1′ dark shale, slightly bituminous. 8—3′ gray limestone, abounding in *Fusulina.* The lower 2′ is generally a dark ash and quite brittle; it abounds in fossils, including *Pr. tubulospinus, Pr. gigantissimus, Allorisma, Edmondia Hawnii, Pinna, Nautilus nodoso-dorsatus, Bryozoa, Or. umbraculum, Pr. æquicostatus, Chonetes,* &c.	
135	3	997	Brownish calcareous sandstone; has a green tinge; contains *Myalina,* and *Or. umbraculum.*	Union Mills, & Ringgold, in Platte Co.
136	16	1013	Sandy shales.	
137	16	1029	Sandstone; at one place is 38′ thick.	
138	10	1039	Sandy shales.	
139	2 6	1041 6	2½′ to 10′ dark brownish-gray silicious limestone; is sometimes Oolitic; often abounds in fossils; *Pr. tubulospinus* and *Pr. gigantissimus* are the most common.	Liberty, and 5 ms. above Parkville, & on Todd's Creek.
140	5	1046 6	Shales.	
141	1 6	1048	Calcareous sandstone, fossiliferous; contains *Bellerophon Urii,* a trilobite, and several species of univalves.	
142	20	1068	Sandy shales.	
143	13	1081	Irregularly bedded gray limestone, dark colored towards the lower part, and contains a small *Productus, Goniatite,* &c.	
144	25	1106	Slope, probably shales; at Parkville it is 38′, a few miles above it is 20′, and 25′ to base of No. 145.	
145	5+	1111	Shales.	
146	5	1116	Tolerably fine-grained limestone, ashy-gray or dark bluish-ash; abounds in fossils, the principal of which are *Pr. gigantissimus, Pr. tubulospinus, Pr. costatus, Pr. Rogersii, Orthisina Missouriensis, Or. robusta, Spirifer cameratus, Bryozoa,* and *Pr. punctatus.*	At Parkville, and ½ a mile east of Liberty.
147	16	1132	Shales; some beds are purple.	
148	1 6	1133 6	Coarse greenish-gray limestone, full of *crinoid* stems and remains of fossils.	
149	5	1138 6	Shales.	
150	6	1144 6	Greenish-drab limestone, fine-grained and closely crystalline; contains a coral resembling a *Cyathophyllum.*	
151	3	1147 6	Shales.	
152	13	1160 6	Mostly a light colored fleshy-drab, fine-grained silicious limestone, somewhat resembling lithographic limestone, with beds of buff hornstone often with	Parkville, & bluffs below for 6 miles.

Section on Missouri River (continued).

No.	Thickness. ft.	in.	Total Thick. ft.	in.	Description.	Localities.
					beautiful dendritic markings. Three-quarters of a mile N.E. of Liberty, Clay Co., it appears in railroad cut 13′ in thickness, of which the upper 4′ is fine-grained compact buff, containing reniform concretions and lenticular beds of chert; the next 5′ is s coarse Oolitic brownish-gray silicious, and the lower is ashy-blue with buff shaly partings. Fossils are very rare; found an *Orbiculoidea.*	Near Liberty.
153	19		1179	6	Dark olive and blue shales.	Parkville & Liberty.
154		10	1184	4	Even-bedded dark ash or bluish-gray coarse limestone, somewhat shaly; contains *Pr. splendens.*	Lowest rock at Parkville.
155	3		1183	4	Greenish olive argillaceous shales.	¾ mile N.E. of Liberty.
156	1		1184	6	Hard compact limestone; fracture shows a deep ashy-blue color; a ferruginous crust is formed on exposure; is somewhat concretionary: contains *Pinna Pr. æquicostatus,* &c.	Liberty, and 2 miles above Randolph.
157	4		1188	6	Drab and blue shales.	
158	1	10	1190	6	Hard, close-grained, thinly laminated, blue calcareous sandstone; fossils in the upper 4″, including *Pecten,* small *Myalina,* &c.	¾ mile N.E. of Liberty. Mo. Bluffs, 2 miles above Randolph.
159	2	6	1193		Blue shales.	
160	13		1206		Deep blue limestone with blue chert; on Missouri bluffs near the west line of Clay Co. the upper part consists of hard crystalline limestone, then 4′ blue limestone with lenticular beds of blue chert containing small Lamellabranch fossils in the lower part; and at bottom 4′ deep blue concretionary argillaceous limestone in shales, and containing impressions of plants (161). Three-quarters of a mile N.E. of Liberty the section appears thus:	E. of Liberty and on Missouri bluffs from west co. line nearly to Liberty landing.
					1.—2′ thinly laminated, blue, silicious limestone, interstratified with blue chert and containing many beautiful univalves silicified; also some impressions of plants and carbonaceous stains. 2.—2½′ blue silicious limestone, with beds of blue hornstone in lenticular strata—vegetable impressions. 3.—8′ blue limestone, with many fossil plants; also *Myalina subquadrata, Myalina, Pinna, Orthoceras,* &c.	Probably the equivalent of the deep blue limestone near Bethany, Harrison County, which abounds in so many beautiful fossils.

Section on Missouri River (continued).

No.	Thickness. ft. in.	Total Thick. ft. in.	Description.	Locatitics.
161	4	1210	0 to 7′ calcareo-argillaceous and earthy concretionary limestone. Half a mile east of Liberty it appears thus : 1. 3′ shales. 2. 14″ blue limestone. 3. 8″ shales. 4. 6″ blue limestone. 5. 2′ shales with a thin bed of concretionary limestone—fossil plants.	Same locality as the last.
162	16	1226	Limestone, distinctly separated lithologically into two parts ; the upper 5′, the lower 11′. The upper part is generally very fine-grained, and in two beds ; its color flesh, dove, or fawn ; and contains particles of calc spar, but which are often absent, leaving minute cavities. The lower 11′ is white, light gray, or bluish-drab, and contains *Productus costatus, Pr. Prattenianus, Pr punctatus*, and *Productus* (small species like *Pr. Wabashensis*).	
163	1	1227	Clay shales.	
164	2	1229	Bituminous shales.	
165	2 6	1231 6	Argillaceous shales ; upper part dark, and containing many small round calcareous concretions.	
166	18	1251 6	18′ to 22′ "Bethany Falls" limestone. Upper 7″ is fine-grained dove-colored, brittle, shelly, and fucoidal, scarcely containing fossils. The lower part is irregularly and evenly bedded, light grayish, or drab crystalline, weathering buff ; contains *Prod. costatus* and *Pr. splendens*. Springs abound at the base.	Randolph ; Liberty landing ; e. of Liberty ; top rock at Missouri City ; Bethany, in Harrison Co.; Gallatin, in Daviess Co.
167	3	1254 6	Blue and bituminous shales ; 1½ feet at bottom consists of bituminous shales, and at top we have 1′ to 2½′ of blue argillaceous.	Randolph, E. of Liberty.
168	1	1255 6	Even-bedded ashy-blue limestone, jointed perpendicularly. Near Randolph it is 16″ in thickness, but eastward it becomes thinner.	Randolph, E. of Liberty.
169	2 6	1258	Nodular limestone and shales abounding in fossils—*Pr. tubulospinus, Pr. costatus, Orthisina Missouriensis, Or. umbraculum.*	
170	6	1264	Fine-grained, hard, bluish-buff, silico-ferruginous limestone ; weathers brown ; is rather irregularly bedded.	
171	20	1284	Shales, mostly sandy ; towards the lower part are calcareous beds containing *Myalina Swallovii* and *Pr. Norwodii.*	
172	8	1292	Buff and gray limestone.	
173	86	1378	Shales and sandstone.	
174	8	1379	Gray crystalline limestone.	

Section on Missouri River (continued).

No.	Thickness ft.	Thickness in.	Total Thick. ft.	Total Thick. in.	Description.	Localities.
175	12		1391		Blue and purple argillaceous shales.	
176	4		1395		Buff and gray argillaceous shales.	
177	9		1404		Variegated and argillaceous shales.	
178	4	6	1408		Bluish-gray shaly limestone.	
179	2		1410		Drab argillaceous shales.	
180		2			Bituminous shales.	
181		1			Coal.	
182		1	1411		Dark blue limestone.	
183	2	6	1414		Bituminous shale.	
184	2		1416		Calcareous shales.	
185		4			Coal.	
186	1		1417		Fire clay.	
187	20		1437		Sandy shale and sandstone.	
188	2		1439		2′ to 5′ bluish-gray limestone.	
189	8		1447		8′ to 15′ argillaceous and marly shales.	
190	4		1451		4 to 7′ bluish-gray limestone.	
191		6	1452		Bituminous shales.	
192	2		1454		1′ 8″ to 2′ 4″ bituminous coal.	Lexington.
193	3		1457		Argillaceous shales.	
194	3		1460		Coarse-grained light gray limestone.	
195	29		1489		Shales.	
196	2		1491		Hard blue limestone.	
197	34		1525		Brown micaceous sandstone.	
198	28		1553		Argillaceous shales.	(*) The coal near Utica (two beds) should come in about here.
199	2	6	1555	6	Gray and bluish-gray limestone, fossiliferous.	
200	9		1564		6′ to 12′ 6″ argillaceous shales.	
201		6	1565		Hard blue limestone.	
202		8	1566		Argillaceous shales.	
203	2		1568		Bituminous shales.	
204	1	10	1570		Bituminous coal—Lower Grand River.	
205	6		1576		Argillaceous shale. It is 12 feet in Carroll Co.	
206	4		1580		Impure gray limestone.	
207	41		1621		Sandstone and sandy shales.	
208	11		1632		Argillaceous shale.	
209	4		1636		Blue limestone.	
210	2		1638		Bituminous shale.	
211	8		1646		Argillaceous shale.	
212	2		1648		Coal. Lower coal at Wm. B. Brown's, 5 miles N. of Brunswick.	
213	6	6	1654	6	Argillaceous shale.	
214	4		1658	6	Light gray limestone.	
215	5		1663	6	Argillaceous shale.	
216	5		1668	6	Fine-grained gray limestone.	
217	4		1672	6	Argillaceous shale.	
218	3		1675	6	Bituminous shales.	
219	1	6	1677		Coal. Marion G. O'Wherin's.	
220		6	1677	6	Fire clay.	
221	1	6	1679		Blue limestone.	
222	26		1705		Sandstone and sandy shales.	
223	2		1707		Blue limestone.	
224	4		1711		Argillaceous shales.	
225	2		1713		Bituminous shales.	
226	1	6	1714	6	Coal.	
227	4	6	1719		Argillaceous shale.	

Section on Missouri River (continued).

No.	Thickness. ft.	in.	Total Thick. ft.	in.	Description.	Localities.
228	2		1721		Coarse-grained light gray limestone.	
229	3		1724		Bituminous shales.	
230	4		1728		Gray and blue limestone.	
231	40		1768		Sandstone and sandy shales.	
232	3		1771		Gray limestone.	
233	1		1772		Argillaceous shale.	
234	1	6	1773	6	Bituminous shale.	
235	7		1780	6	Argillaceous shales.	
236	3		1783	6	Hard blue limestone.	
237	6		1789	6	Argillaceous shale.	
238	3		1792	6	Bituminous shale.	
239	3		1795	6	Blue and gray limestone.	
240	18		1813	6	Argillaceous shale.	
241	1	8	1815		5" to 1' 8" coal.	
242	24		1839		Argillaceous shale.	
243	1	6	1840	6	5" to 1' 6" coal.	
244	17		1857	6	Sandstone and sandy shale.	
245	2		1859	6	Gray and buff limestone.	
246	2		1861	6	Argillaceous shale.	
247	30		1891	6	Micaceous sandstone.	
248	2	6	1894		Impure gray limestone.	
249	3		1897		Argillaceous shale.	
250	6		1903		Shaly sandstone.	
251	1		1904		Argillaceous shales.	
252	2	6	1906	6	2' 6" to 4' coal.	
253	9		1915	6	Sandstone and shales.	
254	2		1917	6	Blue and buff limestone.	
255	10		1927	6	Shales.	
256	3		1930	6	Blue limestone.	
257	3		1933	6	Bituminous shale.	
258	1	6	1935		Coal.	
259	7		1942		Argillaceous shale.	
260		8	1943		8" to 1' 6" coal.	
261	47		1990		Sandstone.	
262	1	6	1991	6	2" to 1' 6" bituminous shale.	
263	1	6	1993		Argillaceous shale.	
264	2	6	1995	6	Coal.	
265	5		2000	6	Argillaceous shale.	
266	1	6	2002		Coal.	
267	3	6	2005	6	Argillaceous shale.	
268	2		2007	6	Hard blue limestone.	
269	5		2012	6	Argillaceous shale.	
270	1		2013	6	Fine-grained light gray limestone.	
271	5		2018	6	Argillaceous shale.	
272	1		2019	6	Light gray limestone.	
273	2		2021		Argillaceous shales.	
274	2	6	2024		Buff limestone.	
275	2	6	2026		Light gray limestone.	
276	3		2029		Argillaceous shale; 3' to 8' with ferns, at Glasgow.	
277	8		2037		Fine-grained limestone, mottled.	
278	3	6	2040		Argillaceous shales.	
279	1		2041		Bluish-gray and buff limestone.	
280	3		2044		Bituminous shale with nodules of limestone.	
281	4		2048		Argillaceous shales.	

Section on Missouri River (continued).

No.	Thickness. ft. in.	Total Thick. ft. in.	Description.	Localities.
282	1 8	2050	Bituminous coal. The lower 8" is shaly with clay.	At Glasgow, in river.
283	8	2058	Blue and yellow ochreous shales.	
284	7	2065	Micaceous sandy shales.	

In the above Section there are 433′ of limestone, 55′ of calcareous shale, 730′ of argillaceous shale, 289′ of sandy shale, 465′ of sandstone, 24′ bituminous coal, 38′ bituminous shale, 1½′ fire clay, 4½′ calcareous sandrock, and 8″ ironstone.

For convenience and comparison I have separated the coal series into several Groups, each possessing characters somewhat peculiar, and separable from each other by moderately well marked natural lines; but there can scarcely be said to be any strongly marked Groups, and but few strata can be recognized, except by their connection and relation with other beds of the series.

The base of Group "F" is a good natural line of division, for no beds of fire clay have been found above it, while the workable beds of coal are thicker and more abundant below.

The base of the Lexington Coal Group is another good line of demarcation, since the coal is mostly below, and the lower limestones differ essentially from those above.

The Plattsburgh Group is the only well marked group in the whole coal series; and by its fossils may readily be distinguished from all other groups.

The following table shows the thickness and general character of the several groups.

NAME OF GROUP.	NOS.	LIMESTONE.	CALCAREOUS SHALE.	ARGILLACEOUS SHALE.	SANDY SHALE.	SANDSTONE.	BITUMINOUS SHALE.	BITUMINOUS COAL.	CLAY.		TOTAL.
A	TO 47	32½ 0.08	30 0.08	188 0.50	8 0.02	112 0.3		1′ 4″ 0.004		8″ ironstone.	370
B	69	28½ 0.37	2 0.02	18½ 9.24	14	13					76
C	98	85 0.47	5 0.028	48 0.27	32	5	3	Trace.			178
D	134	72 0.21	12½ 0.37	122 0.362	110 0.32	15 0.044	6 0.017	2′ 2″ .0064			337
E	146	38 0.28		30 0.22	46 0.34	16 0.12				4½′ calcareous sandstone. 0.033	134
F	172	91 0.52	3½ 0.02	55	20		3				174
G	193	27 0.15	2 0.01	36 0.20	20 0.11	86 0.5	3 0.01	2′ 6″ 0.01	1 .006		176
H	284	59 0.70		233 0.39	39 0.06	218 0.30	21 0.03	18 0.03			588
Total.		433	55	730	289	465	24	38	1½		2,039
		0.21	0.02	0.35	0.143	0.22	0.011	0.018			

From the above table it will be seen that the shales occupy a large proportion of the whole series, the argillaceous shales forming 35 per cent.; sandstone and sandy shales 36 per cent.; making 71 per cent. of material for the most part unfit for useful purposes. The limestone measures 433 feet or 21 per cent. of the whole, while there is only about one per cent. of coal.

DESCRIPTION OF GROUPS.

Group A.—This Group includes the highest rocks found in the State, and occurs in Atchison and adjoining counties. Its base appears at Forest City, and passing northeastwardly is found at N.E. part of Holt County, dips beneath the Nodaway River at Quitman, is found eastwardly on Sand and Florida Creeks in Nodaway County; thence diverges northeastwardly.

In Atchison County the upper members are found along the river bluffs, and also on Rock Creek.

This Group is distinguished for its great thickness of shales and sandstone, and small proportion of limestone. The latter are generally very pyritiferous and inferior for building or for lime, and readily decompose from exposure.

The blue limestone occurring near the base is well marked and easily recognised by the occurrence of a small *Lingula* which I have found only in this rock; it is also the lowest range of *Productus Calhounianus*, Sw., and *Euomphalus complanatus?* A *Gervillia* has been found in No. 41, and *Fusulina cylindrica?* abounds in the limestones throughout the Group. A trace of bituminous coal occurs in No. 10. At Yancton and above White Cloud there crops out a seam of coal varying from 8″ to 10″ in thickness, and of good quality. At Forest City, in No. 43, a seam occurs varying from 2″ to 4″ in thickness; this thickens northwardly; it occurs in Nodaway County on several branches of Nodaway River, and is worked at several places. On Nodaway River, near the State line, it is divided by shales. On Florida Creek *Chonetes* and *Spirigera* occur in the coal.

Some of the sandstones are useful for building purposes. Near the State line on Nodaway River, argillaceous shale is used for making brick.

Group B.—This might properly be placed in the next lower Group, but as that is more well marked, and its upper and lower members are more intimately connected, I have separated it, and placed it in a separate group.

It has a thickness of 69 feet and contains some beds of good limestone. From a sandstone quarry at Forest City excellent grindstones are made. *Pr. Rogersii* (Nor. & Prat.), *Archæocidaris*, and *Chætetes** abound. The latter of

* This *Chætetes* also occurs on Grindstone Creek, DeKalb County, and on Brush Creek, Caldwell County, in Group "E."

which is very characteristic of some of the lower limestone beds; I also observed this coral on Nodaway River, at Ohio Mills, Graham, &c.

Group C.—This comprises 178′, of which 85′ or 47 per cent. (nearly ½) is limestone, of a gray, buff or ashy-blue color. It is a good material for building and lime. Two traces of coal occur in this Group, and 3′ bed of bituminous shale.

At the upper part we have about 20′ of limestone, containing *Orthis? hemiplicata* (Hall). The upper limestone is easily recognized, and being seen at many places I have placed it at the top of this Group; it caps the hills from near the mouth of Nodaway River as far up as Ohio Mills. It occurs also at Howard's Mill on Platte River, Nodaway County. A two inch bed of "cone in cone," or *Tutenmergel*, occurs at the top of this Group; it consists of green, fibrous, calcareo-argillaceous matter, and sometimes, as at Kunkel's Mill on Nichols Creek, Holt Co., the upper surface is weathered and washed out so as to leave exposed numerous beautiful minutely terraced peaks, standing in relief over the surface.

At the base is 20′ of limestone, similar to that at the top of the Group, and having also at top a thin bed of *Tutenmergel.* To satisfy the incredulous as to its stratigraphical position, examine the Missouri bluffs 4 miles below Forest City, where the upper limestones are first seen; thence, following down the river bluffs we see them gradually rise higher and higher in the bluffs. At Dallas, the lower limestone occurs at the water's edge, and is seen along the bluffs to the Nodaway River; capping the hills in the rear is seen the upper limestone. The lower bed can easily be traced along the Missouri bluffs, gradually rising as we descend; at Amazonia it occupies the hill tops, and retains this horizon at St. Joseph and throughout Buchanan County, gently undulating, and is last seen high in the bluffs 4 miles above Weston. This rock is seen on Third Fork of Platte River, in the N.W. part of DeKalb County; near Whitesville, in Andrew County, at bridge on Hundred-and-two River, 4 miles N.E. of Savannah, and caps hills at Jesup's Mill; on Niagara Creek, near Rochester, it serves as a good guide to the coal, 60 feet below; it is also the highest rock seen on Island branch, in Gentry County. It is sometimes quite cherty. Near Savannah there occurs a dark gray bed at top much valued for building; this bed thins out towards the river, but it is 8′ thick at Landers. *Pr. Rogersii* abounds in the lower part near Dallas and at Jesup's Mill, and its interior is often composed of calc spar.

Group D.—This Group comprises 337′, including one 18′

bed and one 13′ bed and other thinner limestone beds; two beds of bituminous shale, and three thin beds of coal. The upper coal bed is scarcely seen on the Missouri River, but thickens eastward. Its principal outcrops are on Platte River and Niagara Creek, near Rochester, and on Third Fork of Platte, in N.E. part of Andrew County. At the above named localities it is from 5″ to 10″ in thickness, and sometimes divided by thin layers of argillaceous shale abounding in fossil plants. The next coal crops out in No. 110, three and a half miles above Weston; and 97′ beneath the last is another bed of 9″.

The limestones of this Group are usually of a light gray or buff and gray color, and are a good building rock.

The fossils are *Spirigera subtilita* (Hall), and *Productus Rogersii* (Nor. & Prat.); *Orthis? hemiplicata* (Hall) abounds in the lower part; several species of *Bellerophon* and a *Nucula* are common in the upper beds, are also found above but are rarely found below this Group. *Orthisina Missouriensis* of Swal. is not found above.

Group E.—Plattsburg Group. The most important member of this Group is the "Plattsburg Limestone," which forms the upper part and is better developed and more easily recognized than any other limestone of the Coal measures. Fossils are abundant, and some of them are confined to this division. Among these are *Productus gigantissimus* (Swal.), which ranges throughout the entire Group; also a beautiful shell allied to *Pteroperna* and *Avicula. Bryozoa* are abundant. The Group also contains *Orthis hemiplicata,* which does not extend below in the series. A small trilobite occurs in the calcareous sandstone in Platte County.

The Plattsburg Limestone is found nearly everywhere in Platte County except the western part. The inferior beds pass through the western part of Clay, thence northeasterly to vicinity of Plattsburg, thence to the N.E. part of Clinton, thence northwardly through DeKalb, Gentry, and northeastern part of Harrison Counties.

Group F.—This is 174 feet thick and rather more than one half is limestone. The latter is variable in color, texture and composition, and at the Missouri River bluffs contains but few fossils. Two beds of bituminous shale, and some pyritiferous beds occur near the lower part.

The bed of deep blue cherty limestone found in river bluffs, near Randolph, is probably the equivalent of beds found on Big Creek, Harrison Co., abounding in so many beautiful fossils. At a mill, 4 miles north of Bethany, I obtained many fine fossils, among which are *Pr. Norwoodi* (Swall.), *Pr. æquicostatus* (Shum.), several beautiful *Cri-*

noids, *Synocladia*, *Pecten Broadheadi* (Sw.), (found only here and in Group A,) *Myalina subquadrata* (Shum.), (probably its lowest range,) some branching corals, *Pinna* (several species), *Pr. Rogersii* (Nor. & Prat.), *Or. Missouriensis* (Sw.), *Allorisma* (several species). *Pr. Norwoodii* does not range below, nor does *Pr. splendens* (Nor. & Prat.) above. *Productus Rogersii* is rare below, *Orthisina Missouriensis* rare above No. 169, but below it is often abundant. A limestone occurs in Daviess and Gentry Counties almost entirely made up of this beautiful fossil. In the blue limestone of Daviess Co. I found fossil wood. Some of the fossils of this Group, especially the *Bryozoa*, are of Permian types. The lower stata pass northwardly from Liberty landing through Caldwell, Daviess, and the middle of Harrison County.

Group G—Includes the rocks below the last as far as Lexington, its base passing northwardly via Breckenridge, Trenton, and northeastwardly.

More than half this Group is composed of sandstone and sandy shales. The limestones resemble each other both lithologically and palæontologically, and abound in a small *Productus* resembling the *Pr. Wabashensis* (Nor. & Prat.) The limestones are useful for building purposes and for making lime, and generally are of a light gray or whitish color. A white oolitic limestone is found in Caldwell and Mercer, which is highly esteemed as a fire rock.

No bed of unlaminated clay has been found in Coal measure series above this Group, and here it is first seen lying beneath a bed of coal which is generally capped by bituminous shale. The "Lexington Coal" occurs at the base of this Group; it varies in thickness from 1′ 8″ to 2′ 4″, and is extensively worked. In the northern counties it becomes quite thin and is rarely seen.

The limestone in Grundy is characterized by a vermicular fucoid which often decomposes, leaving tortuous cylindrical cavities in the rock, sometimes filled with oxide of iron. This rock is the lower limit of *Terebratula millepunctata* (Hall).

Group H.—This Group of 514′ includes most of the remaining Coal Measure rocks of Missouri as far eastward as Glasgow, thence northward by Huntsville and northward. The beds of sandstone and shales are of great thickness; the limestone is thin, often silicious and pyritiferous, and contains but few good fossils; some of the shaly beds abound in *Spirigera*, *Orthisina Missouriensis* (Sw.), *Spirifer cameratus* (Mort.), *Spirifer perplexus*, *Pro. costatus*.

This Group contains 14 workable coal beds, varying in thickness from 1′ to 4′. These coal beds are generally capped with beds of bituminous shale. They include those of Grand River as far as Utica, and those of Chariton River. The sandy shales also occasionally contain seams of coal of varying thickness and persistency.

Group I.—This Group corresponds to Prof. Swallow's "Lower Coal Series," and includes all the coal rocks beneath those enumerated in the General Section. Not having the proper facilities of connection, I have omitted them from that section. Their thickness is 60 to 90 feet, and include several important coal beds, namely, the coal of Boone, Callaway, Audrain, Ralls, Monroe, the eastern part and middle of Randolph, Macon and Adair.

There are several thick beds of fire clay and bituminous shale. The limestones are generally bluish-drab, thin-bedded, impure, and contain but few fossils. *Chonetes mesoloba* (Nor. & Prat.), *Spirigera Maconensis* (Sw.), *Sp. Missouriensis* (Sw.), *Sp. subtilita* (Hall), *Productus nuricatus* (Nor. & Prat.), *Spirifer perplexus*, *Sp. cameratus* (Mort.), *Sp. Kentuckensis* (Shum.), *Sp. hirsatus* (Mort.), *Chætetes milleporaceus*, *Fusulina cylindrica.* In Randolph County a *Fucoid* was obtained from calcareous sandstone very closely resembling the *Fucoides cauda-galli* of the Chemung Group. It occurs a few feet beneath the 4′ feet coal bed. Fossil wood is often found in large masses, and I suppose it to be derived from the sandstone of this Group.

GENERAL REMARKS.

Sandstone and Sandy Shales.—From inspection of the Section it will be perceived that we have enumerated 754 feet of sandstone and sandy shales, or about $\frac{1}{3}$ of the whole mass. It is scarcely correct to separate the sandy shales from the sandstone, since the one passes into the other very suddenly and at short intervals.

The sandstones and shales frequently contain small particles of silver mica, and are generally soft and more or less ripple-marked. Some of the firmer beds of the upper coal series make good grindstones. Beautiful examples of cross lamination are sometimes seen. The Lamellibranchs and Gasteropods are found in the upper series. Fossil plants, including Calamites and Ferns, range throughout. Sigillariæ have been observed in the lower measures.

Argillaceous Shale forms about 730 feet, $\frac{1}{3}$ of the whole section. Its prevailing color is drab, sometimes blue, olive, and green, rarely purple. The strata are generally thinly laminated, sometimes micaceous, and pass insensibly into sandy shale. They possess a jointed structure and usually a smooth soapy feel. Concretions of carbonate of iron are quite common, and the layers are sometimes concretionary. The ironstone concretions are sometimes beautifully divided by small calcareous veins passing perpendicularly to the concentric circles forming "septaria;" these varying in size from one inch to four feet.

Fossils are exceedingly rare; in the thinly laminated beds adjacent to and interstratified with the coal, they sometimes abound. The shale beds intercalated with the coal in Andrew County, near Rochester, abound in beautiful fossil plants. When the shales are calcareous they often abound in Brachiopoda.

Limestones.—The gray and buff limestones are better than the blue for most purposes, being purer, firmer and more easily worked. They are good for building and for making lime, and withstand fire better. The blue limestones, especially the ashy-blue, are generally pyritiferous, and when containing iron pyrites, oxidize with a thick brown crust on the exposed surfaces. The beds are generally jointed by vertical planes passing through and forming regular rhomboid blocks; when the upper surface is much exposed, an appearance is often presented as of a floor paved with lozenge-shaped flagstones. This character belongs sometimes to the buff limestones, and is more common in the lower series.

Some fossils seem to be peculiar to the blue limestones, and Lamellibranchs and Gasteropods are more often associated together. *Leptodomus* and *Edmondia* are more often associated in the blue limestones and occur but seldom anywhere else. *Allorisma* is also more common. Brachiopods are more characteristic of the gray limestones, *Lamellibranchiata* and *Gasteropoda* of the blue.

Coal.—The following is the boundary of the Coal Measures in North Missouri, giving the principal points, it varying often for several miles either way:

Crossing the Missouri above Arrow Rock, thence *via* Boonslick, Columbia, New Bloomfield, Fulton, Wellsville, near Montgomery City, Middleton, near Vannoy's Mill, Lick Creek, Santa Fé, Mexico, Middlegrove, Madison, N.W. corner of Monroe County, Lakenan, Kirksville, and northwardly; with patches and outliers in Monroe, Marion and Shelby. If we trace an imaginary line from Lexington *via* Utica, thence N.E. to the N.E. part of Sullivan County, and northwardly to the State line, we have on the east the workable coal beds, and to the west 1,450 feet of unproductive coal measure rocks; for the beds of coal in the upper measures are too thin to admit of working to any advantage, and only when situated in remote districts where wood is scarce and transportation expensive, will it pay to work them.

In Livingston County, on and near Grand River, are about four coal beds; they are generally from 10″ to 14″ in thickness, and some of them are much worked.

Two beds crop out on Locust Creek, in Linn County, but are difficult of access; they are about a foot in thickness. A 17″ bed is worked on Muscle Fork of Chariton, N. of H. & St. Jo. Railroad. On East Fork of Chariton, and near Hudson, are several good coal beds, relatively 1′ 22″, and 2½′ to 3′. These beds are much worked; the 22″ bed crops out at Carbon and is valuable.

The same beds crop out on East Fork of Chariton, in Randolph County. The 3′ bed above mentioned thickens to 5′ and 7′ in the neighborhood of McGee College; at Huntsville it is 4′ and near Renick 3′; on Silver Creek it is 4′ in thickness; it also crops out in Adair County, near Nineveh, and on Spring Creek, in Adair and Sullivan. The Flat Creek banks, in Monroe County, include three beds relatively 1′, 22″, and 1′. On Lick Creek, Ralls County, two beds are worked—18″ and 24″, the latter sometimes 3′ thick. In Montgomery, near Wellsville, a 2½′ bed is worked. Near Mexico, 1′ and 3′ beds crop out. In Callaway County, 1′ and 3′. Near Columbia, Boone County, is a 3′ bed. The Monroe, Ralls, Montgomery, Audrain, Boone and northern Callaway coal beds are identical, and include only three beds.

The best and thickest coal beds occur in the counties of Montgomery, Callaway, Boone, Randolph, Macon, Adair, Howard, Chariton, Carroll, and Lafayette.

Near St. Charles is a small coal field covering an area of 8 or 9 square miles, and containing one bed of coal from 15″ to 30″ in thickness. This is not connected with the larger coal basin of Missouri, and is probably an outlier of the Illinois coal field.

The regular coal beds are bituminous; the coal breaks with smooth joints perpendicular to the surface, and the surface has generally the character of charcoal. All the coal of Missouri has more or less sulphuret of iron intercalated with it, and it also often has thin plates of carbonate of lime interpolated in the joints. Fossils are rarely found in immediate juxtaposition with coal, and I only found *Brachiopoda* in coal at one place in Nodaway County.

The above is but a brief sketch of the various coal beds, and to do them justice much more would require to be written.

Palæontology.—In addition to what has been written above concerning the range of certain fossils, it is but fit to add a few additional facts. *Productus tubulospinus* is not abundant, and does not range below the middle of Group "H," is more abundant in Group "E," and scarcely ranges above. *Productus muricatus* only exists in the lower measures and generally in calcareous or bituminous shale. *Productus auriculatus* (Sw.) is rare,—only has been found near middle of the series in Caldwell Co. *Productus Norwoodii* (Sw.) occurs in argillo-calcareous shales, and is often much compressed. *Spirifer cameratus* ranges throughout, although in the lower series it more rarely resembles the *Spirifer striatus;* in the upper series its ribs are more angulated and fasciculated.* *Spirifer Kentuckensis* occurs throughout, but is not abundant anywhere. *Spirifer plano-convexus* seems to be gregarious, and is generally found in calcareous shales; it ranges throughout. *Orthisina umbraculum* occurs from the lowest to the highest of the series, and is more often found in shales, either calcareous or bituminous, and in different rocks varies a little in its general appearance. *Fusulina cylindrica,* although abounding in Group "I," is rarely seen again until found abounding in the rocks of the upper series.

Crinoids are not common in the Coal Measures of Missouri.

Spirigera subtilita is found everywhere. Specimens of genus *Archæocidaris* are rare; species occur in upper portion of "H," in limestone, just above the Lexington coal bed; in lower members of "F," and in the upper part of "B," they abound.

Fossil fish bones are rare; teeth are found in bituminous shales in lower series.

The interior of some of the fossils, especially *Producti,* in the upper series, is pure crystallized carbonate of lime. In the bituminous shale of lower series, (particularly Group "I,") many fossils are composed of iron pyrites. The pyritiferous shales often abound in plants and shells.

Changes.—Beds of rock are occasionally found much indurated In Caldwell County some of the limestones occupying the lower part of group "G" are very hard and close grained, and appear to have been indurated; they are silicious and ferruginous. Similar limestones are found in Group "H," on Yellow Creek, Linn Co., Muscle Fork, Macon Co., &c.

Some sandstones are much indurated and resemble altered or metamorphosed rocks; for example, the sandstone showing cross lamination near Princeton, Mercer Co.

Disturbance.—The local disturbances are not important, do not seriously affect the relation or general dip of the rocks, or their practical economy. During the early periods of their existence they have evidently been subjected to undulations, oscillations, and sometimes to violent disturb-

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* *Spirifer cameratus*, var. *Kansasensis* of Prof. Swallow.

ances, but these are mostly local and extend only a short distance. At but few places has any remarkable dip been observed. In DeKalb County, on Grindstone Creek, in south part of T. 58, R. 30 W., there is a remarkable evidence of disturbance of strata extending over a space of half a mile diameter, and sometimes dipping 45°. In Caldwell County, in south part T. 57, R. 26, is another evidence of disturbance. On Grand River, below Compton's Ferry, Mr. Ulffers observed a very remarkable inclination of strata. Near Huntsville is a protrusion of lower carboniferous rocks through rocks of coal series. A line will pass very nearly direct through these several points, and terminate in Lincoln County, near other and more remarkable dips and faults among the older rocks.

Dip.—The prevailing dip of the series is to the N.W. Sometimes it may be west for many miles, again it may be north for some distance. In Clay County it is a little north of west, dipping about 190′ and quite regularly; in Buchanan and Platte, nearly N.W.; in Holt, Andrew, and Livingston, regularly N.W., and in Holt more W. than N.

A Catalogue of the Palæozoic Fossils of North America.

By B. F. Shumard, M.D.

No one can be more sensibly aware of the imperfections of this Catalogue than the Author, although he has spared no pains to make it as complete as possible. There can be no doubt that the list of species will be very considerably diminished and the classification materially modified when the subject shall have been more thoroughly studied. The difficulties in the way of producing, at this time, a complete synonymic list of Palæozoic Fossils must be acknowledged by all who have devoted much attention to the study of American Palæontology. While it is true that a great many of our fossils have been well described and figured, it is equally true that the descriptions of others are exceedingly meagre and unsatisfactory, and the type specimens are often inaccessible to the student. Indeed in not a few instances it is absolutely impossible to identify species from the published descriptions and figures. It is earnestly hoped that the mania for species-making is rapidly passing away, and that Naturalists will deem it of quite as much importance to the interests of science to rectify and properly classify what has already been done, as to add new names to the list of species. In the Catalogue, the Author has not hesitated to place among the synonyms of species such names as he felt satisfied properly belong there; but in cases where there seemed to be a doubt he has, for the present, allowed them to rank as species, rather than run the risk of adding to the confusion by wrong references.

LIST OF ABBREVIATIONS OF THE GEOLOGICAL FORMATIONS.

Lower Silurian.	Pots.—Potsdam Sandstone.
	Cal.—Calciferous Sand Group = Quebec Group.
	Cha.—Chazy Group.
	B. B.—Birdseye and Black River Limestone.
	Tr.—Trenton Limestone.
	Gal.—Galena Limestone.
	U. S.—Utica Slate.
	H. R.—Hudson River Group.
	M. S.—Middle Silurian.
Upper Silurian.	Cl.—Clinton Group.
	C. G.—Cape Girardeau Limestone.
	Niag —Niagara Group.
	O. S —Onondaga Salt Group.
	W. L.—Water-Lime Group.
	L. H.—Lower Helderberg Group.
Devonian.	Orisk.—Oriskany Sandstone.
	U. H.—Upper Helderberg Group.
	Ham.—Hamilton Group
	Chem.—Chemung and Portage Groups.
Carboniferous.	Enc.—Encrinital Limestone = Burlington Limestone.
	Arch.—Archimedes Limestone = Keokuk and Warsaw Limestones of Prof. Hall.
	St. L.—St. Louis Limestone.
	Kas.—Kaskaskia Limestone, or Upper Archimedes Limestone.
Coal Measures.	L. C. M.—Lower Coal Measures.
	U. C. M.—Upper Coal Measures.
	Per.—Permian.

PART I.

PALÆOZIC ECHINODERMATA.

A Chronological List of Works which contain Descriptions or Notices of North American Palæozoic Echinodermata.

1811—*J. Parkinson. Organic Remains of a Former World. 3 vols. in 4to, with plates.
1817—De France,† in Dict. des Sciences Naturelles, vol. xiv.
1818—G. Cuvier. Theory of the Earth, with Mineralogical Notes, and an Account of Cuvier's Geological Discoveries, by Prof. Jameson: to which are now added Observations on the Geology of North America, illustrated by the description of various Organic Remains found in that part of the world, by S. L. Mitchell.
1819—C. S. Rafinesque. Prodrome de 70 Noveaux Genres d'Animaux découvert dans l'intérieur des Etats Unis d'Amérique durant l'année 1818.—[Jour. de Phys., tome 88.
1829—Thomas Say. Observations on some species of Zoöphytes and Shells, principally fossil.‡—[Amer. Jour. Sci. & Arts, vol. ii., p. 34.
1821—J. S. Miller. A Natural History of the Crinoidea or Lily-shaped Animals, with Observations on the Genera Asteria, Euryale, Comatula, and Marsupites; illustrated with fifty colored plates.
1824—Thomas Say. On two Genera and several Species of Crinoidea.—[Jour. Acad. Nat. Sci. Philad., vol. iv., p. 289.
1826—*Id.* On two Genera and several Species of Crinoidea.—[Zoölog. Jour. conducted by T. Bell, J. G. Childern, J. De C., & G. B. Sowerby, vol. ii., p. 311.
1826—G. B. Sowerby. Note on the Paper of Thomas Say, together with a description of a New Species of Pentremites.—[Zoölog. Jour., vol. ii., p. 316.
1826—*Id.* Notice of a Fossil belonging to the Class Radiaria, found by Dr. Bigsby in Canada.—[Zoölog. Jour., vol. ii., p. 318.
1826—A. Goldfuss. Petrefacta Germaniæ, 3 vols. in fol. cum tab.
1828—Amos Eaton. A Geological Nomenclature for North America.
1830—*Id.* Geological Text Book for aiding the Study of North American Geology. 2d edition. 1832.
1834—H. M. De Blainville. Manuel d'Actinologie ou de Zoophytologie, 2 vols. in 8vo.
1835—G. Troost. On the Pentremites Reinwardtii, a New Fossil; with Remarks on the Genus Pentremites.—[Trans. Geol. Soc. of Penn., vol. i., p 224.
1835—*Id.* Description of a New Species of Fossil Asterias (*Asterias antiqua*).—[Trans. Geol. Soc. of Penn., vol. i., p. 232.
1835—L. Agassiz. Prodrome d'une Monographie des Radiaires ou Echinodermes.—[Mémoires de la Soc. des Sciences Naturelles de Neufchatel, tome i,, p. 168.
1835—Bonny. Schenectaday Reflector.—[Schenectaday, N. Y.
1837-1841—G. Troost. Fourth, Fifth and Sixth Geological Reports of the State of Tennessee.
1838—J. G. Anthony. Encrinite from the Blue Limestone of Cincinnati, Ohio.—[Amer. Jour. Sci. & Arts, vol. xxxv., p. 405.
1838—T. A. Conrad. Report on the Palæontological Department of the the Geological Survey of the State of New York, p. 107.

* This seems to be the earliest publication in which we find a notice of an American species of Crinoid. Under the name of Kentucky Asterial Fossil, it contains a very good figure of a common species of Pentremites in the Carboniferous strata of the Western States; the *P. Godonii* of De France=*Pentremites florealis* of most subsequent authors.

† This author gives a very good description of the Kentucky Asterial Fossil of Parkinson under the designation of *Encrina Godonii*.

‡ In this paper Mr. Say has given a description of the genus *Pentremites*.

1839—J. G. ANTHONY. Fossil Encrinite from the Blue Limestone of Cincinnati.—[Amer. Jour. Sci., vol. 35, p. 359.

1840–1841—T. A. CONRAD. Annual Reports on the Palæontology of New York.

1840—D. D. OWEN. Report of a Geological Exploration of Iowa, Wisconsin, and Illinois, made under Instructions from the Secretary of the Treasury of the United States in the autumn of the year 1839.

1842—D. D. OWEN. Regarding Human Footprints in solid Limestone.—[Amer. Jour. Sci. & Arts, vol. xliii.. p. 14.

1842—EBENEZER EMMONS. Geology of New York. Part II., comprising the Survey of the 2d Geological District. In 4to, with figures.

1842—LARDNER VANUXEM. Geology of New York. Part III., comprising the Survey of the 3d Geological District. In 4to, with figures.

1842—DR. A. CLAPP. Geological Equivalents of the Rocks of the Falls of the Ohio.—[Proc. Acad. Nat. Sci. Philad., vol. i., p. 177.

1842—T. A. CONRAD. Observations on the Silurian and Devonian System of the United States, with Descriptions of New Organic Remains. —[Jour. Acad. Nat. Sci. Philad., vol viii., part 2, p. 228.

1843—D. D. OWEN. A Catalogue of Geological Specimens illustrating the Formations of the Ohio Valley.

1843—T. A. CONRAD. Observations on the Lead-bearing Limestone of Wisconsin, and Descriptions of a New Genus of Trilobites and fifteen New Silurian Fossils.—[Proc. Acad. Nat. Sci. Philad., vol. i., p. 329.

1843—J. HALL. Geology of New York. Part IV., comprising the Survey of the 4th Geological District. In 4to, with figures.

1843—F. DE CASTELNAU. Essai sur le Système Silurien de l'Amérique Septentrionale; in 4to, with plates.

1843—T. AUSTIN and T. AUSTIN, Jr. A Monograph on Recent and Fossil Crinoidea—in 4to, with plates.

1844–46—F. J. PICTET. Traité Elémentaire de Palæontologie, ou Histoire Naturelle des Animaux Fossiles; 4 vols. in 8vo., and 1 vol. of Plates in 4to.

1844—D. D. OWEN. Report of Geological Exploration of Iowa, Wisconsin, and Illinois, made under Instructions from the Secretary of the Treasury of the United States in the autumn of the year 1839; in 8vo, with plates.

1844–45—*Id.* Review of the New York Geological Reports.— [Amer. Jour. Sci., vols. 46–49.

1845—L. VON BUCH. Ueber Cystideen, Eingeleilet durch die Entwickelung der Eigenthümlichkeiten von *Caryocrinus ornatus*, Say.—[Abhand. Kön. Akad. Wiss. zu Berlin.

1845—I. N. NICOLLET. Report intended to illustrate a Map of the Hydrographical Basin of the Upper Mississippi River.

1846—G. GRAHAM, J. G. ANTHONY, and U. P. JAMES. Two Species of Fossil Asterias in the Blue Limestone of Cincinnati.—[Amer. Jour. Sci., new ser., vol. i.

1846—J. G. NORWOOD and D. D. OWEN. Description of a Remarkable Fossil Echinoderm from the Limestone Formation of St. Louis, Missouri.—[Amer. Jour. Sci., 2d series, vol. ii., p. 225.

1846—E. DE VERNEUIL. Note sur le Paralélisme des Dépôts Paléoziques de l'Amérique Septentrionale avec ceux de l'Europe, suive d'un Tableau des Espèces Fossiles communes aux deux Continents avec l'indication des Etages où elles se rencontrent, et terminée par une Examen Critique de chacune de ces espèces.—[Bull. Soc. Géologique de France, 2e. ser., i.–iv.

1846—JOHN LOCKE. On an Asterias from the Blue Limestone of Cincinnati.—[Proc. Acad. Nat. Sci. Philad., vol iii., p. 32.

1847—L. P. YANDELL & B. F. SHUMARD. Contributions to the Geology of Kentucky, in 8vo, with a plate.

1847—JAMES HALL. Natural History of New York, Part VI.; Palæontology, vol. i., in 4to, with numerous plates, 1847—D. D. OWEN & J. G. NORWOOD. Researches among the Protozoic and Carboniferous Rocks of Central Kentucky made during the summer of 1846; 8vo, with a plate.

1847—GEO. ENGELMANN. Remarks on Melonites multipora.—[Amer. Jour. Sci., new series, vol. 3, p. 124.

1848—EDWARD FORBES. On the Cystidea of the Silurian Rocks of the British Islands.—[Mem. Geol. Surv. of Great Britain & Mus. Econ. Geol., vol. ii.

1848—T. AUSTIN. Observations on the Cystidea of M. Von Buch, and the Crinoidea generally.—[Quart. Journal Geol. Soc. London; Nov., 1848; p. 291.

1848—C. FERD. RŒMER. Ueber Gegliederte, aus Kalkstückchen Zusammengesetzke Tentakeln oder Pinnulæ auf den Sogennanten Ambulakral-Feldern der Pentremiten.—[Neues Jahrbuch für Min. und Geol. Leonhard und Bronn, p. 292.

1848—JOHN LOCKE. Fossil Asterias antiquata from Cincinnati.—[Proc. Acad. Nat. Sci. Philad., vol. iii., p. 32, with figure.

1848—DAVID CHRISTY. Letters on Geology, being a Series of Communications originally addressed to John Locke of Cincinnati, Illustrated by Geological Sections and Engravings of some New Fossils, in 8vo.

1848—L. P. YANDELL. Note to M. De Verneuil concerning the discovery of calcareous arms in Pentremites florealis.—[Bulletin Soc. Géol. de France, tome v., 2e. series, p. 296.

1848-1849—H. G. BRONN. Index Palæontologicus oder Uebersicht des bisjetzt bekamten Fossilen Organismen.—[Nomenclator et Enumerator Palæontologicus, 3 vols. in 8vo.

1848-1849—L. AGASSIZ. Lectures on Embryology.—[Amer. Traveler & Daily Evening Traveler.

1850—FERD. RŒMER. Ueber Stephanocrinus, eine Fossile Crinoiden-Gattung aus der Familie der Cystideen.—[Arch. für Naturgeschichte Jahr. 1850, p. 365.

1850—G. TROOST. A List of the Fossil Crinoids of Tennessee.—[Proc. Amer. Assoc. for Advancement of Science.

1850—D. D. OWEN and B. F. SHUMARD. Descriptions of fifteen New Species of Crinoidea from the Subcarboniferous Limestone of Iowa, collected during the U. S. Geological Survey of Iowa, Wisconsin and Minnesota in the years 1848-9.—[Jour. Acad. Nat. Sci. Philad., New Ser., vol. ii., p. 57, in 4to, with plate.

1850-1851—A. D'ORBIGNY. Prodrome de Palæontologie Stratigraphique Universelle des Mollusques et Rayonnés, 3 vols. in 12mo.

1850-1852—*Id.* Cours Elémentaire de Palæontologie et de Géographie, Stratigraphique, 3 vols. in 12mo.

1851—D. D. OWEN & B. F. SHUMARD. Descriptions of seven New Species of Crinoidea from the Subcarboniferous Limestone of Iowa and Illinois.—[Jour. Acad. Nat. Sci. Philad., new ser., vol. ii., p. 89.

1851—L. P. YANDELL. On the Distribution of the Crinoidea in the Western States.—[Proc. Amer. Assoc. for Advancement of Science, Fifth Meeting, p. 229.

1851—D. D. OWEN and B. F. SHUMARD. On the Number and Distribution of Fossil Species in the Palæozoic Rocks of Iowa, Wisconsin and Minnesota.—[Proc. Amer. Assoc. for Advancement of Science, Fifth Meeting, p. 235.

1851—JAMES SAFFORD. The Silurian Basin of Middle Tennessee, with Notices of the Strata surrounding it.—[Amer. Jour. Sci. & Arts, N. Ser., vol. xii., p. 352.

1851—FERD. RŒMER. In Verh. Naturh. Ver. für Rheinl. und Westphal., vol. viii.

(In this publication Prof. Rœmer has given a description with figures of Agelacrinus Cincinnatiensis.)

1851-1856—H. G. BRONN and F. RŒMER. H. G. Bronn's Lethæa Geognostica oder Abbildung und Beschreibung der für die Gebirgs-Formationen Bezeichnendsten Versteinerungen-Dritte Stark Vermehrte Auflage.

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1854—L. De Koninck et H. Le Hon. Recherches sur les Crinoïdes du Terrain Carbonifère de la Belgique, suivies d'une Notice sur le Genre Woodocrinus, par L. De Koninck.

1854—Sam'l A. Casseday. Beschreibung einer neuer Crinoideengeschlechts aus dem Kohlenkalkstein, Nord Amerika's.—[Zeitschr. d. Deutschen Geologischen Gesellschaft, Jahrg. 1854.

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1855—*F. Rœmer. Ueber den Bau von Melonites multipora ein Echinid des Amerikanischen Kohlenkalks.

1856—B. F. Shumard and L. P. Yandell. Notice of a New Fossil Genus belonging to the Family Blastoidea, from the Devonian Strata near Louisville, Ky.—[Proc. Acad. Nat. Sci. Philad, vol. 8, p. 73.

1856—James Hall. Description of New Species of Fossils from the Carboniferous Limestones of Indiana and Illinois.—[Trans. Albany Inst., vol. iv., No. 1.

1856—B. F. Shumard. Descriptions of New Fossil Crinoidea from the Palæozoic Rocks of the Western and Southern Portions of the United States.—[Trans. Acad. Sci. St. Louis, vol. i., p. 71.

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* This Memoir gives a very minute and satisfactory description of *Melonites multipora* of Owen and Norwood, and is accompanied with a beautifully engraved quarto plate accurately representing the form and structure of this remarkable fossil.

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1858—E. BILLINGS. Figures and Descriptions of Canadian Organic Remains; Decade iii., Genus Cyclocystoides; by E. W. Billings and J. W. Salter.—[Geol. Survey of Canada.

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1858–60—JAS. HALL. Contributions to Palæontology 1858 and 1859, with Additions in 1860.—[13th Rep. Reg. State Cab. N. Y.

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1859—S. S. LYON and S. A. CASSEDAY. A Synonomic List of the Echinodermata of the Palæozoic Rocks of North America.—[Proc. Amer. Acad. Arts & Sci., vol. iv., Aug., 1859.

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1860—A. H. WORTHEN. Notice of a New Species of Platycrinus and other Fossils, from the Mountain Limestone of Illinois and Iowa.—[Trans. Acad. Sci. St. Louis, vol. i., p. 569.

1860—S. S. LYON. Descriptions of four New Species of Blastoidea, from the Subcarboniferous Rocks of Kentucky.—[Trans. Acad. Sci. St. Louis, vol. i., p. 628.

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* This work is dated December 24 1860 at which time it was submitted to Governor Randall; it was not published, however, until the year following.

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1862—*Id.* Report of the Geological Survey of the State of Wisconsin, vol. i. James Hall, on General Geology and Palæontology; and J. D. Whitney, on the Upper Mississippi Lead Region.

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1862—G. C. SWALLOW. Descriptions of some New Fossils from the Carboniferous and Devonian Rocks of Missouri.—[Trans. Acad. Sci., St. Louis, vol. ii., p. 81.‡

1863—CHAS. A. WHITE. Observations on the Summit Structure of Pentremites, the structure and arrangement of certain parts of Crinoids, and Descriptions of New Species from the Carboniferous Rocks at Burlington, Iowa.—[Bost. Jour. Nat. Hist., vol. vii., p. 481.

1863—Sir WM. E. LOGAN, ALEX. MURRAY, T. STERRY HUNT, E. BILLINGS. Geological Survey of Canada. Report of Progress from its commencement to 1863; Illustrated by 498 Wood Cuts in the text, and accompanied by an Atlas of Maps and Sections.

1863—J. D. DANA. Note on a Fossil Echinoderm from the Blue Limestone (Lower Silurian) of Cincinnati, Ohio.—[Amer. Journal Sci. & Arts, vol. xxxv., p. 295.

1863—*Id.* Manual of Geology, treating of the Principles of the Science with special reference to American Geological History.

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† This paper bears date 1859; it was, however. issued in three parts, at different times. Pages 1 to 56 inclusive were, I learn. first published January 3. 1860; pp. 57 to 76 about the 24th of May of the same year, while pp. 77 to 96 were not distributed until February, 1861

‡ This paper was read October 16, 1860, but not published till 1862. It contains a description of a new species of Pentremites (*P. Missouriensis*), from the Carboniferous Limestone of Missouri and Illinois.

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1864—JULES MARCOU. Une Reconnaisance Géologique au Nebraska.—[Bull. Géol. Soc. France, 2e. ser., tome xxi., p. 132.

1865—J. H. MCCHESNEY. Plates illustrating in part the New Species of Fossils from the Palæozoic Rocks of the Western States, and two New Species noticed March, 1860, published in April, 1865.—[Trans. Chicago Acad. Sci., vol. i.*

1865—F. B. MEEK. Remarks on the Carboniferous and Cretaceous Rocks of Eastern Kansas and their relations to those of adjacent States and other localities further eastward, in connection with a review of a Paper recently published on this subject by M. Jules Marcou in the Bulletin of the Geological Society of France.—[Am. Jour. Sci. & Arts, vol. xxxix., 2d ser., p. 157.

1865—F. B. MEEK and F. V. HAYDEN. Palæontology of the Upper Missouri Country.—[Smithsonian Contributions to Knowledge.

1865—E. BILLINGS. New Species of Palæozoic Fossils.—[Geolog. Surv. of Canada.

1865—JAS. HALL. Account of some new or little known species of Fossils from rocks of the age of the Niagara Group.—[18th Rep. N. Y. State Cab.

1865—F. B. MEEK and A. H. WORTHEN. Note in relation to a Genus of Crinoids from the Coal Measures of Illinois and Nebraska.—[Amer. Jour. Sci. & Arts, new ser., vol. xxxix., p. 350.

Catalogue of Palæozoic Echinodermata.

NOTE.—Those marked with an asterisk (*) are doubtful species, being known simply as Catalogue names; or, if descriptions have been published, they are so unsstisfactory as to render it impossible to recognize with certainty the species.

ACANTHOCRINUS—See RHODOCRINUS.

ACROCRINUS, Yandell, 1855. Amer. Jour. Sci., vol. xx., n. ser., p. 135.

Shumardi, Yandell, 1855. Amer. Jour. Sci., n. ser., vol. xx., p. 135, with fig.—*Kas.*—Grayson Co., Ky.

urnæformis, Hall, 1858. Geol. Iowa, vol. i., p. 690, pl. 25, fig. 9. —*Kas.*—Pope Co., Ill.

ACTINOCRINUS, Miller, 1821. Nat. Hist. Crinoid., p. 94.—BATONICRINUS, Casseday, 1854.

abnormis—v. Megistocrinus abnormis.

Ægilops, Hall, 1860. Geol. Iowa (Sup.) p. 5.—*Enc.*—Quincy, Ill.

æqualis, Hall, 1858. Geol. Iowa, vol. i., p. 592, pl. xi., fig. 4.—*Enc.*—Burlington, Iowa.

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* These Plates contain beautifully executed figures. drawn on stone by Prof. J. W. Salter, of a number of Crinoids, chiefly from Rocks of the Carboniferous Age of the Western States. It is unfortunate, however, that a large proportion of the figures represent species previously described by other authors.

ACTINOCRINUS, Miller (continued).

æquibrachiatus, McChesney, 1859. Tr. Chicago Ac. Sci., vol. i., p. 25; pl. 4, fig. 2, pl. x. (Compare *A. asteriscus*, Meek & Wor.)

var. alatus, Hall, 1861. Des. New Crinoidea (Prelim. Not.), p. 1.—*Enc.*—Burlington, Iowa.

Agassizi,* Troost, 1850. Crin. Tenn. in Proc. Amer. Assoc., p. 60.—Tennessee.

(Calathocrinus) althea, Hall, 1861. Des. New Crinoidea (Prelim. Not.), p. 13.—*Enc.*—Burlington, Iowa.

(Pradocrinus?) amplus, Meek & Worthen, 1861. Pr. Ac. Nat. Sci. Phil., p. 133.—*Enc.*—Burlington, Iowa.

Andrewsianus—*v.* Actinocrinus Verneuilianus.

araneolus, Meek & Wor., Sept., 1860, Pr. Ac. Nat. Sci. Phil., p. 387.—*Enc.*—Burlington, Iowa.

asterius, McChesney, 1859. Tr. Chicago Ac. Sci., vol. i., p. 13, 1865, pl. 5, fig. 6. (Comp. *A. verrucosus*, Hall.)—*Enc.*—Monmouth, Illinois.

asteriscus, Meek & Wor., Sept., 1860. Pr. Ac. Nat. Sci. Phil., p. 385. (Compare *A. æquibrachiatus.*) — *Enc.* — Warren Co., Illinois.

brontes, Hall, 1860. Geolog. Iowa (Sup.), p. 47.—*Arch.*—Warsaw, Illinois.

biturbinatus, Hall, 1858. Geol. Iowa, vol. i., p. 616, plate xvi., fig. 5 & 6.—*Arch.*—Nauvoo, Ills.

brevis, Hall, 1858. Geol. Iowa, vol. i., p. 567, pl. 10, fig. 3.—*Enc.*—Burlington, Iowa.

brevicornis, Hall, 1858. Geol. Iowa, vol. i., p. 571, pl. x., fig. 4. —Enc.—Burlington, Iowa.

calyculoides, Hall, 1860. Geol. Iowa (Sup.), p. 17.—*Enc.*—Burlington, Iowa.

calyculus, Hall, 1860. Geol. Iowa (Sup.), p. 55.—*Arch.*—Spergen Hill, Indiana.

Calypso, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 133. —*Ham.*—Western New York.

Cassedayi, Lyon, 1861. Pr. Ac. Nat. Sci. Phil., p. 410, pl. iv., fig. 3.— *Upp. Held.*—Bear Grass Cr., near Louisville, Ky.

carica, Hall, Feb., 1861. Des. New Crin. (Prelim. Not.), p. 10. —*Enc.*—Burlington, Iowa.

Caroli, Hall, 1860. Geolog. Iowa (Sup.), p. 53.—*Arch.*—Warsaw, Illinois.

cauliculus, Hall, 1862. 15th Report Reg. State Cab. N. York, p. 132.—*Ham.*—Western New York.

Chloris, Hall, Feb., 1861. Des. New Crin. (Prelim. Not.), p. 3.—*Enc.*—Burlington, Iowa.

Christyi. Shumard, 1855. 2d Report Geol. Missouri, pt. 2, p. 191, pl. A, fig 3. *Actinocrinites*, Christy, Let. on Geol., pl. 1 & 2 (not *A. Christyi*, Hall, 1863.)—*Enc.*—Monmouth, Illinois; Marion and Boone Cos., Missouri.

ACTINOCRINUS, Miller (continued).

Christyi, Hall, 1863—*v. A. Waldronensis.*

Clarus, Hall, Feb., 1861. Des. New Crin., Prelim. Not., p. 2.—*Enc.*—Burlington, Iowa.

clavigerus, Hall, 1860. Geol. Iowa, Sup., p. 44.—*Keok.*—Nauvoo, Illinois.

Clio, Hall, Feb., 1861. Des. New Crin., Prelim. Not., p. 1.—*Enc.*—Burlington, Iowa.

Cloetia, Hall, Feb., 1861. Des. New Crin., Prelim. Not., p. 2.—*Enc.*—Burlington, Iowa.

clypeatus, Hall, 1860. Geol. Iowa, Sup., p. 12.—*Enc.*—Burlington, Iowa.

cœlatus, Hall, 1858. Geol. Iowa, vol. i., p. 585, pl. x., fig. 14. *A. Fosteri*, McChesney, 1860. New Pal. Foss., p. 19, pl. 5, fig. 2.—*Enc.*—Burlington, Iowa.

(Amphoracrinus) concavus, Meek & Wor., 1861. Proc. Ac. Nat. Sci. Phil., p. 132.—*Enc.*—Burlington, Iowa.

concinnus, Shumard, 1855. 2d Rep. Geol. Missouri, pt. 2, p. 189, pl. A, fig. 5. *A. validus*, Meek & Wor., 1860. Proc. Ac. Nat. Sci. Phil., p. 384. (Compare *A. pentagonus*, Hall.)—*Enc.*—Marion Co., Missouri; Warren Co., Illinois.

corbulis, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 1.—*Enc.*—Burlington, Iowa.

Coreyi, Lyon & Casseday, 1860. Amer. Jour. Sci., n. ser., vol. 29, p. 76.—*Enc.*—Hardin Co., Kentucky; Washington Co., Indiana.

corniculus, Hall, 1858. Geol. Iowa., vol. i., p. 566, pl. 10, fig. 3. (Compare with *A. unicornis*, Owen & Shumard.)—*Enc.*—Burlington, Iowa.

cornigerus, Hall, 1858. Geol. Iowa, vol. i., p. 575, pl. 9, fig. 12. (Compare *A. decornis*, Hall.)—*Enc.*—Burlington, Iowa.

cornutus,* Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 60.—Tennessee.

coronatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 28.—*Enc.*—Burlington, Iowa.

decornis, Hall, 1860. Geol. Iowa,, Sup. p. 13. (Compare *A. cornigerus*, Hall.)—*Enc.*—Burlington, Iowa.

desideratus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not. p. 2.—*Enc.*—Burlington, Iowa.

discoidues, Hall, 1858, Geol. Iowa, vol. i., p. 594.—*Enc.*—Burlington, Iowa.

divaricatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 11.—*Enc.*—Burlington, Iowa.

divergens, Hall, 1860. Geol. Iowa, vol. i., Sup., p. 36.—*Enc.*—Burlington, Iowa.

dodecadactylus, Meek & Worthen, June, 1861. Pr. Ac. Nat. Sci. Philad., p. 131—*Enc.*—Burlington, Iowa.

doris, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 15.—*Enc.*—Burlington, Iowa.

ACTINOCRINUS, Miller (continued).

(Batocrinus) eicosidactylus, Casseday, 1854. Zeitsch. Deutsch. Geol. Gesellsch., p. 238, pl. 2, fig. 1.—*Arch.*—Spergen Hill, Indiana.

(Calathocrinus) erodus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 12.—*Enc.*—Burlington, Iowa.

Eryx, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 12. —*Enc.*—Burlington, Iowa.

Eucharis, Hall, 1862. 15th Rep. Reg. State Cab. N. Y., p. 180.— —*Ham.*—Western New York.

excerptus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 2.—*Enc.*—Burlington, Iowa.

fibula,* Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 60.—Tennessee.

fiscellus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 2.—*Enc.*—Burlington, Iowa.

Fosteri—v. A. cœlatus.

formosus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 30.—*Enc.*— Burlington, Iowa.

gemmiformis, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 23.— *Enc.*—Burlington, Iowa.

gibbosus,* Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 60—Tennessee.

glans, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 16.—*Enc.*—Burlington, Iowa.

glyptus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 2.—*Enc.*— Burlington, Iowa.

Gouldi, Hall, 1858. Geol. Iowa, vol. i., p. 613, pl. 15, fig. 6.— *Arch.*—Warsaw, Illinois.

Hageri, McChesney, 1860. New Pal. Foss., p. 28, pl. iv., fig. 1, & pl. 10.—*Enc.*—Burlington, Iowa.

Humboldtii,* Troost, 1850. List Crin. Tenn. in Pr. Amer. Assoc. Camb. Meet., p. 60.—Tennessee.

Hurdianus, McChesney, 1860. New Pal. Foss., p. 24, pl. 5, fig. 9. —*Enc.*—Burlington, Iowa.

Indianaensis, Lyon & Casseday, 1860. Amer. Jour. Sci., n. ser., vol. 29, p. 75.—*Arch.*(?)—Montgomery Co., Indiana.

inflatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 20. (Compare *A. planobasalis.*)—*Enc.*—Burlington, Iowa.

infrequens, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 14.—*Enc.*—Burlington, Iowa.

(Calathocrinus) insculptus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 12.—*Enc.*—Burlington, Iowa.

inornatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 24—*Enc.*— Burlington, Iowa.

†(Batocrinus) irregularis, Casseday, 1854. Zeitsch. Deutsch. Geol. Gesell., p. 240, pl. 2, fig. 2.—*Arch.*—Spergen Hill, Indiana.

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† It appears to me that it would be well to retain *Batocrinus* of Casseday as a subgenus for such forms as *Actinocrinus* (*Batocrinus*) *eicosidactylus* and *irregularis*, Casseday, *A.*

ACTINOCRINUS, Miller (continued).

jugosus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 49.—*Arch.*—Warsaw, Illinois.

Kentuckensis, Shum. *A. cornigerus*, Lyon and Casseday, 1859. Jour. Sci., n. ser., vol. 28, p. 238 (not *A. cornigerus*, Hall, 1858.)—*Upp. Held.*—Falls of Ohio.

Konincki, Shumard, 1855. 2d Rep. Geol. Missouri, pt. ii., p. 194, pl. A, fig. 8.—*Enc.*—Boone & Marion Cos., Missouri; Burlington, Iowa; Monmouth, Illinois.

lagena, Hall, Feb., 1861. Des. New Crinoidea., Prelim. Not., p. 13.—*Enc.*—Burlington, Iowa.

lagunculus, Hall, 1860. Geol. Iowa, Sup., p. 41.—*Arch.*—Warsaw, Illinois.

Laura, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 15.—*Enc.*—Burlington, Iowa.

lepidus, Hall, 1860. Geol. Iowa, Sup., p. 32.—*Enc.*—Burlington, Iowa.

leucosia, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 1.—*Enc.*—Burlington, Iowa.

limabrachiatus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 2.—*Enc.*—Burlington, Iowa.

liratus, Hall, 1860. Geol. Iowa, Sup., p. 1.—*Enc.*—Burlington, Iowa.

lobatus, Hall. Geol. Iowa, Sup., p. 51.—*Arch.*—Warsaw, Illinois.

locellus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 15.—*Enc.*—Burlington, Iowa.

longirostris, Hall, 1858. Geol. Iowa, vol. i., p. 589, pl. xi., fig. 2. —*Enc.*—Burlington, Iowa.

Lowei, Hall, 1858. Geol. Iowa, vol. i., p. 613, pl. 15, fig. 6.—*Arch.*—Warsaw, Illinois.

lucina, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 11.—*Enc.*—Burlington, Iowa.

matuta, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 14.—*Enc.*—Burlington, Iowa.

var. attenuata, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 14.

Meeki, Lyon, 1861. Pr. Ac. N. Sci. Phil., p. 411, pl. 4, fig. 4.—*Niag.*—Near Louisville, Ky.

minor, Hall, 1858. Geol. Iowa, vol. i., p. 573.—*Enc.*—Burlington, Iowa.

Mississippiensis—*Dorycrinus Mississipiensis*, F. Rœmer, 1853. Archiv. fur. Naturgesch., Jahr. 19, bd. i.—*Arch.*—Warsaw, Illinois.

var. spiniger, Hall, 1860. Geol. Iowa, Sup., p. 53.—*Arch.*—Warsaw, Illinois; Clark Co., Missouri.

Christyi and *A. Verneuilianus*, Shumard, and *A. æqualis* and *A. turbinatus*, Hall. These constitute a very natural group, presenting even at a superficial glance a marked contrast with such species as *A. multiradiatus* and *A. sculptus*, which approach more closely in structural characters and general appearance *A. triacontadactylus* of Miller, the typical species of the genus.

ACTINOCRINUS, Miller (continued).

Missouriensis, Shumard, 1855. 2d Rep. Geol. Surv. Mo., pt. ii., p. 190, pl. A, fig. 4.—*Enc.*—Monmouth, Illinois; Marion Co., Missouri.

moniliformis,* Miller—cited by Troost 1850, in list of Crin. Tenn. Proc. Amer. Assoc. Camb. Meeting, p. 60.—Tennessee.—[It is extremely doubtful whether this species is found in American strata.]

Mortoni,* Troost, 1850. List Crin. Tenn. Proc. Amer. Assoc. Camb. Meet., p. 60.—Tennessee.

multibrachiatus, Hall, 1858. Geol. Iowa, vol. i., p. 58, pl. 10, fig. 10.—*Enc.*—Burlington, Iowa.

var. echinatus,‡ Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 10.

mundulus, Hall, 1860. Geol. Iowa, Sup., p. 40.—*Arch.*—Warsaw, Illinois.

multiradiatus, Shumard, 1857. Trans. Acad. Sci. St. Louis, vol. i., p. 75, pl. 1, fig. 5.—Hall, 1858. Geol. Iowa, vol. i., p. 579, pl. 10, fig. 9.—*Enc.*—Burlington, Iowa; Quincy, Ills.

Nashvillæ, Troost, 1850. List Crin. Tennessee, Pr. Amer. Assoc., p. 60.—Hall, 1858. Geol. Iowa, vol. i., p. 609, pl. 15, fig. 4.—*Arch.*—Warsaw, Illinois; White's Creek Springs, Tennessee.

var. subtractus, White, 1862. Pr. Bost. Soc. Nat. Hist., vol. 9, p. 16 of Extract.—*Enc.*—Burlington, Iowa.

Nyssa, Hall, 1862. 15th Rep. Reg. State Cab. Nat. His., p. 129. —*Ham.*—Western New York.

olliculus—*v.* A. Whitei.

ornatus, Hall, 1858. Geol. Iowa, vol. i., p. 583, fig. 86, pl. 10, fig. 12.—*Enc.*—Burlington, Iowa.

oblatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 38.—*Enc.*—Burlington, Iowa; Rockford, Missouri.

ovatus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 10.—*Enc.*—Burlington, Iowa.

papillatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 29.—*Enc.*—Burlington, Iowa.

parvus, Shumard, 1855. 2d Rep. Geol. Missouri, pt. ii., p. 193, pl. A, fig. 9.—*St. L.*—St. Louis, Missouri.

pendens, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 31. (Compare *A. unicornis*, Owen & Shumard.)—*Enc.*—Burlington, Iowa.

pentagonus, Hall, 1858. Geol. Iowa, vol. i., p. 577, pl. 10, fig. 6. (Compare with *A. concinnus*, Shumard.)—*Enc.*—Burlington, Iowa.

pernodosus, Hall, 1858. Geol. Iowa, vol. i., p. 608, pl. 15, fig. 3, and pl. 16, fig. 7.—*Arch.*—Warsaw, Illinois.

perumbrosus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 7.—*Enc.*—Burlington, Iowa.

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‡ This will probably prove to be a good species, quite distinct from *A. multibrachiatus*.

ACTINOCRINUS, Miller (continued).

planobasalis, Hall, 1858. Geol. Iowa, vol. i., p. 19. (Compare *P. inflatus*, Hall.)—*Enc.*—Burlington, Iowa.

planodiscus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 45.—*Arch.* —Nauvoo, Illinois.

plumosus, *v.* Glyptocrinus plumosus.

pocillum, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 134. —*Ham.*—Western New York.

polydactylus, *v.* Mariacrinus polydactylus.

præcursor, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 131.—*Ham.*—Western New York.

proboscidialis, Hall, 1858. Geol, Iowa, vol. i., p. 584, pl. 10, fig. 13.—Dana, 1863. Man. Geol., p. 312, fig. 524. (Compare *A. quaternarius* and *A. sexarmatus*, Hall.)—*Enc.*—Burlington, Iowa.

pyriformis, Shumard, 1855. 2d Rep. Geol. Missouri, pt. 2, p. 192, pl. A, fig. 6. —*Enc.* —Marion and Clark Counties., Missouri; Burlington, Iowa; near Monmouth, Illinois.

var. *rudis*,† Meek & Wor., 1861; (not *A. rudis*, Hall, 1860.)

pyramidatus, Hall, 1858. Geol. Iowa, vol. i., p. 565.—*Enc.*—Burlington, Iowa.

quadrispinus, White, 1862. Pr. Bost. Soc. Nat. Hist., vol. ix., p. 15.—*Enc.*—Burlington, Iowa.

quaternarius, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 22.—(Compare *A. proboscidialis* and *A. sexarmatus*, Hall.)—*Enc.*—Burlington, Iowa.

var. spiniferus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 11.—*Enc.*—Burlington, Iowa.

quinquelobus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 17.—*Enc.*—Burlington, Iowa.

ramulosus, Hall, 1858. Geol. Iowa, vol. i., p. 616, pl. 15, fig. 7. —*Arch.*—Nauvoo, Illinois.

regalis, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 8.—*Enc.*—Burlington, Iowa.

remibrachiatus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 11.—*Enc.*—Burlington, Iowa.

reticulatus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 2.—*Id.* Jan., 1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 269.—*Enc.*—Burlington, Iowa.

rotundus, Yandell and Shumard, 1855. 2d Rep. Geol. Missouri, pt. 2, p. 191, pl. A, fig. 2.—*Actinocrinites*, Christy, 1848. Letters on Geol., pl. i., fig. 3, 4.—*Arch.*—Rocheport, Missouri; Nauvoo, Illinois.

rudis, Hall, 1860, Geol. Iowa, Sup. to vol. i., p. 33.—*Enc.*—Burlington, Iowa.

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† I learn from a letter recently received from Mr. Meek, that he now regards the *var. rudis* as a species quite distinct from *A. pyriformis*, and that he has changed the name in a paper which is being printed by the Acad. Nat. Sci. Philad.

ACTINOCRINUS, Miller (continued).

rusticus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 2.—*Id.* Jan., 1861. Bost. Jour. Nat. Hist.., vol. vii., p. 267. —*Enc.*—Burlington, Iowa.

scitulus, Meek and Worthen, Sept., 1860. Pr. Ac. Nat. Sci. Phil., p. 386.—*Enc.*—Warren Co., Illinois.

sculptus, Hall, 1858. Geol. Iowa, vol. i., p. 582, pl. 10, fig. 11.—*A. tenuisculptus*, McChesney, 1860. New Palæozoic Fossils, p. 15, pl. v., fig. 1.—*Enc.*—Burlington, Iowa.

securis, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 14.—*Enc.*—Burlington, Iowa.

senarius, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 25.—*Enc.*—Burlington, Iowa.

sexarmatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 21. (Compare *A. proboscidialis*, Hall.) — *Enc.* — Burlington, Iowa.

Sillimani, Meek and Worthen, June, 1861. Proc. Acad. Nat. Sci. Phil., p. 134.—*Enc.*—Warren Co., Illinois.

similis, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 41.—*Arch.*—Warsaw, Illinois.

sinuosus, Hall, 1860. Geol. Iowa, Sup. to vol. 1, p. 26.—*Enc.*—Burlington, Iowa.

speciosus, Meek and Worthen, Sept., 1860. Proc. Acad. Nat. Sci. Phil., p. 386.—*Enc.*—Burlington, Iowa.

spinobrachiatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 6.—*Enc.*—Burlington, Iowa.

spinotentaculus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 86.—*Enc.*—Burlington, Iowa.

spinulosus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 52.—*Arch.* —Nauvoo, Illinois.

steropes, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 43.—*Arch.*—Bluffs of Mississippi, opposite Keokuk.

subaculeatus, Hall, 1858. Geol. Iowa, vol. i., p. 570, pl. 10, fig. 2.—*Enc.*—Burlington, Iowa.

subæqualis, McChesney, 1860. New Pal. Fossils, p. 17, pl. v., fig. 7. (Compare *A. verrucosus*, Hall.)—*Enc.*—Monmouth, Illinois.

(Amphoracrinus) subturbinatus, Meek and Worthen, Sept., 1860. Proc. Acad. Nat. Sci. Philad., p. 388.—*Enc.*—Burlington, Iowa.

subumbrosus, Hall, 1860. Geol. Iowa, Sup. to vol. i.—*Enc.*—Burlington, Iowa.

subventricosus, *v.* A. ventricosus.

superlatus, Hall, 1858. Geol. Iowa, vol. i., p. 573, fig. 82.—*Enc.* —Burlington, Iowa.

symmetricus, Hall, 1858. Geol. Iowa, vol. i., 575, pl. 10, fig. 8.—*Enc.*—Burlington, Iowa.

(?) tenuidiscus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 14.—*Enc.*—Burlington, Iowa.

ACTINOCRINUS, Miller (continued).

tenuisculptus, *v*. A. sculptus.

tenuiradiatus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 12.—*Enc.*—Burlington, Iowa.

tenuiradiatus, Hall, 1847 (not of Iowa Rep.) See Palæocystites tenuiradiatus.

Thalia, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 13.—*Enc.*—Burlington, Iowa.

Themis, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 11.—*Enc.*—Burlington, Iowa.

Thetis, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 11.—*Enc.*—Burlington, Iowa.

Tholus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 35.—*Enc.*—Burlington, Iowa.

tricornis, Hall, 1858. Geol. Iowa, vol. i., p. 569.—*Enc.*—Burlington, Iowa.

trinodus, Hall, 1858. Geol. Iowa, vol. i., p. 575, fig. 83.—*Enc.*—Burlington, Iowa.

turbinatus, Hall, 1858. Geol. Iowa, vol. i., p. 587, pl. 11, fig. 1.—*Enc.*—Burlington, Iowa.

var. elegans, Hall, 1858. Geol. Iowa, vol. i., p. 588, pl. 11, fig. 5.—*Enc.*—Burlington, Iowa.

unicarinatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 48.—*Arch.*—Nauvoo, Illinois.

unicornis, Owen and Shumard, 1850. Jour. Acad. Nat. Sci. Phil., vol. ii., new ser., p. 67, pl. 7, fig. 12. Geol. Rep. Iowa, Wisconsin and Minnesota, p. 593, tab. V, A, fig. 12.—Hall, 1858. Geol. Iowa, vol. i., p. 568, pl. x., fig. 5.—Dana, 1863. Man. Geol. p. 312, fig. 525.—*Enc.*—Burlington, Iowa; near Monmouth, Illinois.

unispinus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 2.—*Id.* Jan., 1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 270.—*Enc.*—Burlington, Iowa.

umbrosus, Hall, 1858. Geol. Iowa, vol. i., p. 590, pl. xi., fig. 3.—*Enc.*—Burlington, Iowa.

urna,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Arch.*(?)—Tennessee.

urnæformis, McChesney, 1860. New Pal. Foss., p. 23.—*Enc.*—Honey Creek, Illinois.

validus, *v*. A. concinnus.

ventricosus, Hall, 1858. Geol. Iowa, vol. i., p. 595, pl. xi., fig. 6.—*Id.* 1861. Boston Journal Nat. Hist., vol. vii., p. 279. (Compare *A. cancellatus*, Hall.)—*Enc.*—Burlington, Iowa.

var. internodius, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 3.—*Enc.*—Burlington, Iowa.

var. cancellatus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 3.—*Enc.*—Burlington, Iowa.

verrucosus, Hall, 1858. Geol. Iowa, vol. i., p. 578, fig. 84, pl. 10, fig. 7.—*Enc.*—Burlington, Iowa.

Verneuili, *v*. Melocrinus Verneuili.

ACTINOCRINUS, Miller (continued).

Verneuilianus, Shumard, 1855. 2d Rep. Geol. Missouri, pt. 2, p. 193, pl. A, fig. 1.—*A. Andrewsianus*, McChesney, 1859. New Pal. Foss., p. 27, pl. v., fig. 5.—*Enc.*—Boone and Marion Counties, Missouri; Burlington, Iowa; near Monmouth, Illinois.

viminalis, Hall, 1863. Crin. Waverly Sand. Ser. Ohio, p. 5.—*Chem.*—Summit County, Ohio.

Wachsmuthi, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. 9, p. 15.—*Enc.*—Burlington, Iowa.

Waldronensis,† *v.* A. Whitfieldi.

Whitfieldi—*A. Christyi*, Hall, 1863. Trans. Alb. Inst., vol. iv, p. 196. (Not *A. Christyi*, Shumard.)—*A. Whitfieldi*, Hall, 1864. Acc. New Foss. Niag. Group, p. 22.—*Niag.*—Racine and Waukesha, Wisconsin; Waldron, Indiana.

(Megistocrinus) Whitei, Hall, 1861. Jour. Boston Soc. Nat. Hist., vol. vii., p. 271.—*Enc.*—Burlington, Iowa.

Yandelli, Shumard, 1857. Trans. Ac. Sci. St. Louis, vol. i., p. 76, pl. i., fig. 4.—*Actinocrinites*, Yandell & Shumard, 1847. Cont. Geol. Ky., p. 24, fig. 5.—*Arch.*—Button-mould Knob, Jefferson Co., Kentucky; White's Creek Springs, Tenn.

The following species of Actinocrinus were omitted in their proper places in the Catalogue, and are now added:

clivosus, Hall, Jan., 1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 274.—*Enc.*—Burlington, Iowa.

Daphne, Hall, 1863. Crin. Wav. Sands. Ohio, p. 3.—*Chem.*—Summit Co., Ohio.

Helice, Hall, 1863. Crin. Wav. Sands., p. 4.—*Chem.*—Summit Co., Ohio.

opusculus, Hall, 1861. Geol. Iowa, Sup. Explan., pl. 2, fig. 6.—*Id.* Jan., 1861. Jour. Boston Soc. Nat. Hist., vol. vii., p. 264.—*Enc.*—Burlington, Iowa.

AGARICOCRINUS,‡ Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet.—Hall, 1858. Geol. Iowa, vol. i., p. 617.—AMPHORACRINUS, F. Rœmer, 1854. Leth. Geog., vol. 2, p. 250. (Not *Amphoracrinus*, Austin.)

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† Since the first form of this Catalogue was printed, I have received through the attention of Prof. Hall, a copy of his paper entitled "Account of some New or little known Fossils from the Rocks of the age of the Niagara Group," bearing date Dec., 1864, in which I find that Prof. H. has changed the preoccupied name *Actinocrinus Christyi* to that of *A. Whitfieldi.* The name *Waldronensis*, recently proposed by me for the same fossil, is therefore now cancelled.

‡ In accordance with the views of Troost, Hall, Meek, and others, we here adopt the genus *Agaricocrinus*, a catalogue name proposed in 1850 by Dr. Troost (*List Crinoidea of Tennessee in Proc. Amer. Assoc.*) for a mushroom-shaped Crinoid, which in the number and arrangement of the plates composing the body presents considerable analogy with *Actinocrinus* of Miller, as shown by Prof. Hall (Geol. Iowa, vol. i., p. 617), but which in other respects exhibits characters of generic, or at least subgeneric, value separating it from that genus. The typical species of the genus is *Agaricocrinus Americanus* (Rœmer sp.), described and figured in Brown's Lethæa Geognostica as an *Amphoracrinus*. *Agaricocrinus*, however, differs

AGARICOCRINUS, Troost (continued).

Americanus—*Agaricocrinus tuberosus*, Troost, 1850.§ List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 60.—*Amphoracrinus Americanus*, F. Rœmer, 1854. Leth. Geog., vol. 2, p. 250, tab. iv., fig. 15.—*Agaricocrinus tuberosus*, Hall, 1858. Geol. Iowa, vol. i., p. 617, pl. 16, fig. 2.—*Arch.*—Nauvoo and Warsaw, Illinois; White's Creek Springs, Tennessee; Keokuk, Iowa; Clark Co., Missouri.

(Amphoracrinus) bellatrema, Hall, Jan., 1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 281.—*Enc.*—Burlington, Iowa.

bullatus, Hall, 1858. Geol. Iowa, vol. i., p. 562, pl. 9, fig. 11.—*Enc.*—Burlington, Iowa.

corrugatus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 3.—*A.* (*Amphoracrinus*) *corrugatus*, Hall, 1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 283.—*Enc.*—Burlington, Iowa.

(Amphoracrinus) excavatus, Hall, Feb., 1861. Des. New Crinoid., Prelim. Not., p. 3.—Jan., 1861. Jour. Boston Soc. Nat. Hist., vol. vii., p. 282.—*Enc.*—Burlington, Iowa.

geometricus, Hall, 1860. Geol. Iowa, Sup., p. 56.—*Enc.*—Quincy, Illinois.

gracilis, Meek & Wor., June, 1861. Proc. Ac. Nat. Sci. Phil., p. 135.—*Enc.*—Burlington, Iowa,

inflatus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 4.—*A.* (*Amphoracrinus*) *inflatus*, Hall, 1861. Jour. Bost. Society Nat. Hist., vol. vii., p. 284. — *Enc.* — Burlington, Iowa.

ornotrema, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 3.—*Enc.*—Burlington, Iowa.

planoconvexus, Hall, Feb., 1861. Des. New Crinoidea, Prelim. Not., p. 3.—*A.* (*Amphoracrinus*) *planoconvexus*, Hall, Jan., 1861. Jour. Bost. Soc. Nat. Hist., vol. vii, p. 280.—*Enc.*—Burlington, Iowa.

pentagonus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 57.—*Enc.*—Burlington, Iowa.

var. convexus, Hall. 1860. Geol. Iowa, Sup. to vol. i., p. 58.—*Enc.*—Burlington, Iowa.

stellatus, Hall, 1858, Geol. Iowa, vol. i., p. 564, fig. 79.—*Enc.*—Quincy, Illinois.

tuberosus, *v.* Agaricocrinus Americanus.

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quite as materially from *Amphoracrinus* as the latter does from *Actinocrinus*. We are inclined to adopt both names, at least in a subgeneric sense. Allowing *Amphoracrinus Gilbertsoni* of Austin to stand as the type of the genus *Amphoracrinus*, such American species as *Actinocrinus* (*Dorycrinus*) *Mississippiensis*, *A. Missouriensis*, *A. unicornis*, *A. Gouldi*, *A. cornigerus*, *A. corniculus*, *A. desideratus*, and *A. brevis*, might be separated from *Actinocrinus* and conveniently arranged with that species in one group under Austin's name.

§ A strict adherence to the laws of priority compels us to adopt the specific name of Rœmer for this fossil, this author having first published a description of it. Troost's name, *tuberosus*, appears simply as a catalogue name in his List of the Crinoidea of Tennessee, and is unaccompanied with either description or figure.

AGARICOCRINUS, Troost (continued).

Whitfieldi, Hall, 1858. Geol. Iowa, vol. i., p. 621.—*Arch.*—Green Co., Illinois.

Wortheni, Hall, 1858. Geol. Iowa, vol. i., p. 619, pl. 16, fig. 1.—*Arch.*—Warsaw, Illinois.

AGASSIZOCRINUS, Troost, 1850. List of Crinoidea of Tenessee, p. 60.—Owen & Shumard, 1851. Jour. Ac. Nat. Sci. Phil., n. ser., vol. ii.—Shumard, 1853. Marcy's Rep. Red River of Louisiana.†—ASTYLOCRINUS, Rœmer, 1854. Leth. Geog., p. 229.—AGASSIZOCRINUS, Hall, 1858. Geol. Iowa., vol. i., p. 685.

conicus, Owen & Shumard, 1851. Jour. Acad. Nat. Sci. Phil., n. ser., vol. ii., p. 93, pl. xi., fig. 6.—*Id.* Geol. Rep. Iowa, Wisconsin and Minnesota, p. 597, pl. v., fig. 6.—*Kask.*—Chester, Illinois.

dactyliformis, Troost, 1850. List Crin. Tenn. Camb. Meet., p. 60. Shumard, 1853. Marcy's Rep. Red River of Louisiana, p. 199.—*Astylocrinus lævis*, Rœmer, 1854. Lethæa Geognost. Kohl. Geb., p. 229, tab. iv., fig. 13.—*Agassizocrinus dactyliformis*, Hall, 1858. Geol. Iowa, vol. i., p. 685, fig. 113. —*Kask.*—Chester, Illinois; Crittenden County, Kentucky; Washington Co., Arkansas; Tennessee.

constrictus, Hall, 1858. Geol. Iowa, vol. i., p. 687, pl. 25, fig. 10.—*Kask.*—Chester, Illinois.

gibbosus, Hall, 1858. Geol. Iowa, vol. i., p. 686, pl. 25, fig. 6. (Compare *A.* [*Poteriocrinus*] *occidentalis*, Owen & Shum.) —*Kask.*—Chester, Illinois.

gracilis,* Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 62.—Tennessee.

(?) occidentalis.‡ *Poteriocrinus occidentalis*, Owen & Shumard, 1852. Jour. Acad. Nat. Sci. Phil., n. ser., vol. ii., p. 92, pl. xi., fig. 5.—*Id.* Geol. Surv. of Iowa, Wis. & Minnes., p. 596, tab. v. B, fig. 4. (Compare *A. gibbosus*, Hall.)—*Kask.* —Chester, Illinois.

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† In this Report the present writer gave a short description, with a figure of *Agassizocrinus dactyliformis*, from a specimen collected by Dr. Geo. G. Shumard in Washington Co., Arkansas, adopting Troost's catalogue name, under which designation the fossil was widely known by collectors in the Western States. The nearly perfect specimen figured by Rœmer (Lethæa Geognost., Tab. IV., fig. 13) as *Astylocrinus lævis* is now in my cabinet, and a plaster cast of it obligingly made for me by S. S. Lyon, Esq., together with some basal plates of the fossil, were furnished to Dr. Rœmer, with Troost's name attached, during his visit to this country.

‡ I am now pretty well satisfied that this Crinoid belongs to *Agassizocrinus* rather than *Poteriocrinus*. *A. gibbosus* of Hall is very nearly related, if not identical. The published figures of the species in the Jour. of Acad. Nat. Sci. Phil., and in Owen's Report, are faulty in this, that the excavation at the point of attachment for the column is too strongly marked, and in the description a *quære* mark should have been placed after "basal plate" in the second sentence, because the existence of a concealed basal plate was merely inferred under the supposition that the fossil was a *Poteriocrinus*. The original specimen of *A. occidentalis* is now in the collection of the late Dr. D. D. Owen, at New Harmony, Indiana, and until we can have an opportunity of comparing Hall's species with it, the question of identity or non-identity must remain unsettled.

AGASSIZOCRINUS, Troost (continued).

tumidus, *Poteriocrinus tumidus*, Owen & Shumard, 1852. Jour. Acad. Nat. Sci. Phil., vol. ii., p. 90, pl. xi., fig. 3. — *Id.* 1852. Geol. Surv. of Iowa, Wis. & Minn., p. 595, pl. v. B, fig. 3.—*Kask.*—Chester, Illinois.

AGELACRINUS (AGELACRINITES) Vanuxem, 1842. Geol. 3d Dist. New York, p. 158. — HEMICYSTITES, Hall, 1852. Pal. New York, vol. ii., p. 246.

Cincinnatiensis, Rœmer, 1851. Verh. Naturhist. Ver. für Rhein und Westph., vol. viii., p. 372, tab. 2, fig. 3. — *Id.* 1856. Bronn's Leth. Geognost. Kohl. Gebirg., p. 277, tab. iv., fig. 6.—*H. R.*—Cincinnati, Ohio; Madison, Indiana.

Dicksoni, Billings, 1856. Geol. Surv. Canada, p. 294.—*Id.* Can. Org. Rem. Dec. 3, p. 84, pl. 8, fig. 3 & 4.—*Trent.*—Ottawa, Canada.

Hamiltonensis, Vanuxem, 1842. Geol. Rep. 3d Dist. New York, p. 158, fig. 80 on p. 306.—*Niag.*—Lockport, N. York.

Kaskaskiensis, Hall, 1858. Geolog. Iowa, vol. i., p. 696, pl. 25, fig. 18.—*Kask.*—Kaskaskia, Illinois.

parasitica, *Hemicystites parasitica*, Hall, 1852. Pal. New York, vol. ii., p. 246, pl. 51, fig. 18–20.—*Niag.*—Lockport, New York.

ALLOPROSALLOCRINUS (Subgenus of ACTINOCRINUS), Casseday & Lyon, 1860. Proc. Amer. Acad. Arts & Sci., vol. v., p. 29.—CONOCRINUS,§ Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 60.

conicus, *Conocrinus tuberculosus,*‖ Troost, 1850. List Crinoidea Tenn. Proc. Amer. Ass. Camb. Meet., p. 60.—*Alloprosallocrinus conicus*, Casseday & Lyon, 1860. Proc. Amer. Ac. Arts & Sci., vol. v., p. 29.—*Arch.*—Allen Co., Kentucky; White's Creek Springs, Tennessee.

depressus, Casseday & Lyon, 1860. Proc. Amer. Acad. Arts & Sci., vol. v., p. 31.—*Arch.*—Hardin Co., Kentucky.

Leæ*—*Conocrinus Leæ*, Troost, 1850. List Crinoid. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 60.—Tennessee.

tuberculosus, *v.* A. conicus.

AMYGDALOCYSTITES, Billings, 1854. Canadian Jour., vol. ii., p. 270.

florealis, Billings, 1854. Canad. Jour., vol. ii., p. 270.—*Id.* 1856. Geol. Surv. Canada, p. 289.—*Id.* 1857. Canad. Org. Rem., Dec. 3, p. 63, pl. vi., fig. 1.—*Trent.*—Ottawa, Canada.

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§ The Genus *Alloprosallocrinus*, proposed by Casseday & Lyon, is probably identical with *Conocrinus* of Troost. Their description of *A. conicus* corresponds in almost every particular with the characters exhibited by specimens in my cabinet labelled *Conocrinus tuberculosus* by Troost. These specimens are also from the same geological horizon as that described by Casseday. I have always regarded *Conocrinus* as a subgenus of *Actinocrinus*, and of doubtful value.

‖ As no description of *Conocrinus tuberculosus* was published by Dr. Troost, Casseday & Lyon's name (proposed ten years later) must be adopted for the species.

AMYGDALOCYSTITES, Billings (continued).

radiatus, Billings, 1854. Canad. Jour., vol. ii., p. 271.—*Id.* 1857. Geol. Surv. Canada, p. 289.—*Id.* Canad. Org. Rem., Dec. 3, p. 65, pl. vi., fig. 3.—Ottawa, Canada.

tenuistriatus, Billings, 1854. Canad. Jour., vol. ii., p. 271.—*Id.* 1857. Geol. Surv. Canada, p. 289.—*Id.* 1858. Canad. Org. Rem., Dec. 3, p. 64, pl. 6, fig. 2.—Ottawa and Belleville, Canada.

AMPHORACRINUS, Austin, 1848. Quart. Jour. Geol. Soc. Lond., p. 292. (Subgenus of ACTINOCRINUS.)

ANCYROCRINUS, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 117.

bulbosus, Hall, July, 1862. 15th Rep. Reg. State Cab. N. York, p. 118, pl. 1, fig. 25 & 26.—*Ham.*—Shore of Lake Erie.

spinosus, Hall, July, 1862. 15th Rep. Reg. State Cab. N. York, p. 119, pl. 1, fig. 27 & 28.—*U. H.*—Falls of Ohio.

ANOMALOCYSTITES, Hall, 1859. Palæont. New York, vol. iii., p. 132.

cornutus, Hall, 1859. Pal. New York, vol. iii., p. 133, pl. vii. A, fig. 5–7.—*L. H.*—Herkimer Co., N. York.

disparilis, Hall, 1859. Pal. N. York, vol. iii., p. 145, pl. 88, fig. 1–4.—*Orisk.*—Cumberland, Maryland.

APIOCYSTITES,† Forbes, 1848. Mem. Geol. Surv. Great Britain. LEPOCRINUS, Conrad, 1840. LEPOCRINITES, Mather, 1843.

elegans, Hall, 1852. Pal. N. York, vol. ii., p. 243, pl. 41, fig. 1–17.—*Niag.*—Lockport, New York.

Gebhardi—*Lepocrinites*, Mather, 1843. Geol. 4th Dist. N. York, p. 347, fig. 4 & 5.—*Lepadocrinus Gebhardi*, Hall, 1859. Pal. New York, vol. iii., p. 127, pl. 7, fig. 1 to 20.—*Apiocystites Gebhardi*, Dana, 1863. Man. Geol., p. 253, fig. 417.—*L. H.*—Scoharie and Ulster Counties, New York.

imago, Hall, 1864. New or little known Foss. from Niag. Group, p. 10, pl. 1, fig. 9.—*Niag.*—Racine, Wisconsin.

ARCHÆOCIDARIS, McCoy, 1844. Synops. Carb. Limes. Foss, Ireland, p. 173.

aculeata, Shumard, 1858. Trans. Acad. Sci. St. Louis, vol. i., p. 223.—*A. Verneuiliana*, Swal. *Ibid*, p. 180. (Not *A. Verneuiliana*, King.)—*U. C. M.*—Valley of Verdigris River, 25 miles west of Council Grove, Kansas; Fort Belknap, Texas.

Agassizi, Hall, 1858. Geol. Iowa, vol. i., p. 698, pl. 26, fig. 1.—*Enc.*—Burlington, Iowa.

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† I adopt the generic term *Apiocystites* although aware that Conrad in 1840 and Mather in 1843 had designated a similar Crinoid under the name *Lepocrinus*. Conrad's description, however, was so unsatisfactory that no one could possibly recognize the fossil from it, and Mather gave merely a figure and name without description. It is only through works of Prof. Hall, published after Forbes' excellent description and illustrations of his Genus *Apiocystites*, that we have learned what fossil Conrad meant to describe. Under these circumstances, I conceive it but just to give preference to Forbes' name.

ARCHÆOCIDARIS, McCoy (continued).

biangulata, Shumard, 1858. Trans. Acad. Sci. St. Louis, vol. i., p. 224.—*U. C. M.*—Lexington, Missouri.

(?) Drydenensis—*Echinus Drydenensis*, Vanuxem, 1842. Geol. Rep. 3d Dist. N. York, p. 184.—*Chem.*—Dryden, N. York.

gracilis, Newberry, 1861. Rep. Colorado Riv. of West, pt. iii. Geol. Rep., p. 117, pl. 1, fig. 4.— *U. C. M.* —Near Great Cañon of Colorado River.

Keokuk, Hall, 1858. Geol. Iowa, vol. i., p. 699, pl. 26, fig. 2.—*Arch.*—Keokuk, Iowa.

longispina, Newberry, 1861. Rep. Colorado River of the West, pt. iii. Geol. Rep., p. 116, pl. 1, fig. 1. (Compare *A. megastyla*, Shumard.) —*U. C. M.*—Near Great Cañon of Colorado River.

megastyla, Shumard, 1858. Tr. Acad. Sci. St. Louis, vol. i., p. 225.—*U. C. M.*—Head of Verdigris River, Kansas.

mucronata, Meek & Worthen, 1860. Proc. Ac. Nat. Sci. Phil., p. 395.—*Kask.*—Liberty, Illinois.

Norwoodi, Hall, 1858. Geol. Iowa, vol. i., p. 701, pl. 26, fig. 5.—Dana, 1863. Man. Geol., p. 312, fig. 534.—*Kask.*—Chester, Illinois.

ornata, Newberry, 1861. Rep. Colorado River of West, pt. iii. Geol. Rep., p. 116, pl. 1, fig. 2 & 3.—*U. C. M.*—Near Great Cañon of Colorado River.

Shumardana, Hall, 1858. Geol. Iowa, vol. i., p. 699, pl. 26, fig. 3.—Dana, 1863. Man. Geol., p. 312, p. 534.—*St. L.*—St. Louis, Missouri.

(?) Tennesseeæ*—*Cidarites Tennesseeæ*, Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 59.—Tenn.

Verneuilana, *v.* A. aculeata.

Wortheni, Hall, 1858. Geol. Iowa, vol. i., p. 700, pl. 26, fig. 1. —Dana, 1863. Man. Geol., p. 312, fig. 532.—*St. L.*—St. Louis, Missouri.

ASPIDOCRINUS, Hall, 1859. Pal. N. York, vol. iii., p. 122.

callosus, Hall, 1859. Pal. N. York, vol. iii., p. 122, pl. v., fig. 13. —*L. H.*—Helderberg Mts. and Schoharie, N. York.

digitatus, Hall, 1859. Pal. N. York, vol. iii., p. 123, pl. 5, fig. 19 & 20.—*L. H.*—Schoharie, N. York.

scutelliformis, Hall, 1859. Pal. N. York., vol. iii., p. 122, pl. v., fig. 13.—*L. H.* — Schoharie and Helderberg Mts., New York.

ASTERIAS,† Linnæus, 1748. Syst. Nat.

Anthonii, *v.* Palæsterina Jamesii.

antiqua, *v.* Petraster antiquus.

antiquata, *v.* Palæasterina antiquata.

matutina, *v.* Palæaster matutinus.

ASTEROCRINUS, *v.* PTEROTOCRINUS.

ASTRIOS,* Troost, 1850. List Crin. Tennessee, Pr. Amer. Assoc. Camb. Meet., p. 59.

ASTRIOS, (continued).

Tennesseeæ,* Troost, 1850. List Crin. Tenn., Pr. Amer. Assoc. Camb. Meet, p. 59.—*Tr.*(?)—Tennessee.

ASTROCRINITES, *v.* MARIACRINUS.

ASTYLOCRINUS, *v.* AGASSIZOCRINUS.

ATELEOCYSTITES, Billings, 1858. Canad. Org. Rem., Dec. 3, p. 72.

Huxleyi, Billings, 1858. Canad. Org. Rem., Dec. 3, p. 72.—*Tr.* —Ottawa, Canada.

BALANOCRINUS, *v.* LAMPTEROCRINUS.

BATOCRINUS (Subgenus of ACTINOCRINUS).

BELEMNOCRINUS, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 14.

typus, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 14. —*Enc.*—Burlington, Iowa.

BLASTOIDOCRINUS, Billings, 1859. Fig. & Des. Can. Org. Rem., Dec. iv., p. 18.

carchariædens, Billings, 1859. Fig. & Des. Can. Org. Rem., Dec. iv., p. 18, pl. 1, fig. 1.—*Cha.*—Caughnawaga, Island of Montreal, Isle Jesus, Canada.

BRACHYOCRINUS, Hall, 1859. Pal. N. York, vol. 3, pt. i., p. 118.

nodosarius, Hall, 1859. Pal. N. York, vol. iii., pt. 2, p. 118, pl. 5, fig. 5–7, and pl. 6, fig. 1–3.—*L. H.*—Helderberg Mts. and Schoharie, New York.

BURSACRINUS, Meek & Worthen, June, 1861. Proc. Acad. Nat. Sci. Phil., p. 136.

confirmatus, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. 9, p. 11.—*Enc.*—Burlington, Iowa.

Wachsmuthii, Meek & Worthen, June, 1861. Proc. Ac. Nat. Sci. Phil., p. 137.—*Enc.*—Burlington, Iowa.

CACABOCRINUS, *v.* DOLATOCRINUS.

CALATHOCRINUS,† Hall, 1861. (Proposed Subgenus of ACTINOCRINUS.)

CALCEOCRINUS, Hall, 1852. Pal. N. York, vol. ii., p. 352, pl. 85, fig. 5–6. (Compare with CHEIROCRINUS.)

CALLOCYSTITES, Hall, 1852. Pal. N. York, vol. ii., p. 238.

Jewettii, Hall, 1852. Pal. N. York, vol. ii., p. 239, pl. 50, fig. 1–11 & 12–16.—*Niag.*—Lockport, N. York.

CAMPANULITES,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.

tessellatus,* Troost, 1850. List. Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—Tennessee.

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† Not CALATHOCRINUS, Von Meyer, 1848, a Permian genus described in Leonhard und Bronn's Jahrbuch, p. 467, and in Palæontographica, t. 1, p. 265, pl. 32, fig. 2.

CARABOCRINUS, Billings, 1856. Rep. Geol. Surv. Canada, p. 275.

radiatus, Billings, 1856. Rep. Geol. Surv. Canada, p. 275.—1859. Canad. Org. Rem., Dec. iv., p. 31, pl. 2, fig. 3.—*Tr.*—Ottawa, Canada.

(?) tuberculatus, Billings, 1859. Canad. Organ. Rem., Dec. iv., p. 33, pl. x., fig. 2.—*H. R.*—Charleton Point, Anticosti, Canada.

Vancortlandtii, Billings, 1859.—Canad. Org. Rem., Dec. iv., p. 32, pl. 2, fig. 4.—*Tr.*—McNab Township, Canada.

CARYOCYSTITES, *v.* HOLOCYSTITES.

CARYOCRINUS, Say, 1825. Jour. Acad. Nat. Sci. Phil., vol. iv., p. 289.

globosus,* Troost, 1850. List. Crin. Tenn., p. 60.—*Niag.*—Decatur Co., Tennessee.

granulatus,* Troost, 1850. List. Crin. Tenn., p. 60.—*Niag.*—Decatur Co., Tennessee.

hexagonus,* Troost, 1850. List Crin. Tenn., p. 60.—*Niag.*—Decatur Co., Tennessee.

insculptus,* Troost, 1850. List Crin. Tenn., p. 60.—*Niag.*—Decatur Co., Tennessee.

loricatus, *v.* Caryocrinus ornatus.

meconoideus,* Troost, 1850. List Crin. Tenn., p. 60.—*Niag.*—Decatur Co., Tennessee.

ornatus, Say, 1825. Jour. Acad. Nat. Sci. Phil., vol. iv., p. 289. — *Caryocrinus loricatus*, Say, 1825. *Ibid.* — *C. ornatus*, Sow., 1825. Zoolog. Jour., vol. ii., p. 311. — Blainville, 1843. Man. Actinol., p. 263, pl. 29, fig. 5. — Castelnau, 1843. Syst. Sil. Amer. Sept., pl. 25, fig. 2. — Hall, 1843. Geol. Rep. 4th Dist. N. York, p. 111.—Buch, 1845. Ueber. Cystid., p. 1–13, pl. 1, fig. 1–7, and pl. 2, fig. 1, 3, 8.—Hall, 1852. Pal. N. York, vol. 2, p. 216, pl. 49 & 49 *a*.—Rœmer, 1860. Silur. Faun. West Tenn., p. 33, pl. 3, fig. 1.—Dana, 1863. Man. Geol., p. 240, fig. 390.—*Niag.*—Lockport and Rochester, and Monroe and Wayne Cos., New York; Bear Grass Creek, near Louisville, Kentucky; Decatur County, Tennessee.

CATILLOCRINUS,† Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.

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* It is quite probable that all the species of *Caryocrinus* mentioned in Troost's list are merely varieties of *C. ornatus*, Say.

† As no description of Troost's *Catillocrinus* has been published, I am pleased to be able to add the following, drawn from a specimen kindly communicated to me by Prof. Litton of this city, for that purpose.

Genus *Catillocrinus*, Troost.

Generic Character.—Basal pieces 5, small, forming together a low cone. *Primary radials* 5? *Secondary radials* 5, very irregular in form, two of them large, transverse, somewhat lozenge-shaped; two subquadrangular, one lanceolate; their superior edges broad and marked with strong, radiating curved sulci. *Arms* slender, numerous (facets for 56 in the specimens before me), arising directly from the upper straight edges of the secondary radials. *Column* large, round, the superior joint concealing the basals and nearly the whole of the primary radials.

CATILLOCRINUS, Troost (continued).

Tennesseeæ,† Troost, 1850. List Crin. Tenn. Proc. Amer. Assoc. Camb. Meet, p. 60.—*Arch.*—Button-mould Knob, 7 miles south of Louisville, Kentucky; White's Creek Springs, Tennessee.

CHEIROCRINUS,‡ Hall, 1859.

(*Calceocrinus?*) chrysalis, Hall, 1859. 13th Rep. Reg. State Cab. N. York, p. 123, fig. 1–5.—*Niag.*—New York.

(Calceocrinus?) clarus, Hall, July, 1862. 15th Rep. Reg. State Cab. New York, p. 116, pl. 1, fig. 17.—*Ham.*—Ontario Co., New York.

(Calceocrinus?) dactylus, Hall, 1859. 13th Rep. Reg. State Cab. N. York, p. 123, fig. 1–3 on p. 24—*Enc.*—Burlington, Iowa.

(Calceocrinus?) lammellosus, Hall, 1859. 13th Rep. Reg. State Cab. N. York, p. 123.—*Enc.*—Burlington, Iowa.

(Calceocrinus?) nodosus, Hall, 1859. 13th Rep. Reg. State Cab. N. York, p. 124.—*Arch.*

(Calceocrinus?) perplexus,§ Shumard, n. sp.—*Arch.*—Button-mould Knob, Kentucky.

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† *Catillocrinus Tennesseeæ*, Troost.
Description.—Cup hemispherical, width one and a half times greater than the height, composed of thick pieces firmly united together; surface thickly studded with small granulæ and marked with strong sulci at the sutures, which impart to the cup an irregularly lobed appearance. *Base* (concealed by the column) small, pentagonal, situated in a dgep cavity and projecting into the interior in form of a low cone. *Primary radials* forming united an irregular pentagon, with curved margins which scarcely rise above the plane of the under surface of the cup, almost entirely concealed by the last joint of the column. *Secondary radials*, very irregular in form, thick, convex; two very large, transverse, forming about two thirds the cup, expanding rapidly from below upwards so as to embrace nearly the whole of the superior circumference; between these on one side are wedged in two of the smaller pieces, one of them quadrangular with nearly parallel sides, the other linguæform, and opposite these is a large quadrangular piece with sides converging from below upwards. The upper surfaces of this series of pieces are marked with numerous sharply-impressed, curved, radiating sulci, each of them pierced with a minute aperture at the points of attachment for the arms.

I have had a number of specimens of this very curious Crinoid since 1845. They were found at Button-mould Knob, seven miles south of Louisville, Kentucky, in blue marls and marly limestones, which I suppose to be of the age of the Keokuk division of the Archimedes Limestone. They were found associated with *Actinocrinus Yandelli*, *Calceocrinus perplexus*, *Productus semireticulatus*, and *Chonetes Shumardiana*. Dr. Troost's specimen, which I saw during the year 1847 in Nashville, was found, in rocks of the same geological age, at White's Creek Springs, Tennessee.

‡ We strongly suspect that *Cheirocrinus* is identical with *Calceocrinus* proposed by Prof. Hall in 1852. Comparing the figure of the basal portion of *Calceocrinus*, in the supplement plate at the end of the 2d volume of the Palæontology of New York, with that of *Cheirocrinus tunicatus*, in the 13th Report of the Regents of the State Cabinet of Natural History, we perceive, at least, a very striking similarity of structure.

§ Cheirocrinus (*Calceocrinus?*) perplexus.
Description.—This species is much larger than any described by Prof. Hall. The pieces are moderately robust, and the surface thickly studded with small but distinct granules. The basal plate in some examples attains a width of more than an inch, and a height of from one third to one fourth of an inch: the pieces composing it are firmly anchylosed; the dor-

CHEIROCRINUS, Hall (continued).

(Calceocrinus?) stigmatus, Hall, 1863. Trans. Alb. Inst., vol. iv., p. 31 of Abstract.—*Niag.*—Waldron, Indiana.

(Calceocrinus?) tunicatus, Hall, 1859. 13th Rep. Reg. State Cab. New York, p. 124.—*Arch.*

(Calceocrinus?) ventricosus, Hall, 1859. 13th Rep. Reg. State Cab. N. York, p. 123.

CLEIOCRINUS, Billings, 1857. Rep. Geol. Surv. Canada, p. 276.

grandis, Billings, 1859. Can. Org. Rem., Dec. iv., p. 54, pl. 5, fig. 3.—*Tr.*—Ottawa, Canada.

magnificus, Billings, 1859.—Can. Org. Rem., Dec. iv., p. 54, pl. 5, fig. 3.—*Tr.*—Ottawa, Canada.

regius, Billings, 1857. Rep. Geol. Surv. Canada, p. 276.—1859. Can. Org. Rem., Dec. iv., p. 52, pl. 5, fig. 1.—*Tr.*—Ottawa, Canada.

CLOSTEROCRINUS, Hall, 1852. Pal. N. York, vol. ii., p. 179.

elongatus, Hall, 1852. Pal. N. York, vol. ii., p. 179, pl. 41 A, fig. 2.—*Cl.*—Lockport, New York.

COCCOCRINUS, J. Muller, 1855. Verhand. Naturhist. Vereins Rhein. und Westph., Jahrg. 12, p. 20, pl. 7.

bacca, Rœmer, 1860. Sil. Faun. West Tenn., p. 51, pl. 4, fig. 5. —*Niag.*—Perry Co., Tennessee.

CODASTER, McCoy.

alternatus, Lyon, 1857. Geol. Ky., vol. iii., p. 493, pl. 3, fig. 3. (Comp. *C. Americanus.*)—*U. H.*—Falls of Ohio.

Americanus, Shumard, 1858. Tr. Ac. Sci. St. Louis, vol. i., p. 239.—*U. H.*—Falls of Ohio.

Kentuckyensis—*Pentremites Kentuckyensis*, Shumard, 1858. Tr. Acad. Sci. St. Louis, vol. i., p. 239, pl. 9, fig. 5.—*Arch.*—Button-mould Knob, 7 miles south of Louisville, Ky.

pyramidatus, Shumard, 1858. Tr. Acad. Sci. St. Louis, vol. i., p. 238, pl. 9, fig. 1.—*U. H.*—Falls of Ohio.

stelliformis—*Pentremites stelliformis*, Owen and Shumard, 1850. Jour. Ac. Nat. Sci. Phil., n. ser., vol. ii., p. 67, pl. 7, fig. 16.—*Enc.*—Hannibal, Missouri; Burlington, Iowa; near Monmouth, Illinois.

Whitei, Hall, 1861. Des. New Crinoidea, Prelim. Not., p. 10.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 327.—*Enc.*—Burlington, Iowa.

CODONOCRINUS, *v.* PTEROTOCRINUS.

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sal plates are also anchylosed. The first dorsal plate is short triangular, and supports upon its oblique upper edges two large irregular five-sided lateral pieces, and upon the upper beveled edges of these rests a short triangular tumid plate.

Geol. Pos. & Locality.—In blue calcareous shale, supposed to be of the age of the Keokuk division of the Archimedes Limestone. Button-mould Knob, seven miles south of Louisville, Kentucky. At this locality we have found hundreds of basal and dorsal plates of this species in the space of a few yards, but never any examples with arms and column attached.

CŒLIOCRINUS‡ (Subgenus of POTERIOCRINUS), White, 1863. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 499.

dilatatus, Hall, 1861. Des. New Crin., Prelim. Not., p. 6.—*Cœliocrinus*, White, 1863. Bost. Jour. Nat. Hist., vol. vii., p. 501.—*Enc.*—Burlington, Iowa.

subspinosus, White, 1863. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 501.—*Enc.*—Burlington, Iowa.

ventricosus — *Poteriocrinus ventricosus*, Hall, 1861. Des. New Crinoidea, Prelim. Not., p. 6. — *Cœliocrinus*, White, 1863. Bost. Jour. Nat. Hist., vol. vii., p. 501.—*Enc.*—Burlington, Iowa.

COMAROCYSTITES, Billings, 1854. Canad. Jour., vol. ii., p. 270.

punctatus, Billings, 1854. Canad. Jour., vol. ii., p. 270.—1857. Geol. Surv. Canada, p. 288.—1858. Can. Org. Rem., Dec. iii., p. 61, pl. 5.—*Trent.*—Ottawa, Canada.

CONOCRINUS, *v.* ALLOPROSALLOCRINUS.

COTYLEDONOCRINUS§ (Subgenus of DICHOCRINUS), Casseday & Lyon, 1860. Pr. Amer. Acad. Arts & Sci., vol. v., p. 26.

pentalobus, Casseday & Lyon, 1860. Proc. Amer. Acad. Arts & Sci., vol. v., p. 26.—*Kas.*—Grayson Co., Kentucky.

CRASSIBRACHIATUS, Hall, 1860. Geol. Iowa, Sup., p. 60.

CRINOCYSTITES, Hall, 1864. Acc. New or little known Fossils Niag. Group, p. 13.—*Niag.*—Racine, Wisconsin.

chrysalis, Hall, 1864. Acc. New or little known Foss. Niag. Gr., p. 14.—*Niag.*—Racine, Wisconsin.

(?) rectus, Hall, 1864. Acc. New or little known Foss. Niag. Gr., p. 14.—*Niag.*—Racine, Wisconsin.

CRUMENÆCRINITES,* Troost, 1850. List Crin. Tenn. Proc. Am. Assoc. Camb. Meet., p. 62.

ovalis,* Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 62.—Tennessee.

CTENOCRINUS, Bronn, 1840. Leonh. und Bronn, Jahrb., p. 542, pl. 8.—MACROSTYLOCRINUS, Hall, 1852. Pal. N. York, vol. ii., p. 203.—CYTOCRINUS,† Rœmer, 1860. Sil. Faun. West. Tenn., p. 46.

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‡ It is questionable whether the characters given by the author are sufficiently distinctive to warrant us in separating this group from *Poteriocrinus*. They are, however, quite as important, as we find in some of the Subgenera of *Actinocrinus*, *Dichocrinus*, and *Rhodocrinus*, now recognized by some of our prominent palæontologists.

§ This Subgenus, proposed by Casseday and Lyon, presents a very close analogy with *Dichocrinus*. The formula given by the authors is: Basal pieces, 2; Primary radials, 3X5; Secondary radials, 2X10; Arms, 20; Interradials, 3X5; Anal piece, none. It seems to differ from *Dichocrinus* chiefly in the absence of an anal piece in the first series above the base, and there may be some reason for doubt whether this be a permanent or merely an accidental character.

† In the Trans. of the Albany Institute (vol. iv., p. 207), Prof. Hall has pointed out the identity of *Cytocrinus*, Rœm., with *Macrostylocrinus*, Hall, and in the same place Prof. H. remarks that "the Genus *Ctenocrinus* of Bronn, as described by Pictet, possesses a structure resembling or identi-

CTENOCRINUS, Bronn (continued).

lævis—*Cytocrinus lævis*, Rœmer, 1860. Sil. Faun. West. Tenn., taf. iv., p. 46, fig. 2.—*Niag.*—Decatur Co., Tennessee; Bear Grass Creek, near Louisville, Kentucky.

ornatus—*Macrostylocrinus ornatus*, Hall, 1852. Pal. New York, vol. ii., p. 204, pl. 46, fig. 4.—*Niag.*—Lockport, N. York.

striatus—*Macrostylocrinus striatus*, Hall, 1863. Trans. Alb. Inst., vol. iv., p. 207.—*Niag.*—Waldron, Indiana.

CUPELLÆCRINUS,|| (Subgenus of PLATYCRINUS), Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 61. —PLATYCRINUS, Rœm., 1860. Sil. Faun. West. Tenn., p. 35.

Buchii,* Troost, 1850. List Crin. Tenn.—*Niag.*—Decatur Co., Tennessee.

corrugatus,* Troost, 1850. List Crin. Tenn.—*Niag.*—Decatur Co., Tennessee.

inflatus,* Troost, 1850. List Crin. Tenn.—*Niag.*—Decatur Co., Tennessee.

lævis,* Troost, 1850. List Crin. Tenn.—*Niag.*—Decatur Co., Tennessee.

magnificus,* Troost, 1850. List Crin. Tenn.—*Niag.*—Decatur Co., Tennessee.

pentagonalis,* Troost, 1850. List Crin. Tenn.—*Niag.*—Decatur Co., Tennessee.

rosæformis,* Troost, 1850. List Crin. Tenn.—*Niag.*—Decatur Co., Tennessee.

stellatus,* Troost, 1850. List Crin. Tenn.—*Niag.*—Decatur Co., Tennessee.

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cal with *Macrostylocrinus* and *Cytocrinus*, though the exterior character is very distinctive;" he, however, preserves the name of *Macrostylocrinus* for a species the description of which immediately follows. Believing that the surface characters given are merely of specific importance, we take the liberty of grouping this, as well as other species of *Macrostylocrinus*, in Bronn's genus, which has priority.

|| The name *Cupellæcrinus* was published by Dr. Troost in his List of Crinoidea of Tennessee in 1850. It was applied by him to a group of Crinoids obtained by him from the Upper Silurian strata of Perry (now Decatur) County, Tennessee, where they occur in considerable numbers. The subgenus exhibits the following structure:

Basals,	3.
Radials,	2x5: first series large; second series rudimentary and occupying a small depression in the upper margin of the large radial.
Interradials,	5 large.
Arms,	10 (at origin), arising directly from the upper straight margin of the large radials.

It will be observed from the above formula that *Cupellæcrinus* presents considerable analogy with *Platycrinus*, to which genus Dr. Rœmer has referred a species of this group from the glades of Decatur County, Tenn. The differences consist in the rudimentary form of the 2d radials in *Cupellæcrinus*, which are not brachial-bearing as in *Platycrinus*, the brachials being supported almost entirely upon the superior straight edges of the large 1st radials. Prof. Troost indicated by name a number of species as appertaining to this group, one of which has since been described by Dr. Rœmer under the name of *Platycrinus Tennesseensis*.

CUPELLÆCRINUS, Miller (continued).

striatus,* Troost, 1850. List Crin. Tenn.—*Niag.*—Decatur Co., Tennessee.

Tennesseensis—*Platycrinus Tennesseensis*, Rœmer, 1860. Silur. Faun. West. Tenn., p. 35, taf. 3, fig. 4.

CYATHOCRINUS, Miller, 1821. Nat. Hist. Crinoid., p. 85.— Isocrinus and Taxocrinus, Phillips; Cladocrinus, Austin; Vasocrinus, Lyon, 1857. Geology of Kentucky, vol. iii., p. 485.

angulatus, Meek & Worthen, Sept., 1860, Proc. Acad. Nat. Sci. Phil., p. 393.—*Arch.*—Nauvoo, Illinois.

bulbosus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 123. —*U. H.*—Livingston Co., N. York.

bullatus, Hall, 1858. Geol. Iowa, vol. i., p. 624, pl. 18, fig. 1.—*Arch.*—Green Co., Illinois.

Cora, Hall, 1864. New or little known Foss. Niag. Group, p. 20. —*Niag.*—Racine, Wisconsin.

cornutus, Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., n. ser., vol. ii., p. 63, pl. 7, fig. 8.

decadactylus, *v.* Poteriocrinus decadactylus.

depressus, *v.* Zeacrinus depressus.

divaricatus, Hall, 1858. Geol. Iowa, vol. i., p. 554, pl. 9, fig. 5.—*Enc.*—Burlington, Iowa.

florealis, *v.* Zeacrinus florealis.

gracilis, *v.* Scaphiocrinus gracilis.

granuliferus, Shumard, 1852. Rep. Expl. Red River, Louisiana, App., p. 199.—*Kask.*—Washington Co., Arkansas.

hexadactylus, Lyon & Casseday, 1860. Amer. Jour. Sci., n. ser., vol. 29, p. 74.—*Kask.*—Hardin Co., Kentucky.

Hoveyi, Hall, 1861. Des. New Crin., Prelim. Not., p. 5.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 298.—*Arch.*—Crawfordsville, Indiana.

incipiens, Hall, 1861. Des. New Crin., Prelim. Not., p. 5.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 296.—*Enc.*—Burlington, Iowa.

intermedius, Hall, 1858. Geol. Iowa, vol. i., p. 627, pl. 18, fig. 10. —*Arch.*—Warsaw, Illinois.

Iowaensis, Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., n. ser., vol. ii., p. 63, pl. 7, fig. 11.— *Enc.*—Burlington, Iowa.

Kelloggi, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 8. —*Enc.*—Burlington, Iowa.

læviculus, Lyon, 1861. Proc. Acad. Nat. Sci. Phil., p. 409, pl. 4, fig. 1.—*U. H.*—Near Louisville, Kentucky.

latus, Hall, Feb., 1861. Des. New Crinoid., Prelim. Not., p. 5.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 292.—*Enc.*—Burlington, Iowa.

lammellosus, White, 1863. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 504.—*Enc.*—Burlington, Iowa.

CYATHOCRINUS, Miller (continued).

Lyoni, Hall, 1861. Des. New Crinoid., Prelim. Not., p. 5.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 298.—*Arch.*—Crawfordsville, Indiana.

macropleurus, Hall, 1861. Des. New Crin., Prelim. Not., p. 5.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 295.—*Enc.*—Burlington, Iowa.

magister, Hall, 1858. Geol. Iowa, vol. i., p. 628, pl. 18, fig. 2 & 3.—*Arch.*—Keokuk, Iowa.

malvaceus, Hall, 1858. Geol. Iowa, vol. i., p. 554, pl. 9, fig. 4.—*Enc.*—Burlington, Iowa.

maniformis,† *v.* Zeacrinus maniformis.

multibrachiatus, Lyon & Casseday, 1859. Amer. Jour. Sci., n. ser., vol. 28, p. 245.—*Arch.*—Montgomery Co., Indiana.

(?) ornatissimus, Hall, 1843. Geol. 4th Dist. N. York, p. 247, No. 56.—*Chem.*—Shore of Lake Erie, New York.

parvibrachiatus, Hall, 1861. Des. New Crin., Prelim. Not., p. 6.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 294—*Arch.*—Keokuk, Iowa.

pentalobus, v. C. (Graphiocrinus) quatuor-decem-brachialis.

Polyxo, Hall, 1863. Trans. Alb. Inst., vol. iv., p. 199.—*Niag.*—Waldron, Indiana.

protuberans, Hall, 1858. Geol. Iowa, vol. i., p. 626, pl. 18, fig. 9.—*Arch.*—Warsaw, Illinois.

pusillus, Hall, 1863. Trans. Alb. Inst., vol. 4, p. 200. (Compare *Poteriocrinus pisiformis,* Rœmer.)—*Niag.*—Waldron, Indiana.

pyriformis, v. Icthyocrinus lævis.

(Graphiocrinus) quatuor-decem-brachialis — *Graphiocrinus,* Lyon, 1857. Geol. Kentucky, vol. iii., p. 477, pl. I, fig. 1.—*Cyathocrinus pentalobus,* Hall, 1858. Geol. Iowa, vol. i., p. 687, pl. 25, fig. 5.—*Enc.*—Burlington, Iowa.

rigidus, White, 1862. Proc. Bost. Soc. Nat. His., vol. ix., p. 8.—*Enc.*—Burlington, Iowa.

quinquelobus, Meek & Worthen, Aug., 1865. Proc. Acad. Nat. Sci. Phil., p. 150.—*Arch.*—Warsaw, Illinois.

rotundatus, Hall, 1858. Geol. Iowa, vol. i., p. 555, pl. 9, fig. 7.—*Enc.*—Burlington, Iowa.

Saffordi, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 391.—*Arch.*—White's Creek, Tennessee.

Sangamonensis, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 392.—*C. M.*—Sangamon Co., Illinois.

scitulus, v. Cyathocrinus sculptilis.

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† This species has much the aspect of *Graphiocrinus.* Should it prove, upon a more critical examination, that Koninck and Le Hon have overlooked the true basals in their Genus and described the subradials for these pieces, as seems somewhat probable, it will become necessary to transfer this species, and a number of others now grouped in *Zeacrinus* and *Scaphiocrinus,* to *Graphiocrinus.*

CYATHOCRINUS, Miller (continued).

sculptilis, Hall, 1860. Geol. of Iowa, Sup. p. 59. — *C. scitulus*, Meek & Worthen, Sept., 1860. Proc. Acad. Nat. Sci. Phil., p. 386.—*C. sculptilis, id.*, 1861. Proc. Ac. Nat. Sci. Phil., p. 148.—*Enc.*—Burlington, Iowa.

sculptus—*Vasocrinus sculptus*, Lyon, 1857. Geol. Kentucky, vol. iii., p. 486, pl. 4, fig. 3.—*U. H.*—Falls of Ohio.

solidus, Hall, 1861. Des. New Crin., Prelim. Not., p. 5.—Jour. Bost. Soc. Nat. Hist., vol. vii., p. 292.—*Enc.*—Burlington, Iowa.

spurius, Hall, 1858. Geol. Iowa, vol. i., p. 625, pl. 8, fig. 7 & 8. —*Enc.*—Warsaw, Illinois.

stellatus, (Troost, Ms.) Hall, 1858. Geol. Iowa, vol. i., p. 623, pl. 16, fig. 3–8.—*Arch.*—Warsaw, Illinois.

subtumidus, Meek & Worthen, Aug., 1865. Proc. Acad. Nat. Sci. Phil., p. 151.—*Arch.*—Green Co., Illinois.

Thomæ, Hall, 1860. Geol. Iowa, Sup. p. 61.—*Arch.*—Warsaw, Illinois.

tiaræformis, v. Icthyocrinus tiaræformis.

tumidus, Hall, 1858. Geol. Iowa, vol. i., p. 624, pl. 18, fig. 1.—*Arch.*—Warsaw, Illinois.

valens—*Vasocrinus valens*, Lyon, 1857. Geol. Kentucky, vol. iii., p. 485, pl. 4, fig. 3.—*U. H.*—Bear Grass Creek, near Louisville, Kentucky.

viminalis, Hall, 1861. Des. New Crin., Prelim. Not., p. 5.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 299.—*Enc.*—Burlington, Iowa.

Waukoma, Hall, 1864. New or little known Foss. Niag. Group, p. 20.—*Niag.*—Racine, Wisconsin.

Wortheni, Lyon, 1861. Proc. Acad. Nat. Sci. Philad., p. 410.—*U. H.*—Near Louisville, Kentucky.

Wachsmuthii, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 136.—*Enc.*—Burlington, Iowa.

arboreus, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 160.—*Arch.*—Crawfordsville, Indiana.

In Prof. Troost's Catalogue of Crinoidea of Tennessee (Proc. Am. Sci. Assoc. 1850), we find, besides the species above enumerated, the following names of *Cyathocrini*; it is probable, however, that some of these have since been described under different names, and that others belong to different genera :

C. conglobatus.	C. robustus.
" corrugatus.	" Rœmeri.
" crateriformis.	" sculptus.
" globosus.	" stellatus.
" inflatus.	" Tennesseæ.
(?) " planus.	

CYCLOCYSTOIDES, Salter & Billings, 1858. Can. Org. Rem. Dec. iii., p. 86.

Halli, Billings, 1858. Canad. Org. Rem. Dec. iii., p. 87, pl. 10 *bis.*, fig. 1–7.

CYCLOCYSTOIDES (continued).

Davisii, Salter, 1858. Canad. Org. Rem. Dec. iii., pl. 10 *bis.*, fig. 8-10.—*Tr.*—Canada.

CYSTOCRINUS, Rœmer, 1860. Sil. Faun. West. Tenn., p. 56.

Tennesseensis, Rœmer, 1860. Sil. Faun. West. Tennessee., p. 56, pl. 4, fig. 8.—*Niag.*—Decatur Co., Tennessee.

CYTOCRINUS, *v.* MACROSTYLOCRINUS.

CYCLASTER, *v.* EDRIOASTER.

DÆMONOCRINITES, *v.* PTEROTOCRINUS.

DECADACTYLOCRINITES, *v.* HETEROCRINUS.

DENDROCRINUS, Hall, 1852. Pal. N. York, vol. 2, p. 193.

acutidactylus, Billings, 1857. Rep. Geol. Surv. Can., p. 266.—1859. Canad. Org. Rem. Dec. iv., p. 37, pl. 3, fig. 2.—*Tr.*—Montreal, Canada.

angulatus, *v.* Palæocrinus angulatus.

conjugans, Billings, 1857. Rep. Geol. Surv. Can., p. 268.—Can. Org. Rem. Dec. iv., p. 41, pl. 4, fig. 1-2. — *Tr.* — Ottawa, Canada.

cylindricus, Billings, 1857. Rep. Geol. Surv. Canada, p. 268.—1859. Canad. Org. Rem. Dec. iv., p. 44, pl. 3, fig. 8.—*Tr.*—Montreal, Canada.

gregarius, Billings, 1857. Report Geol. Surv. Canada, p. 265.—1859. Canad. Org. Rem. Dec. iv., p. 36, pl. 3, fig. 1.—*Tr.*—Ottawa, Canada.

humilis, Billings, 1857. Rep. Geol. Surv. Canada, p. 270.—1859. Canad. Org. Dec. iv., p, 39, pl. 3, fig. 4.—*Tr.*— Ottawa, Canada.

Jewettii, Billings, 1857. Rep. Geol. Surv. Canada, p. 270.—1859. Canad. Org. Rem. Dec. iv., p. 43, fig. 15.— *Tr.* — Bay of Quinte, Canada.

latibrachiatus, Billings, 1857. Rep. Geol. Surv. Canada, p. 270.—1859. Canad. Organ. Rem. Dec. iv., p. 39, pl. 3, fig. 5.—*H. R. G.*—Island of Anticosti, Canada.

longidactylus, Hall, 1852. Pal. N. York, vol. ii., p. 193, pl. 43, fig. 1, and pl. 42, fig. 7.—*Niag.*—Lockport, N. York.

proboscidiatus, Billings, 1857. Rep. Geol. Surv. Canada, p. 267.—1859. Canad. Org. Rem. Dec. iv., p. 38, pl. 3, fig. 3.—*Tr.*—Montreal, Canada.

rusticus, Billings, 1857, Rep. Geol. Surv. Canada, p. 270.—1859. Canad. Org. Rem., Dec. iv., p. 41.—*Tr.*—Ottawa, Canada.

similis, Billings, 1857. Rep. Geol. Surv. Canada, p. 267.—1859. Canad. Org. Rem. Dec. iv., p. 40.—*Tr.*—Ottawa, Canada.

DICHOCRINUS, Munster, 1839. Beitr. zur Petref., vol. 1.

angustus, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 19.—*Enc.*—Burlington, Iowa.

Chesterensis, *v.* Pterotocrinus Chesterensis.

DICHOCRINUS (continued).

constrictus, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 381.—*Arch.*—Bloomington, Indiana.

conus, Meek and Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 381.—*Enc.*—Warren Co., Illinois.

cornigerus, v. Pterotocrinus cornigerus.

crassitestus, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 19.—*Enc.*—Burlington, Iowa.

crassus, v. Pterotocrinus crassus.

dichotomus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 85.—*Arch.*—Warsaw, Illinois.

elegans, Casseday & Lyon, 1860. Proc. Amer. Acad. Arts & Sci., vol. v., p. 22.—*Kask.*—Near Mammoth Cave, Edmondson Co., Kentucky.

ficus, Casseday & Lyon, 1860. Proc. Amer. Acad. Arts & Sci., vol. v., p. 24.—*Kask.*—Hardin Co., Kentucky.

lachrymosus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 84.—*Enc.*—Burlington, Iowa.

lævis, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 83.—*Enc.*—Burlington, Iowa.

liratus, Hall, 1861. Des. New Crin., Prelim. Not., p. 5, 1861. Bost. Jour. Nat. Hist., vol. vii., p. 290.—*Enc.*—Burlington, Iowa.

ovatus, Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., vol. ii., n. ser., p. 61, pl. 7, fig. 9.—1852. Geol. Surv. Iowa, Wisconsin and Minnesota, p. 590, pl. v. A., fig. 9.—*Enc.*—Burlington, Iowa.

plicatus, Hall, 1861. Des. New Crin., Prelim. Not., p. 4.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 288.—*Enc.*—Burlington, Iowa.

pocillum, Hall, 1861. Des. New Crinoidea, Prelim. Not., p. 5.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 291.—*Enc.*—Burlington, Iowa.

polydactylus, Casseday & Lyon, 1860. Proc. Amer. Acad. Arts & Sci., vol. v., p. 18.—*Kas.*—Hardin Co., Kentucky.

protuberans, Hall, 1858. Geol. Iowa, vol. i., p. 689, pl. 25, fig. 7.—*Kas.*—Chester, Illinois.

scitulus, Hall, 1861. Des. New Crinoidea, Prelim. Not., p. 4.—1861. Jour. Boston Soc. Nat. Hist., vol. vii., p. 289.—*Enc.*—Burlington, Iowa.

sculptus, Casseday & Lyon, 1860. Pr. Amer. Acad. Arts & Sci., vol. v., p. 25.—*Kas.*—Hardin Co., Kentucky.

sex-lobatus, v. Pterotocrinus sex-lobatus.

simplex,† Shumard, 1857. Trans. Acad. Sci. St. Louis, vol. i., p. 74, pl. 1, fig. 2.—Hall, 1858. Geol. Iowa, vol. i., p. 654, pl. 22, fig. 12.—*Arch.*—Spergen Hill, Indiana; St. Mary's Landing, Missouri; Sparta, Tennessee.

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† According to Prof. Hall, this species occurs in the Collection of the late Dr. Troost, under the name of *Doliocrinites ovalis*, but the name does not appear in the Catalogue or MSS. of the Monograph. Troost's specimen was procured from Sparta, Tennessee.

DICHOCRINUS (continued).

symmetricus, Casseday & Lyon, 1860. Proc. Amer. Acad. Arts & Sci., vol. v., p. 18.—*Kas.*—Breckenridge, Grayson, Hart and Edmondson Counties, Kentucky.

striatus, Owen and Shumard, 1850. Jour. Acad. Nat. Sci. Phil., new ser., vol. ii., p. 62, pl. 7, fig. 10.—1852. Geol. Surv. Iowa, Wisconsin and Minnesota, p. 590, tab. v. A., fig. 10. —*Enc.*—Burlington, Iowa.

DICTYOCRINUS (DICTUOCRINITES), Conrad, 1841. Ann. Rep. Geol. Surv. New York.

squamifer, Hall, 1859. Pal. New York, vol. iii., pt. 1, pl. 7 A., fig. 11-13.—*L. H.*—Schoharie, New York.

DONACICRINITES,* Troost, 1850. List Crin. Tennessee, Proc. Amer. Assoc. Camb. Meet., p. 62.

simplex,* Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 62.—Tennessee.

DOLATOCRINUS, Lyon, 1857.† Rep. Geol. Surv. Kentucky, vol. iii., p. 482.—CACABOCRINUS, Troost, 1850. List Crin. Tenn. Proc. Amer. Assoc. Camb. Meet., p. 60.—*Id.* Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 137.

glyptus—*Cacabocrinus glyptus*, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 140.—*Ham.*—Pavillion Co., New York.

var. intermedius—*Cacabocrinus*, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 141.—*Ham.*—Livingston Co., New York.

lacus, Lyon, 1857. Geol. Kentucky, vol. iii., p. 482, pl. 4, fig. 2. —*U. H.*—Bear Grass Creek, near Louisville, Ky.

lamellosus—*Cacabocrinus lamellosus*, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 141.—*U. H.*—New York.

liratus—*Cacabocrinus liratus*, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 139.—*Ham.*—Western New York.

var. multilira—*Cacabocrinus multilira*, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 139.—*Ham.*—Western New York.

speciosus—*Cacabocrinus speciosus*, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 137.—*U. H.*—Schoharie, N. York.

Troosti—*Cacabocrinus Troosti*, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 138.—*Ham.*—Western New York.

DORYCRINUS, *v.* ACTINOCRINUS.

ECHINOCYSTITES, Hall, 1864. New or little known Foss. Niag. Group, p. 12. (Abst. 18th Rep. Reg. State Cab. N. York.)

nodosus, Hall, 1864. New or little known Foss. Niag. Gr., p. 12 of Abst..—*Chem.*—Racine, Wisconsin.

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† The name *Cacabocrinus*, Troost, antedates that of *Dolatocrinus*, Lyon; but as the former appears simply in the Catalogue of Crinoids of Tennessee without description or figure, we are, according to the laws of priority, compelled to adopt the latter, which has been very minutely described and illustrated by Mr. Lyon in the 3d volume of the Ketucky Geological Report.

ECHINO-ENCRINITES, Von Meyer, 1826.

anatiformis, Hall, 1847. Pal. N. York, vol. i., p. 89, pl. 29, fig. 4. —*Tr.*—Turin, Lewis Co., New York.

fenestratus,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—Tennessee.

ECHINOENCRINUS, *v.* ARCHÆOCIDARIS.

ECHINUS, *v.* ARCHÆOCIDARIS.

EDRIOASTER, Billings, 1858. Canad. Org. Rem. Dec. iii., p. 82.—CYCLASTER, Billings, 1857. Rep. Geol. Surv. Canada, p. 292.

Bigsbyi—*Cyclaster Bigsbyi*, Billings, 1857. Rep. Geol. Surv. Canada, p. 293.—*Edrioaster Bigsbyi*, Billings, 1858. Canad. Org. Rem., Dec. iii., p. 82.—*Trent.*—Ottawa, Canada.

EDRIOCRINUS, Hall, 1859. Pal. N. York, vol. iii., pt. 1, p. 119.

pocilliformis, Hall, 1859. Pal. N. York, vol. iii., p. 121, pl. 5, fig. 8-12.—*L. H.*—Helderberg Mts., Albany, New York.

pyriformis, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 116, fig. 1-22.—*U. H.*—Near Utica, New York.

sacculus, Hall, 1859. Pal. N. York, vol. iii., pt. 1, p. 143, pl. 87, fig. 1-22.—*Orisk.*—Cumberland, Maryland.

ELÆACRINUS—PENTREMITES, Troost, 1841. 6th Rep. Geol. Tenn. —NUCLEOCRINUS,† Conrad, 1843. Jonr. Acad. Nat. Sci. Phil., vol. viii., p. 280.—OLIVANITES, Troost, 1850. Cat. Crin. Tenn.—PENTREMITES (Beadle), D'Orbigny, Prod. Pal., vol. i.—ELÆACRINUS, Rœmer, 1851. Monog. Blastoidea, p. 55.—*Id.* 1856. Leth. Geog. Kohlen Gebirg., p. 204.—OLIVANITES, Lyon, 1857. Geol. Surv. Kentucky, vol. iii., p. 490.—NUCLEOCRINUS,, Lyon & Casseday, 1859. Proc. Am. Ac., vol. iv., p. 295.—ELÆACRINUS, Bronn, 1860. Die Klass. Ord. b. Thier-Reichs, bd. 2, Aktinozoen taf. 23.—Shumard, 1862. Proc. Acad. Sci. St. Louis, vol. ii., p. 111. —NUCLEOCRINUS, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 146.—*Id.*, Dana, 1863. Man. Geol., p. 274.

angularis—*Olivanites angularis*, Lyon, 1857. Geol. Kentucky, vol. iii., p. 492, pl. 5, fig. 2.—*Nucleocrinus angularis*, Lyon & Casseday, 1859. Proc. Amer. Acad. Arts & Sci., vol. iv.,

† I have elsewhere (Trans. Acad. Sci. St. Louis, vol. ii., p. 111) given my reasons for adopting the name *Elæacrinus* in preference to *Nucleocrinus*, although the latter was proposed considerably in advance of the former. Strictly adhering to the laws which govern Naturalists in such cases, we cannot in justice to Rœmer set aside his name. The description of Conrad is not only extremely imperfect, but it is entirely erroneous, and calculated to mislead the student in his efforts to identify the fossil he attempted to describe. In a word, no one could possibly recognize the genus from Conrad's description, since there is no section of the Family Blastoidea presenting such a structure. Conrad's entire description is as follows :— "NUCLEOCRINUS, Conrad. This Genus differs from *Pentremites*, Say, in having only one perforation at the top, which is central." Now, if we examine Prof. Hall's excellent description of the same fossil in the 15th Rep. of the Regents of the State Cabinet of New York, published in 1852, ten years after Rœmer's description of *Elæacrinus*, we find that there are at the summit, in addition to the central opening (closed in perfect specimens by small calcareous plates?), five pairs of ovarian apertures, as in the typical species of *Pentremites;* besides, there is also an anal opening.

ELÆACRINUS (continued).

p. 295.—*U. H.*—Bear Grass Creek, near Louisville, Ky.; Falls of Ohio.

Conradi—*Nucleocrinus Conradi*, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 149.—*U. H.*—Stafford, Genesee Co., New York.

elegans—*Nucleocrinus elegans*, Conrad, 1842. Jour. Acad. Nat. Sci. Phil., vol. 8, p. 280.—*Nucleocrinus Halli*, Vanuxem, p. 163.—*N. elegans*, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 147, pl. 1, fig. 14 & 15.—*Ham.*—Livingston Co., New York.

lucina—*Nucleocrinus lucina*, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 148, pl. 1, fig. 16.—*Ham.*—Livingston Co., New York.

Verneuili—*Pentremites Verneuili*, Troost, 1841. 6th Geol. Rep. Tenn.—*Pentremites carioides*, Owen, 1843. Cat. Geol. Spec. Ohio Valley.—*Olivanites Verneuili*, Troost, 1849. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 62. —*Olivanites globosus*, *id. ib.*—*Pentremites Verneuili* (Beadle), D'Orb. Prod. Palæont., vol. i., p. 102.—*Elæacrinus Verneuili*, Rœmer, 1851. Monog. Blastoid., p. 50, pl. 5, fig. 1.—1856. Leth. Geog. Kohlen Gebirg., p. 284, taf. 4, fig. 10.—*Olivanites Verneuili*, Lyon, 1857. Geol. Surv. Kentucky, vol. iii., p. 490, pl. 5, fig. 1.—*Nucleocrinus*, Lyon & Casseday, 1859. Proc. Amer. Ac., vol. iv., p. 295.—*Elæacrinus*, Bronn, 1860. Die Klass. Ord. Thier-Reichs bd. 2, Aktinozoen taf. 23.—*Nucleocrinus*, Dana, 1863. Man. Geol., p. 274, fig. 452.—*U. H.*—Falls of Ohio, near Columbus, Oh.

ELEUTHEROCRINUS, Shumard & Yandell, 1856. Proc. Ac. Nat. Sci. Phil., vol. viii., p. 73.

Cassedayi, Shumard & Yandell, 1856. Proc. Ac. Nat. Sci. Phil., vol. viii., p. 74, pl. 2.—Bronn, 1860. Die Klass. Ord. d. Thier-Reichs, bd. 2, Aktinozoen taf. 23, fig. 7.—*U. H.*—Bear Grass Creek, near Louisville, Kentucky.

Whitfieldi, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 151.—*Ham.*—Western New York.

ENCRINA, *v.* PENTREMITES.

ERETMOCRINUS,† Lyon & Casseday, 1859. Amer. Jour. Sci., n. ser., vol. 28, p. 24. (Subgenus of ACTINOCRINUS.)

magnificus, Lyon & Casseday, 1859. Amer. Jour. Sci., vol. 28, p. 241. (Compare *Actinocrinus remibrachiatus*, Hall.)

ERISOCRINUS, Meek & Worthen, March, 1865. Amer. Jour. Sci., n. ser., vol. 39, p. 174.—PHILOCRINUS, *id. ibid*, May, 1865. (Not Koninck, 1863.)—ERISOCRINUS, *id. ibid*, Aug., 1865, p. 149.

conoideus, Meek & Worthen, Aug., 1865. Proc. Acad. Nat. Sci. Phil., p. 150.—*U. C. M.*—Springfield, Illinois.

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† This Subgenus is very closely related to *Actinocrinus*, the essential points of structure being precisely the same in both. The peculiarities in form and arrangement of the arms mentioned by Lyon and Casseday seem to me to be of merely specific value.

ERISOCRINUS (continued).

Nebrascensis, Meek & Worthen, 1865. Amer. Jour. Sci., n. ser., vol. 39, p. 174.—*U. C. M.*—Bellevue, Nebraska.

typus, Meek & Worthen, 1865. Amer. Jour. Sci., n. ser., vol. 39, p. 174.—*U. C. M.*—Springfield, Illinois.

tuberculatus, Meek & Worthen, Aug., 1865. Proc. Ac. Nat. Sci. Phil., p. 150.—*U. C. M.*—Sangamon and Jersey Counties, Illinois.

EUCALYPTOCRINUS, Goldfuss, 1826. Petref. Germ., p. 212.—HYPANTHOCRINITES, Phillips, 1839. Sil. Syst., p. 672.

conicus,* Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 61.—*Niag.*—Decatur Co., Tennessee.

cœlatus—*Hypanthocrinites cœlatus*, Hall, 1843. Geol. 4th Dist. N. York, p. 113, fig. 1.—*Eucalyptocrinus cœlatus*, Hall, 1852. Pal. N. York, vol. ii., p. 210, pl. 47, fig. 4.—Rœmer, 1860. Sil. Faun. West. Tenn., p. 48, pl. iv., fig. 3.—*Niag.*—Lockport, New York; Waukesha, Wisconsin; Decatur County, Tennessee.

cornutus, Hall, 1864. New or little known Foss. Niag. Group, p. 18.—*Niag.*—Waukesha and Racine, Wisconsin.

var. excavatus, *id. ib.*, p. 18.—*Niag.*—Waukesha and Racine, Wisconsin.

crassus, Hall, 1863. Trans. Alb. Inst., vol. iv., p. 197.—*Niag.*—Waldron, Ohio; Racine, Wisconsin.

decorus—*Hypanthocrinites decorus*, Phillips, 1839. Silur. Syst., p. 672, pl. 17, fig. 3.—Hall, 1843. Geol. 4th Dist. N. York, p. 113, fig. 2 & 3.—*Eucalyptocrinus decorus*, Hall, 1852. Pal. New York, vol. ii., p. 207, pl. 47, fig. 1–3.—*Niag.*—Lockport, Rochester, and Monroe Co., New York.

extensus,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Niag.*—Decatur Co., Tennessee.

gibbosus,* Troost, 1850. List. Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Niag.*—Decatur Co., Tennessee.

Goldfussi,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Niag.*—Decatur Co., Tennessee.

lævis,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Niag.*—Decatur Co., Tennessee.

Nashvillæ,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Niag.*—Decatur Co., Tennessee.

obconicus, Hall, 1864. New or little known Foss. Niag. Group, p. 19.—*Niag.*—Racine, Wisconsin.

ornatus, Hall, 1861. Rep. Sup. Geol. Surv. Wisconsin, p. 20.—*Niag.*—Racine and Waukesha, Wisconsin.

ovalis,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Niag.*—Decatur Co., Tennessee.

papulosus, Hall, 1852. Pal. N. York, vol. ii., p. 211, pl. 47, fig. 5.—*Niag.*—Monroe Co., New York.

Phillipsii,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Niag.*—Decatur Co., Tennessee.

EUCALYPTOCRINUS (continued).

ramifer,† Rœmer, 1860. Sil. Faun. West. Tenn., p. 51, pl. 4, fig. 4.—*Niag.*—Decatur Co., Tennessee.

splendidus,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Niag.*—Decatur Co., Tennessee.

Tennesseeæ,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 61.—*Niag.*—Decatur Co., Tennessee.

FORBESIOCRINUS,‡ Koninck & Le Hon.—1854. Crin. Ter. Carb. Belg., p. 18.—POTERIOCRINUS (*Part.*), Phil., 1836. Geol. Yorksh., vol. i. (*non* Miller).—CYATHOCRINUS, *id.* 1841. Pal. Foss. Cornw. (*non* Miller).—ISOCRINUS, *id. ibid.* (*non* Meyer).—CLADOCRINITES, Aust., 1842. Ann. & Mag. Nat. Hist., vol. x. (*non* Agass., 1835).—TAXOCRINUS, Phil., 1843. Morris' Brit. Cat. Foss.—ONYCHOCRINUS, Lyon & Cassed., 1859. Amer. Jour. Sci., vol. 29, p. 77.

Agassizi, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 630.—*Enc.*—Burlington, Iowa.

var. giganteus, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 131.—*Enc.*—Burlington, Iowa,

asteriæformis, Hall, Feb., 1861. Des. New Crin., Prelim. Not. p. 9.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 320.—*Enc.*—Burlington, Iowa.

Cestriensis, Hall, 1860. Geol. Iowa, Sup. p. 68.—*Enc.*—Burlington, Iowa.

communis, Hall, 1863. Crin. Wav. Sands. Ohio, p. 6.—*Chem.*—Summit Co., Ohio.

exculptus—*Onychocrinus exculptus*, Lyon & Casseday, 1859. Am. Jour. Sci., vol. 29, n. ser., p. 78.—*Kas.*(?)—Hardin Co., Kentucky.

Giddingei, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 633, pl. 17, fig. 2 & 4.—*Keok.*—Missouri.

juvenis, Hall, 1861. Des. New Crin., Prelim. Not., p. 8.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 319.—*Enc.*—Burlington, Iowa.

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† This species is probably one of those mentioned in the List of Crinoids of Tennessee, it having been procured from the same district whence Prof. Troost obtained his fine collection of *Eucalyptocrini.*

‡ Since this part of the Catalogue was in type, I have received through the kind attention of Mr. Meek a paper, entitled "Remarks on the Genus Taxocrinus, (Phillips,) McCoy, 1844, and its relations to Forbesiocrinus, Koninck & Le Hon, 1854, with Descriptions of New Species by F. B. Meek and A. H. Worthen." This paper contains a tabular list of 22 species of American and European Crinoids referred to *Forbesiocrinus* or *Taxiocrinus*, with a statement of the number of radials, interradials, anals, &c., in each, from which it appears very clearly that there are no constant characters by which we can separate *Forbesiocrinus* as a distinct Genus from *Taxocrinus*. These authors, however, for the present retain *Forbesiocrinus* in a subgeneric sense, grouping under this name species which possess more than two interradials and anals, and under *Taxocrinus not* only those which are deficient in these pieces, but those also in which one or two exist. Believing with these authors that it will be convenient to employ both names, at least provisionally, I shall here nevertheless follow De Koninck, Le Hon, Pictet, and others, and group in *Taxocrinus* only such species as are devoid of interradials and anals, and in *Forbesiocrinus* those having one or more of these pieces.

FORBESIOCRINUS (continued).

Kelloggi, Hall, 1863. Crin. Wav. Sands., p. 7.—*Chem.*—Summit Co., Ohio.

lobatus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 124. —*Ham.*—Ontario Co., New York.

var. tardus, Hall, 1863. Crin. Waverly Sands., p. 7.—*Chem.*—Summit County, Ohio.

Meeki, Hall, 1858. Geol. Iowa, vol. i., p. 631, pl. 17, fig. 3.—*Keok.*—Warsaw, Illinois.

Monroensis, Meek & Worthen, June, 1861. Proc. Acad. Nat. Sci. Phil., p. 130.—*Enc.*—Burlington, Iowa.

multibrachiatus, Lyon & Casseday, 1859. Amer. Jour. Sci., n. ser., vol. 28, p. 235.—*Kask.*(?)—Hardin Co., Kentucky.

(?) Norwoodi, Meek & Worthen, 1860. Proc. Ac. Nat. Sci. Phil., p. 389.—*Keok.*—Nauvoo, Illinois.

nuntius, *v.* Taxocrinus nuntius.

Pratteni, *v.* Melocrinus Pratteni.

ramulosus, Lyon & Casseday, 1859. Amer. Jour. Sci., new ser., vol. 28, p. 237.—*Kas.*(?)—Hardin Co., Kentucky.

Saffordi, Hall, 1860. Geol. Iowa, vol. i., p. 87.—*Enc.*—Burlington, Iowa.

(?) semiovatus, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 389.—*Enc.*—Burlington, Iowa.

Shumardianus, Hall, 1858. Geol. Iowa, vol. i., 671, pl. 17, fig. 1. —*St. L.*—St. Louis, Missouri.

subramulosus—*F. ramulosus*, Hall, 1860. Geol. Iowa, Sup. vol. i., p. 67 (non *F. ramulosus*, Lyon & Cass., 1859).—*Enc.*—Burlington, Iowa.

Thiemei, *v.* Taxocrinus Thiemei.

Whitfieldi, Hall, 1860. Geol. Iowa, vol. i., pt. 2, p. 632, fig. 104. —*Arch.*—Warsaw, Illinois.

Wortheni, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 632, pl. 17, fig. 5.—*Arch.*—Keokuk, Iowa.

GILBERTSOCRINUS, *v.* RHODOCRINUS.

GLYPTOCRINUS—APIOCRINITE, Anthony, 1838. Amer. Jour. Sci., vol. 35, p. 405 (non *Apiocrinite*, Miller, 1821).—ICOSIDACTYLOCRINUS, Owen, 1843. Cat. Geol. Spec. Ohio Valley.—GLYPTOCRINUS, Hall, 1847. Pal. New York, vol. i., p. 281.

Carleyi, Hall, 1863. Trans. Alb. Inst., vol. iv., p. 203.—*Niag.*—Waldron, Indiana.

decadactylus—*Apiocrinite*, Anthony, 1838. Amer. Jour. Sci., vol. 35, p. 405.—*Icosidactylocrinites reticulatus*, Owen, 1843. Cat. Geol. Spec. Ohio Valley.—*Glyptocrinus decadactylus*, Hall, 1847. Pal. N. York, vol. i., p. 281, pl. 77, fig. 1, and pl. 78, fig. 1.—*H. R. G.*—Cincinnati, Ohio; Madison, Indiana.

fimbriatus, Shumard, 1855. 2d Rep. Geol. Surv. Missouri, pt. 2, p. 194, pl. A, fig. 10.—*C. G.*—Near Cape Girardeau, Missouri, and near Thebes, Illinois.

GLYPTOCRINUS (continued).

lacunosus, Billings, 1857. Rep. Prog. Geol. Surv. Canada, p. 261. —1859. Canad. Org. Rem., Dec. iv., p. 61, pl. 8, fig. 3.—*Tr.*—Ottawa, Canada.

marginatus, Billings, 1857. Rep. Prog. Geol. Surv. Canada, p. 260.—1859. Canad. Org. Rem., Dec. iv., p. 59, pl. 9, fig. 1. —*Tr.*—Ottawa, Canada.

nobilis, Hall, 1861. Rep. Sup. Geol. Surv. Wisconsin, p. 21.—*Niag.*—Racine, Wisconsin.

ornatus, Billings, 1857. Rep. Prog. Geol. Surv. Canada, p. 260. —1859. Can. Org. Rem., Dec. iv., p. 60, pl. 9, fig. 2.—*Tr.* —Ottawa, Canada.

plumosus—*Actinocrinites*(?) *plumosus,* Hall, 1843. Geol. 4th Dis. N. York, p. 72.—*Glyptocrinus plumosus,* Hall, 1852. Pal. N. York, vol. ii., p. 180, pl. A 41, fig. 3.—*Cl.*—Niagara Co. and Lockport, New York.

priscus, Billings, 1857. Rep. Prog. Geol. Surv. Canada, p. 257. —*B. B.*—County of Renfrew and Ottawa, Canada.

quinquepartitus, Billings, 1857. Rep. Prog. Geol. Surv. Canada. —1859. Canad. Org. Rem., Dec. iv., pl. 8, fig. 4.—*Tr.*—Ottawa, Canada.

ramulosus, Billings, 1857. Rep. Prog. Geol. Surv. Canada, p. 258. —*Tr.*—Ottawa, Canada.

syphonatus, Hall, 1861. Rep. Sup. Geol. Surv. Wisconsin, p. 22. —*Niag.*—Racine and Waukesha, Wisconsin.

GLYPTOCYSTITES, Billings, 1854. Canad. Jour., vol. ii., p. 215.

Forbesi, Billings, 1857. Rep. Geol. Surv. Canada, p. 283.—1858. Can. Org. Rem., Dec. iii., p. 59, pl. 4, fig. 3.—*Cha.*—Montreal and Caughnawaga, Canada.

gracilis, Billings, 1858. Canad. Org. Rem., Dec. iii., p. 59, pl. 4, fig. 2.—*Tr.*—Montreal, Canada.

Logani, Billings, 1857. Geol. Surv. Canada, p. 282.—1858. Can. Org. Rem., Dec. iii., p. 57, pl. 4, fig. 1.—*Trent.*—Island of Montreal, Canada.

multiporus, Billings, 1854. Canad. Jour., vol. ii., p. 215.—1857. Geol. Surv. Canada, p. 281.—1858. Canad. Org. Rem., Dec. iii., p. 54, pl. 3.—*Tr.*—Ottawa, Montreal, and Beauport, Canada.

GLYPTASTER, Hall, 1852. Palæont. New York, vol. ii., p. 187. (Compare LAMPTEROCRINUS, Rœmer.)

brachiatus, Hall, 1852. Pal. New York, vol. ii., p. 187, pl. 41, fig. 4.—*Niag.*—Lockport, New York.

inornatus, Hall, 1863. Trans. Alb. Inst., vol. iv., p. 205.—*Niag.* —Waldron, Indiana.

occidentalis, Hall, 1863. Trans. Albany Inst., vol. iv., p. 204.—*Niag.*—Waldron, Indiana; Racine, Wisconsin.

pentangularis, Hall, 1864. New or little known Foss. from Niag. Group, p. 22.—*Niag.*—Racine, Wisconsin.

GOMPHOCYSTITES, Hall, 1864. New or little known Foss. from Niag. Group, p. 5.

GOMPHOCYSTITES (continued).

clavus, Hall, 1864. New or little known Foss. Niag. Group, p. 6, pl. 1, fig. 3.—*Niag.*—Racine, Wisconsin.

glans, Hall, 1864. New Foss. Niag. Group, p. 6, pl. 1, fig. 4 & 5. —*Niag.*—Racine, Wisconsin.

tenax, Hall, 1864. New Foss. Niag. Group, p. 6, fig. 1.—*Niag.*— Lockport, New York.

GONIASTEROIDOCRINUS,† (Subgenus of RHODOCRINUS,) Lyon & Casseday, 1859. Amer. Jour. Sci., n. ser., vol. 38, p. 233. — TREMATOCRINUS, Hall, 1860. Geol. Iowa, Sup., p. 70.— GONIASTERODOCRINUS, F. B. Meek, Aug., 1865. Proc. Ac. Nat. Sci. Philad., p. 166. (Compare ACANTHOCRINUS, Rœmer, 1850.)

fiscellus—*Trematocrinus fiscellus*, Meek & Worthen, Feb., 1861. Proc. Acad. Nat. Sci. Phil., p. 383.—*Gilbertsocrinus* (*Goniast.*) *fiscellus*, Meek, Aug., 1865. *Ibid*, p. 167.—*Enc.*— Burlington, Iowa.

papillatus—*Trematocrinus papillatus*, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 76.—*Gilbertsocrinus* (*Goniast.*) *papillatus*, Meek, Aug., 1865. Proc. Acad. Nat. Sci. Phil., p. 167. —*Enc.*—Burlington, Iowa.

reticulatus—*Trematocrinus reticulatus*, Hall, Feb., 1861. Des. New Crin., Prelim. Not., p. 9.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 325.—*Enc.*—Burlington, Iowa.

robustus—*Trematocrinus robustus*, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 77.—*Gilbertsocrinus* (*Goniast.*) *robustus*, Meek, Aug., 1865. Proc. Acad. Nat. Sci. Phil., p. 167.—*Arch.*— Keokuk, Iowa.

spinigerus, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 128.—*Gilbertsocrinus* (*Goniast.*) *spinigerus*, Meek, August, 1865. Proc. Acad. Nat. Sci. Phil., p. 167.—*Ham.*—Ontario Co., New York.

tuberculosus—*Trematocrinus tuberculosus*, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 75.—*Enc.*—Burlington, Iowa.

tuberosus, Lyon & Casseday, 1859. Amer. Jour. Sci., 2d series, vol. 28, p. 233.—*Gilbertsocrinus* (*Goniast.*) *tuberosus*, Meek, 1865. Proc. Ac. Nat. Sci. Phil., p. 167.—*Kas.*(?)—Hardin Co., Kentucky.

typus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 73.—*Gilbertsocrinus* (*Goniast.*) *typus*, Meek, Aug., 1865. Proc. Acad. Nat. Sci. Phil., p. 167.—*Enc.*—Burlington, Iowa.

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† In a paper published by Mr. Meek in the Proceedings of the Academy of Natural Science of Philadelphia for August, 1865, entitled "Note on the Genus Gilbertsocrinus Phillips," it is stated that after a close comparison of the typical species of *Goniasteroidocrinus* furnished by Mr. Lyon, one of the authors of the Genus, with examples of *Trematocrinus* Hall," there is not the slightest generic or subgeneric difference between the types for which these two names were proposed." It therefore becomes necessary to range the species now grouped in *Trematocrinus* under *Goniasteroidocrinus*, although it must be confessed that it is with some regret we find ourselves compelled to adopt the latter instead of the much more euphonious name of *Trematocrinus*.

GRANATOCRINUS,† Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 62. PENTREMITES of most authors.

cidariformis, v. G. granulatus.

cornutus—*Pentremites cornutus*, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 141.—*St. L.*—Brown Co., Illinois.

curtus—*Pentremites curtus*, Shumard, 1855. 2d Rep. Geol. Missouri, pt. 2, p. 187, pl. B., fig. 3.—*Elæacrinus curtus*, Shumard, 1862. Trans. Acad. Sci. St. Louis, vol. ii., p. 112.—*Arch.*—Fenton, St. Louis Co., Missouri.

granulatus—*Granatocrinus cidariformis*, Troost, 1850. Cat. Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 62.—*Pentatrematites granulatus*, Rœmer, 1852. Monog. Blast., p. 43, pl. 3, fig. 13.—*Kas.*—Allen Co., Kentucky; near Huntsville, Alabama; Tennessee.

granulosus—*Pentremites* (*Granatocrinus?*) *granulosus*, Meek & Worthen, 1865. Proc. Ac. Nat. Sci. Phil., p. 165.—*Arch.*—Near Warsaw, Illinois.

melo—*Pentremites melo*, Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., 2d ser., vol. i., p. 65, pl. 7, fig. 14.—1852. Geol. Iowa, Wisc. & Minnes., p. 592, tab. v. A., fig. 14.—*Elæacrinus melo*, Shumard, 1862. Tr. Ac. Sci. St. Louis, vol. ii., p. 112.—*Enc.*—Burlington, Iowa; Hannibal and St. Louis Co., Missouri; near Monmouth, Illinois.

var. projectus—*Pentremites melo*, var. *projectus*, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 142.—*Enc.*—Burlington, Iowa.

Missouriensis‡—*Pentremites Rœmeri* (*pars*), Shumard, 1855. Geol. Rep. Missouri, pt. 2, pl. B., fig. *b. c. d.*—*Chem.*—Providence, Boone Co., Missouri.

Norwoodi—*Pentremites Norwoodi*, Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., 2d ser., vol. ii., p. 64, pl. 7, fig. 13.—1852. Geol. Surv. Iówa, Wis. & Minnes., p. 591, pl. 5 A., fig. 13.—*Elæacrinus Norwoodi*, Shumard. Tr. Acad. Sci. St. Louis, vol. ii., p. 112.—*Enc.*—Burlington, Iowa; near Monmouth, Illinois; Hannibal, and St. Louis Co., Missouri.

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† Adopting the suggestion of Prof. Hall, I here include under *Granatocrinus* (a Genus proposed by the late Dr. Troost) a number of elliptical Blastoideans which have hitherto been grouped with *Pentremites* and *Elæacrinus*. The *Granatocrinus* (*Pentatrematites*) *granulatus*, Rœmer=*Granatocrinus cidariformis*, Troost, may be regarded as the type of the Genus, and for the present it may be extended so as to include such species as *Pentremites melo* and *P. Norwoodi*, Owen and Shumard, and allied forms, though it may become necessary after a while to remove these from *Granatocrinus* and group them in a separate subsection under another name. They differ from *Elæacrinus* in having elongate radial plates, extending, in some instances, almost the entire length of the pseudambulacral fields, while the interradials are in most instances extremely short. The structure of the summit is also quite different; the anal field is not flattened and conspicuously wider than the others, and it is not provided with a supplementary lanceolate piece as we find in *Elæacrinus* proper. The *Granatocrini* appear first in the Chemung Group and extend as high up in the series as the Kaskaskia Limestone, while the *Elæacrini* commence in the Upper Silurian and do not range above the Devonian Age.

‡ This species differs from *P. Rœmeri* in being more regularly globose; the pseudambulacral fields are wider, the base smaller and concave, instead of convex, as we find in *P. Rœmeri.*

GRANATOCRINUS (continued).

Rœmeri—*Pentremites Rœmeri*, Shumard, 1855. 2d Geol. Rep. Missouri, pt. 2, p. 186, pl. B., fig. 2 *a*. (Exclude fig. 2 *b. c. d.*)—*Chem.*—Providence, Boone Co., Missouri.

Sayi, Shumard, 1855. 2d Rep. Geol. Surv. Missouri, pt. 2, p. 185, pl. B., fig. 1.—*Enc.*—Boone, Marion, St. Louis and Ste. Genevieve Counties., Missouri.

GRAPHIOCRINUS,† De Koninck and Le Hon, 1854. Rech. Crin. Carb. de la Belgique, p. 115.

dactylus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 81.—*St. L.*—Near St. Louis, Missouri.

quatuor-decem-brachialis, v. Cyathocrinus 14-brachialis.

HAPLOCRINUS,

Clio, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 143.—*Marc.*—Onondaga Co., New York.

granulatus,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 61.—*Niag.*(?)—Decatur Co., Tennessee.

hemisphericus,* *id. ibid.*—*Niag.*(?)—Decatur Co., Tennessee.

maximus,* *id. ibid.*—*Niag.*(?)—Decatur Co., Tennessee.

ovalis,* *id. ibid.*—*Niag.*(?)—Decatur Co., Tennessee.

HEMICOSMITES, Von Buch, 1840. Monatsber. d. Berlin Akad., p. 129.

subglobosus, Hall, 1864. New Fossils Niag. Group, p. 12. (Ext. from 18th Rep. Reg. State Cab.)—*Niag.*—Racine, Wis.

HEMICYSTITES, *v.* AGELACRINUS.

HETEROCRINUS, Hall, 1847. Pal. N. York, vol. i., p. 278.—DECADACTYLOCRINITES,‡ Owen, 1843. Cat. Geol. Spec. of Ohio Valley.

articulosus, Billings, 1859. Canad. Org. Rem., Dec. iv., p. 51, pl. 4, fig. 8.—*H. R. G.*—Ottawa, Canada.

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† I have long been of opinion that the pieces described by Messrs. De Koninck and Le Hon as the basals in their Genus *Graphiocrinus*, are in reality the subradials; and that the former, from their minuteness, and perhaps from being concealed by the last joint of the column, have escaped the notice of these distinguished authors. If, upon a more critical examination of type specimens, this surmise shall be found correct, it will become necessary to transfer a number of American species, now arranged in *Zeacrinus* and *Scaphiocrinus*, into the Genus of De Koninck and Le Hon. The *Graphiocrinus encrinoides* of these authors so closely resembles in general form, and in the proportion and arrangement of its parts, the American *Poteriocrinus* (*Zeacrinus*) *maniformis*, Yandell and Shumard, that it is difficult to believe they belong to distinct genera. Indeed, were it not for the greater size of the former, I should be inclined to regard the two forms as specifically identical.

* It is extremely doubtful whether any of these species belong to *Haplocrinus*. I have in my collection two small Crinoids from the glades of Decatur County, Tennessee, which were referred by Dr. Troost to this Genus. One of these has since been described by Rœmer (Sil. Faun. West Tenn.) as *Poteriocrinus pisiformis*, and the other as *Synbathocrinus Tennesseensis*.

‡ This name appears in Owen's Catalogue, but I do not think any description of the Genus was published under this designation.

HETEROCRINUS (continued).

Canadensis, Billings, 1859. Canad. Org. Rem., Dec. iv., p. 48, pl. 4, fig. 5.—*Tr.*—Ottawa and Montreal, Canada.

crassus, Meek & Worthen, Aug., 1865. Proc. Ac. Nat. Sci. Phil, p. 147.—*H. R.*—Kendall Co., Illinois.

gracilis, Hall, 1847. Pal. N. York, vol. i., p. 280, pl. 76, fig. 3.—*H. R. G.*—Snake Hill, Saratoga Lake, New York.

heterodactylus, Hall, 1847. Pal. N. York, vol. i., p. 279, pl. 76, fig. 1.—*H. R. G.*—Lewis, Jefferson and Oneida Counties, New York; Cincinnati, Ohio.

inæqualis, Billings, 1859. Can. Org. Rem., Dec. iv., p. 51, pl. 4, fig. 7.—*Tr.*—Ottawa, Canada.

(?) incurvus, Meek & Worthen, Aug., 1865. Proc. Ac. Nat. Sci. Phil., p. 148.—*H. R. G.*—Cincinnati, Ohio.

simplex—*Decadactylocrinites planus*, Owen, 1843. Cat. Geol. Spec, Ohio Valley.—*Heterocrinus simplex*, Hall, 1847. Pal. N. York, vol. i., p. 280, pl. 76, fig. 2.—Billings, 1857. Rep. Prog. Geol. Surv. Canada, p. 271.—*H. R. G.*—Cincinnati, Ohio.—*Tr.*—Ottawa, Canada.

tenuis, Billings, 1857. Rep. Prog. Geol. Surv. Canada, p. 273,—1849. Canad. Org. Rem., Dec. iv., pl. 4, fig. 6.—*Trent.*—Ottawa, Canada.

HETEROCYSTITES, Hall, 1852. Pal. N. York, vol. ii., p. 229.

armatus, Hall, 1852. Pal. N. York, vol. ii., p. 229, pl. 49 A., fig. 3.—*Niag.*—Lockport, N. York.

HOLOCYSTITES—Caryocystites, Hall, 1861. Ann. Rep. Geolog. Surv. Wis., p. 23.—1862. Geol. Wis., vol. i., p. 69. (Not Caryocystites, Von Buch.)—Holocystites, Hall, 1864. New or little known Foss. Niag. Group, p. 7.

abnormis, Hall, 1864. New or little known Foss. Niag. Group, p. 8.—*Niag.*—Racine, Wisconsin.

alternatus—*Caryocystites alternatus*, Hall, 1861. Rep. Prog. Geol. Surv. Wis., p. 23.—1862. Geol. Wisconsin, vol. i., p. 69.—*Holocystites alternatus*, 1864. New or little known Foss. Niag. Group, p. 8, pl. 1, fig. 6.—*Niag.*—Racine, Wisconsin.

cylindricus—*Caryocystites cylindricus*, Hall, 1861. Ann. Report Geol. Surv. Wis., p. 23.—1862. Geol. Wis., vol. i., p. 69.—*Holocystites cylindricus*, 1864. New or little known Foss. Niag. Group, p. 7, pl. 1, fig. 7 & 8.—*Niag.*—Racine and Waukesha, Wisconsin.

ovatus, Hall, 1864. New or little known Foss. Niag. Group, p. 9.—*Niag.*—Waukesha, Wisconsin.

scutellatus, Hall, 1864, New or little known Foss. Niag. Group, p. 10.—*Niag.*—Waukesha, Wisconsin.

Winchelli, Hall, 1864. New or little known Foss. Niag. Group, p. 9.—*Niag.*—Waukesha, Wisconsin.

HOMOCRINUS, Hall, 1852. Pal. N. York, vol. ii., p. 185.

alternatus—*Poteriocrinus alternatus*, Hall, 1847. Pal. N. York, vol. i., p. 83, pl. 28, fig. i.—*Homocrinus alternatus*, Hall, 1852. Pal. N. York, vol. ii., p. 185.—*Tr.*—Lewis and Herkimer Counties, New York.

HOMOCRINUS (continued).

cylindricus, Hall, 1852. Pal. N. York, vol. ii., p. 186, pl. 41, fig. 2 & 3.—*Niag.*—Lockport, N. York.

gracilis—*Poteriocrinus gracilis*, Hall, 1847. Pal. N. York, vol. i., p. 85, pl. 28, fig. 2.—*Homocrinus gracilis*, Hall, 1852. Pal. N. York, vol. ii., p. 185.—*Tr.*—Herkimer Co., New York.

parvus, Hall, 1852. Pal. New York, vol. ii., p. 185, pl. 41, fig. 1.—*Niag.*—Lockport, New York.

polydactylus—*Cyathocrinites*, Christy, 1848. Letters on Geol., pl. 1, No. 7, and pl. 3, No. 1.—*Homocrinus polydactylus*, Shumard, 1857. Tr. Acad. Sci. St. Louis, vol. i., p. 78, pl. 1, fig. 6.—*H. R. G.*—Richmond, Indiana.

proboscidialis, Hall, 1859. Pal. N. York, vol. iii., p. 138, pl. 84, fig. 24 & 25.—*Orisk.*—Cumberland, Maryland.

scoparius, Hall, 1859. Pal. N. York, vol. iii., p. 102, pl. 1, fig. 1.—*Tentac.*—Herkimer Co., New York.

HYBOCRINUS, Billings, 1857. Rep. Geol. Canada, p. 274.

conicus, Billings, 1857. Rep. Prog. Geol. Canada, p. 274.—1859. Canad. Org. Rem., Dec. iv., p. 29, pl. 2, fig. 2.—*Trent.*—Ottawa, Canada.

pristinus, Billings, 1859. Canad. Org. Rem., Dec. iv., p. 23, pl. 1, fig. 2.—*Cha.*—Caughnawaga, Islands of Montreal, Jesus and Bizard, Canada.

tumidus, Billings, 1857. Rep. Prog. Geol. Canada, p. 275.—1859. Canad. Org. Rem., Dec. iv., p. 28, pl. 2, fig. 1.—*Trent.*—Ottawa, Canada.

HYPANTHOCRINITES, *v.* EUCALYPTOCRINUS.

ICTHYOCRINUS, Conrad, 1842. Jour. Acad. Nat. Sci. Phil., vol. viii., p. 279.

Burlingtonensis, Hall, 1858. Geol. Iowa, vol. i., p. 557, fig. 75.—*Enc.*—Burlington, Iowa.

(?) Clintonensis, Hall, 1852. Pal. N. York, vol. ii., p. 181, pl. 41, fig. 5.—*Cl.*—Niagara Co., New York.

lævis, Conrad, 1842. Jour. Ac. Nat. Sci. Phil., vol. viii., p. 279, pl. 15, fig. 16.—Hall, 1852. Pal. N. York, vol. ii., p. 195, pl. 43, fig. 2.—Dana, 1863. Man. Geol., p. 240, fig. 389.—*Niag.*—Lockport, New York.

subangularis, Hall, 1863. Trans. Alb. Inst., vol. iv., p. 201.—*Niag.*—Waldron, Indiana.

tiaræformis—*Cyathocrinus tiaræformis*, Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 60.—*Arch.*—White's Creek Springs, Tennessee.

ICOSIDACTYLOCRINITES, *v*, GLYPTOCRINUS..

LAMPTEROCRINUS, Rœmer, 1860. Sil. Faun. West Tenn., p. 37.—BALANOCRINUS, Troost, 1850. List Crin. Tenn., p. 60 (non *Balanocrinus*, Agassiz, 1846).

inflatus—*Balanocrinus inflatus*, Hall, 1861. Rep. Sup. Geol. of Wis., p. 22.—*Lampterocrinus inflatus*, Hall, 1864. New or

LAMPTEROCRINUS (continued).
little known Fossils Niag. Group, p. 24.—*Niag.*—Racine, Wisconsin.

sculptus, v. L. Tennesseensis.

Tennesseensis—*Balanocrinus sculptus*, Troost, 1850. List Crin. Tenn., p. 60.—*Lampterocrinus Tennesseensis*, Rœmer, 1860. Sil. Faun. West. Tenn., p. 37, pl. 4, fig. 1.—*Niag.*—Decatur Co., Tennessee.

LECANOCRINUS, Hall, 1852. Pal. N. York, vol. ii., p. 199.

caliculus, Hall, 1852. Pal. N. York, vol. ii., p. 203, pl. 46, fig. 3. —*Niag.*—Lockport, New York.

elegans, Billings, 1857. Rep. Geol. Surv. Canada, p. 278.—1859. Canad. Org. Rem., Dec. 4, p. 47, pl. 4, fig. 4.—Dana, 1863. Man. Geol., p. 211, fig. 284.—*Trent.*—Ottawa, Canada.

lævis, Billings, 1857. Rep. Geol. Surv. of Canada, p. 278.—1859. Canad. Org. Rem., Dec. iv., p. 47, pl. 4, fig. 3.—*Trent.*—Ottawa, Canada.

macropetalus, Hall, 1852. Pal. New York, vol. ii., p. 199, pl. 45, fig. 1.—*Niag.*—Lockport, New York.

ornatus, Hall, 1852. Pal. N. York, vol. ii., p. 202, pl. 44, fig. 2. —*Niag.*—Lockport, New York.

simplex, Hall, 1852. Pal. N. York, vol. ii., p. 202, pl. 46, fig. 2. —*Niag.*—Lockport, New York.

LEPADOCRINUS, *v.* APIOCYSTITES.

LEPIDECHINUS (Subgenus of PALÆCHINUS), Hall, 1861. Des. New Crin., Prelim. Not., p. 18. (Compare *Oligoporus*, Meek & Worthen.)

imbricatus, Hall, Feb., 1861. Des. New Crin., Prelim. Not., p. 18.—*Enc.*—Burlington, Iowa.

LEPOCRINITES, *v.* APIOCYSTITES.

LYRIOCRINUS (Subgenus of RHODOCRINUS). MARSUPIOCRINITES, Hall, 1843. Geol. 4th Dist. N. York, p. 114. (Not MARSUPIOCRINITES, Phillips, 1839.)—LYRIOCRINUS, Hall, 1852. Pal. New York, vol. ii., p. 197.

dactylus—*Marsupiocrinites dactylus*, Hall, 1843. Geol. 4th Dist. N. York, p. 114, fig. 4.—*Lyriocrinus dactylus*, Hall, 1852. Pal. New York, vol. ii., p. 197, pl. 44, fig. 1.—*Niag.*—Lockport, New York.

sculptilis, Hall, 1864. New or little known Foss. Niag. Group, p. 21.—*Niag.*—Waukesha, Wisconsin.

MACROSTYLOCRINUS, *v.* CTENOCRINUS.

MALOCYSTITES, Billings, 1858. Can. Org. Rem., Dec. 3, p. 66.

Murchisoni, Billings, 1858. Can. Org. Rem., Dec. 3, p. 66, pl. 7, fig. 1.—Dana, 1863. Man. Geol., p. 209, fig. 265.—*Cha.*—Caughnawaga and Montreal, Canada.

Barrandi, Billings, 1858. Can. Org. Rem., Dec. 3, p. 67, pl. 7, fig. 2.—*Cha.*—Montreal, Canada.

MARIACRINUS, Hall, 1859. Pal. New York, vol. iii., p. 104.

macropetalus, Hall, 1859. Pal. N. York, vol. iii., p. 111, pl. 3 A., fig. 1, 10, 11 & 12; pl. 3 B., fig. 1 & 2.—*L. H.*—Schoharie, New York.

nobilissimus, Hall, 1859. Pal. N. York, vol. iii., p. 105, pl. 2, fig. 1–4, and pl. 2 A., fig. 1.—*L. H.*—Herkimer Co., N. York.

pachydactylus—*Actinocrinus polydactylus*, Bonny, 1835. Schenectady Reflector.—*Astrocrinites pachydactylus*, Conrad, 1841. An. Rep. Pal. N. York, p. 34.—Mather, 1843. Geol. Rep. N. York, p. 246.—*Mariacrinus pachydactylus*, Hall, 1859. Pal. N. York, vol. iii., p. 107, pl. 3, fig. 1–4.—*L. H.* —Herkimer Co., N. York.

paucidactylus, Hall, 1859. Pal. N. York, vol. iii., p. 109, pl. 3, fig. 105.—*L. H.*—Herkimer Co., N. York.

plumosus, Hall, 1859. Pal. N. York, vol. iii., p. 110, pl. 3, fig. 6–11.—*L. H.*—Herkimer Co., N. York.

polydactylus, *v.* Actinocrinus pachydactylus.

ramosus, Hall, 1859. Pal. N. York, vol. iii., p. 147, fig. 6.—*L. H.* —Herkimer Co., N. York.

stoloniferus, Hall, 1859. Pal. N. York, vol. iii., p. 112, pl. 3 A., fig. 2, and pl. 3 B., fig. 3-7.—*L. H.*—Schoharie, N. York.

MARSUPIOCRINITES, *v.* LYRIOCRINUS.

MEGISTOCRINUS (ACTINOCRINUS), Owen & Shumard, 1850. Jour. Ac. Nat. Sci. Phil., n. ser., vol. ii., p. 68.—MEGISTOCRINUS, Owen & Shum., 1852. Rep. Iowa, Wiscon. & Minn., p. 594.

abnormis—*Actinocrinus abnormis*, Lyon, 1857. Geol. Surv. Ky., vol. iii., p. 479, pl. 4, fig. 1.—*U. H.*—Bear-Grass Creek, near Louisville, Kentucky.

crassus, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 17. —*Enc.*—Burlington, Iowa.

depressus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 134. —*Ham.*—Western N. York.

Evansi—*Actinocrinus Evansi*, Owen & Shumard, 1850. Jour. Ac. Nat. Sci. Phil., vol. ii., p. 68, pl. 7, fig. 3.—*Megistocrinus Evansi*, Owen & Shum., 1852. Rep. Geol. Iowa, Wisc. & Minn., p. 594, pl. v. A., fig. 3.—*Enc.*—Burlington, Iowa.

Knappi, Lyon & Casseday, 1861. Proc. Acad. Nat. Sci. Phil., p. 412, pl. 4, fig. 6.—*U. H.*—Clarke Co., Indiana.

latus, Hall, 1858. Geol. Iowa, vol. i., p. 480, pl. 1, fig. 1.—*Ham.* —New Buffalo, Iowa; St. Charles Co., Missouri.

olliculus (*Actinocrinus*), Hall, 1861. Des. New Crin., Prelim. Not., p. 2.—*Enc.*—Burlington, Iowa.

Ontario, Hall, 1862. 15th Rep. Reg. State Cab. N. York.—*Ham.* —Western New York.

plenus, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 16. —*Enc.*—Burlington, Iowa.

rugosus, Lyon & Casseday, 1859. Amer. Jour. Sci., n. ser., vol. 28, p. 243.—*U. H.*—Falls of Ohio.

spinulosus, Lyon, 1861. Jour. Acad. Nat. Sci. Phil., p. 413, pl. 4, fig. 7.—*U. H.*—Falls of Ohio.

MELOCRINUS—MELOCRINITES, Goldfuss, 1826. Petref. Germ., vol. i.—MELOCRINUS, Agassiz, 1834. Prod. Echinod.

nodosus, Hall, 1861. Rep. Sup. Geol. Surv. Wis., p. 19.—*U. H.*? —Milwaukie, Wisconsin.

obconicus, Hall, 1863. Trans. Alb. Inst., vol. iv., p. 206.—*Niag.* —Waldron, Indiana.

Pratteni—*Forbesiocrinus Pratteni*, McChesney, 1860. New Pal. Foss., p. 29, pl. 5, fig. 4.—*Kask.*(?)—Near Huntsville, Alabama.

sculptus, Hall, 1852. Pal. N. York, vol. ii., p. 220, pl. 49, fig. 2. —*Niag.*—Lockport, New York.

Verneuili—*Actinocrinus Verneuili*, Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 60.—*Melocrinus Verneuili*, Hall, 1864. New or little known Foss. Niag. Group, p. 23.—*Niag.*—Decatur Co., Tennessee.

MELONECHINUS, *v.* MELONITES.

MELONITES, Owen & Norwood, 1846. Am. Jour. Sci., 2d Ser. vol. ii., p. 225.—Engelmann, 1847. *Ibid*, vol. iii., p. 124.—Rœmer, 1855. Ueber den Bau, *v. Melonites multipora.*—MELONECHINUS, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 396. — PALÆCHINUS, Dana, 1863. Man. Geol., p. 313.

multipora, Owen & Norwood, 1846. Amer. Jour. Sci., 2d series, vol. ii., p. 225.—Rœmer, 1855. Ueber d. Bau, *v. Melonites multipora.* — *Palæchinus multipora*, Dana, 1863. Man. Geol., p. 313, fig. 536.—*St. L.*—St. Louis, and near Ste. Genevieve, Missouri; Prairie du Rocher, Illinois.

Danæ, *v.* Oligoporus Danæ.

MESPILOCRINUS, DeKoninck & Le Hon, 1854. Rech. sur les Crinoides Terr. Carb. Belg., p. 111.

Konincki, Hall, 1860. Geol. Iowa, Sup., p. 69.—*Enc.*—Burlington, Iowa.

scitulus, Hall, 1861. Des. New Crin., Prelim. Not., p. 9.—*Enc.*—Burlington, Iowa.

MYELODACTYLUS, Hall, 1852. Pal. N. York, vol. ii., p. 191.

brachiatus, Hall, 1852. Pal. N. York, vol. ii., p. 232, pl. 45, fig. 7. —*Niag.*—Lockport, N. York.

convolutus, Hall, 1852. Pal. N. York, vol. ii., p. 192, pl. 42, fig. 5. —*Niag.*—Lockport, New York.

—— sp.(?) Hall, 1852. Pal. N. York, vol. ii., p. 232, pl. 45, fig. 9. —*Niag.*—Lockport, New York.

MYRTILLOCRINUS, Sandberger.

Americanus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 142.—*U. H.*—Near Caledonia, Livingston Co., N. York.

NUCLEOCRINUS, *v.* ELÆACRINUS.

OLIGOPORUS (Subgenus of MELONITES), Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 472.

OLIGOPORUS (continued).

Danæ, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 472.—*Keok.*—Warsaw, Illinois.

OLIVANITES, *v.* ELÆACRINUS.

ONYCHOCRINUS, *v.* FORBESIOCRINUS.

PALÆASTER, Hall, 1852. Pal. N. York, vol. ii., p. 247.

matutina—*Asterias matutina*, Hall, 1847. Pal. N. York, vol. i., p. 91, pl. 29, fig. 5.—*Palæaster matutina*, Hall, 1859. 12th Rep. Reg. State Cab. N. York, p. 65.—Dana, 1863. Man. Geol., p. 211, fig. 282.—*Trent.*—Trenton Falls.

Niagarensis, Hall, 1852. Pal. N. York, vol. ii., p. 247, pl. 51, fig. 21-23.—*Niag.*—Lockport, New York.

PACHYOCRINUS, Billings, 1859. Canad. Org. Rem., Dec. 4, p. 22.

crassibasalis, Billings, 1859. Canad. Org. Rem., Dec. iv., p. 22, pl. 1, fig. 3.—*Cha.*—Near Montreal, Canada.

PALASTERINA, McCoy, 1851. Brit. Pal. Foss., p. 59.—Billings, 1858. Canad. Org. Rem., Dec. iii., p. 76.

antiquata—*Asterias antiquata*, Locke, 1846. Proc. Acad. Nat. Sci. Phil., vol. iii., p. 32 (with wood cut).—*H. R.*—Cincinnati, Ohio.

(Schoenaster) fimbriata, Meek & Worthen, 1860. Proc. Ac. Nat. Sci. Phil., p. 449.—*St. L.*—St. Clair Co., Illinois.

(?) Jamesii—*Asterias Anthonyi*, Dana, 1863. Man. Geol., p. 221, fig. 349.—*Palasterina Jamesii*, Dana, 1863. Amer. Jour. Sci., n. ser., vol. 35, p. 295.—*H. R.*—Cincinnati, Ohio.

rigida, *v.* Petraster rigida.

rugosa, Billings, 1857. Rep. Geol. Surv. Canada, p. 291.—1858. Canad. Org. Rem., Dec. iii., p. 77, pl. 9, fig. 2.—*H. R.*—Charleton Point, Anticosti, Canada.

stellata, Billings, 1857. Rep. Geol. Surv. Canada, p. 290.—1858. Canad. Org. Rem., Dec. iii., p. 76, pl. 9, fig. 1-15.—*Trent.*—Ottawa, Canada.

PALÆOCYSTITES, Billings, 1858. Canad. Org. Rem., Dec. iii., p. 68.

Chapmani, Billings, 1858. Canad. Org. Rem., Dec. iii., p. 71.—*Cha.*—Clarence, Canada.

Dawsoni, Billings, 1858. Canad. Org. Rem., Dec. iii., p. 70.—*Cha.*—Near Montreal, Canada.

pulcher, Billings, 1859. Canad. Nat. Geol., vol. iv., p. 430.—*Cal.*—Canada.

tenuiradiatus—*Actinocrinus tenuiradiatus*, 1847. Pal. N. York, vol. i., p. 18, pl. 4, fig. 8 & 9.—*Palæocystites tenuiradiatus*, Billings, 1858. Canad. Org. Rem., Dec. iii., p. 69, fig. 1-3.—*Cha.*—Chazy, New York; Island of Montreal and Caughnawaga, Canada.

PALÆCHINUS, Scouler, 1840.—McCoy, 1844. Carb. Foss. of Ireland.

Burlingtonensis, Meek & Worthen, Sept., 1860. Proc. Acad. Nat. Sci. Phil., p. 396.—*Enc.*—Burlington, Iowa.

PALÆOCRINUS, Billings, 1859. Can. Org. Rem., Dec. iv., p. 29.

angulatus—*Dendrocrinus angulatus*, Billings, 1857. Rep. Geol. Surv. Canada, p. 269.—*Palæocrinus angulatus*, 1859. Can. Org. Rem., Dec. iv., p. 45, pl. 3, fig. 6.—1863. Geol. Canada, p. 939.—*Trent.*—Ottawa, Canada.

pulchellus, Billings, 1857. Rep. Geol. Surv. Canada, p. 288.—1858. Canad. Org. Rem., Dec. iv., p. 46.—*Trent.*—Ottawa, Canada.

rhombiferus, Billings, 1857. Rep. Geol. Surv. Canada, p. 269.—Canad. Org. Rem., Dec. iv., p. 45.—*Trent.*—Ottawa, Can.

striatus, Billings, 1857. Rep. Geol. Surv. Canada, p. 269.—1859. Canad. Org. Rem., p. 25, pl. 1, fig. 5.—*Cha.*—Caughnawaga and Montreal, Canada.

PALÆOCOMA, *v.* TÆNIASTER.

PENTAGONITES, Rafinesque, 1819. Jour. Phys., p. 429.—[This Genus was proposed by Rafinesque to receive the pentagonal column of a Crinoid, probably, as Mr. Meek has suggested, of a species of *Heterocrinus* from the Blue Limestone of the Valley of the Ohio; but as no characters were given by which the Genus could be identified, the name cannot be adopted.]

PENTREMITES, Say, 1820. Amer. Jour. Sci., vol. ii., p. 36.—KENTUCKY ASTERIAL FOSSIL, Parkinson, 1811. Organ. Rem., p. 235.—ENCRINA, De France, 1818. Dict. Sci. Nat. T., 14.—PENTATREMATITES, Bronn, Rœmer, 1852. Monog. Blast., p. 4.

angularis, Lyon, 1860. Trans. Acad. Sci. St. Louis, vol. i., p. 631, pl. 20, fig. 3.—*Kask.*—Falls of Rough Creek, Breckenridge Co., Kentucky.

bipyramidalis, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 607, pl. 15, fig. 2.—*Arch.*—Missouri.

calycinus, Lyon, 1860. Tr. Acad. Sci. St. Louis, vol. i., p. 628, pl. 20, fig. 1.—*Kask.*—Near Kaskaskia, Illinois; Grayson Co., Kentucky.

calyce, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 150.—*Ham.*—Western New York.

carioides, *v.* Elæacrinus Verneuili.

cervinus, Hall, 1858. Geol. Iowa, vol. i., p. 690, pl. 25, fig. 11.——*Kask.*—Near Huntsville, Alabama; Chester, Illinois.

Cherokeeus, *v.* Pentremites sulcatus.

conoideus, Hall, 1856. Trans. Albany Inst., vol. iv., p. 5.—Geol. Iowa, vol. i., pt. 2, p. 655, pl. 22, fig. 8-10.—*Arch.*—Spergen Hill and Bloomington, Indiana; St. Louis Co., Missouri; Randolph Co., Illinois.

cornutus, *v.* Granatocrinus cornutus.

curtus, *v.* Granatocrinus curtus.

decussatus, Shumard, 1858. Trans. Acad. Sci. St. Louis, vol. i., p. 242, pl. 9, fig. 6.—*Arch.*—Button-mould Knob, 7 miles south of Louisville, Kentucky.

elegans, Lyon, 1860. Trans. Acad. Sci. St. Louis, vol. i., p. 632, pl. 20, fig. 4.—*Kask.*—Near Grayson Springs, Kentucky.

PENTREMITES (continued).

elongatus, Shumard, 1855. 2d Geol. Rep. Missouri, pt. 2, p. 187, pl. B., fig. 4.—*Enc.*—Burlington, Iowa.

florealis, *v.* Pentremites Godoni.

Godoni—*Kentucky Asterial Fossil*, Parkinson, 1811. Org. Rem., p. 235, pl. 13, fig. 36 & 37.—*Encrina Godoni*, De France, 1818. Dict. Sci. Nat. T. 14.—*Encrinus florealis*, Schlotheim, 1820. Pet. Got.—*Pentremites florealis*, Say, 1825. Jour. Ac. Nat. Sci. Phil., vol. iv., p. 295.—Sowerby, 1826. Zool. Jour., vol. ii., p. 314, pl. xi., fig. 2.—Goldfuss Petrif. Germ., vol. i., p. 161, tab. 50, fig. 2.—Troost, 1835. Trans. Geol. Soc. Penn., vol. i., p. 224, pl. 10, fig. 8.—*Pentatrematites florealis*, Rœmer. Monog. Blast., p. 33, tab. 2, fig. 1–4; tab. 2, fig. 8.—*Pentremites Godoni*, Shumard, 1858. Trans. Ac. Sci. St. Louis, vol. i., p. 245.—Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 692, pl. 25, fig. 13.—Dana, 1863. Man. Geol., p. 312, fig. 532.—*Kask.*—Chester, Illinois; Perry Co., Missouri; Grayson Co., Kentucky; Mt. Sano, near Huntsville, Alabama.

granulatus, *v.* Granatocrinus granulatus.

Grosvenori, Shumard, 1858. Trans. Acad. Sci., St. Louis, vol. i., p. 240, pl. 9, fig. 2.—Hall, 1860. Geol. Iowa, vol. i., pt. 2; Supp. pl. 1, fig. 3.—*Arch.*—Spergen Hill, Indiana.

Koninckana, Hall, 1856. Trans. Alb. Inst., vol. iv., p. 4.—Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 656, pl. 22, fig. 11.—Shumard, 1858. Trans. Acad. Sci. St. Louis, vol. i., p. 243, pl. 9, fig. 4.—*Arch.*—Spergen Hill and Bloomington, Indiana; Randolph Co. and Alton, Illinois; St. Louis and Ste. Genevieve Counties, Misssouri.

laterniformis,† Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., n. ser., vol. ii., p. 66, pl. 7, fig. 15.—1852. Geol. of Iowa, Wisc. & Minnes., p. 592, pl. 5 A., fig. 15.—*Pentatrematites obliquatus*, Rœmer, 1852. Monog. Blast., p. 47, pl. 3, fig. xi.—*Arch.*—Randolph Co., Illinois; St. Louis and Ste. Genevieve Counties, Missouri; near Spergen Hill, Indiana.

leda, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 149.—*Ham.*—Western New York.

lineatus, Shumard, 1857. Trans. Acad. Sci. St. Louis, vol. i., p. 241, pl. 9, fig. 3. (Compare *P. Wortheni*, Hall.)—*Enc.*(?)—Monmouth, Illinois.

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† There appear to me good reasons for removing this and other subfusiform species, as *Pentremites Reinwardtii*, *P. lineatus*, *P. bipyramidalis*, *P. Wortheni*, and perhaps *P. Grosvenori*, from among the *Pentremites*, and grouping them together in a separate subsection under another name. These and allied forms are remarkable for their slender, subfusiform shape, linear pseudambulacral fields, triangular base, and simple summit structure. These external differences would seem to imply corresponding modifications in the internal economy of the animals of more than specific importance. If, from a more thorough study of such species, it shall be deemed advisable to separate them from the Genus *Pentremites*, I would propose the name Troosticrinus for the group, in honor of the late lamented Dr. Gerard Troost, of Tennessee, one among the earliest of pioneers in American Geology and Palæontology.

PENTREMITES (continued).

longicostalis, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 85 —*Arch.*—Warsaw, Illinois.

licorias, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 151. —*Ham.*—Western New York.

Maia, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 150.—*Ham.*—Moscow, New York.

melo, v. Granatocrinus melo.

Missouriensis, Swallow, 1862. Tr. Ac. Sci. St. Louis, vol. ii., p. 81.—*Arch.*—Missouri and Illinois.

Norwoodi, v. Granatocrinus Norwoodi.

obesus, Lyon, 1857. Geol. Kentucky, vol. iii., p. 469, pl. 2, fig. 1. —Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 695, pl. 25, fig. 15.—*Kas.*—Kentucky and Illinois.

obliquatus, v. P. laterniformis.

ovalis,* Owen, 1843. Cat. Geol. Spec. Ohio Valley, No. 251.—*Kas.*(?)—Tennessee and Alabama.

pyriformis, Say, 1825. Proc. Ac. Nat. Sci. Phil., vol. iv., p. 294. —Sowerby, 1826. Zool. Jour., vol. ii., p. 315.—Troost, 1835. Trans. Geol. Soc. Penn., vol. i., p. 224, pl. 10, fig. 8. —*Pentatrematites pyriformis*, Rœmer, 1852. Monog. Blast., p. 84, tab. 2, fig. 9.—Hall, 1858. Geol. Iowa, vol. i., p. 693, pl. 25, fig. 16.—Dana, 1863. Man. Geol., p. 312, fig. 530. —Illinois, Kentucky, Missouri, and Alabama.

Reinwardtii, Troost, 1835. Trans. Geol. Soc. Penn., vol. i., pt. 2, p. 224, pl. x.—1841. 6th Rep. Geol.Tenn.—*Pentatrematites*, Rœmer, 1858. Bronn's Jahrb., p. 296.—1852. Monog. Blast, p. 52, pl. 3, fig. 13.—1860. Sil. Faun. West. Tenn., p. 60, pl. 3, fig. 2.—Bronn, 1860. Klass. Ord. d. Thier-Reichs, bd. 2, Aktinozoen taf. 23.—*Niag.*—Decatur Co., Tennessee; Bear-Grass Creek, near Louisville, Kentucky.

robustus, Lyon, 1860. Trans. Acad. Sci. St. Louis, vol. i., p. 629, pl. 20, fig. 2.—*Kas.*—Grayson Co., Kentucky.

Rœmeri, v. Granatocrinus Rœmeri.

Sayi, v. Granatocrinus Sayi.

sirius, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 20, fig. 3.—*Enc.*—Burlington, Iowa.

stelliformis,† *v.* Codaster stelliformis.

subtruncatus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 485, pl. 2, fig. 3.—*Ham.*—New Buffalo, Iowa.

sulcatus—*Pentremites Cherokeeus*, Troost, 1850. Catalogue Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 60.—*P. sulcatus*, Rœmer, 1852. Monog. Blast., p. 354, pl. 6, fig. 10.—*P. Cherokeeus*, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 601, pl. 25, fig. 12.—*Kask.*—Chester, Illinois; near Huntsville, Alabama.

† This fossil in some of its characters agrees with *Codaster*, but in other respects differs from that Genus and from other genera of *Blastoidea.* It may be necessary to create a section or subsection under another name to receive it.

PENTREMITES (continued).

symmetricus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 694, pl. 25, fig. 14.—*Kas.*—Kentucky.

Tennesseeæ,* Troost, 1850. Proc. Amer. Assoc. Camb. Meet., p. 60.—Tennessee.

Troosti, Shumard—*Pentremites globosus,* Troost. Monog.—Hall, 1858. Geol. Iowa, vol. i., p. 695, pl. 25, fig. 17. (Not *P. globosa,* Say.‡)—*Kas.*—Hardin Co., Illinois; Mt. Sano, Alabama.

truncatus, Conrad, 1843. Proc. Acad. Nat. Sci. Phil., vol. i., p. 334.—*Arch.*(?)—Edwardsville, Madison Co., Illinois.

Verneuili, v. Elæacrinus Verneuili.

Whitei, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 150. —*Ham.*—Western New York.

Wortheni, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 606, pl. 15, fig. 1. (Compare *P. lineatus,* Shumard.)—*Arch.*—Keokuk, Iowa; Nauvoo, Illinois.

PETRASTER, Billings, 1858. Canad. Org. Rem., Dec. iii., p. 79.

(?) antiqua—*Asterias antiqua,* Troost, 1835. Trans. Geol. Soc. Penn., vol. i., p. 232, pl. 10, fig. 9.—*Tr.*—Davidson Co., Tennessee.

rigidus—*Palæasterina rigidus,* Billings, 1856. Geol. Rep. Can., p. 291.—*Petraster rigidus,* 1858. Can. Org. Rem. Dec. iii., p. 80, pl. 10, fig. 3.—*Tr.*—Ottawa, Canada.

Wilberanus, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 142.—*Tr.*(?) or *H. R. G.*—Oswego, Kendall Co., Illinois.

PLATYCRINUS, Miller,† 1821.

æqualis, Hall, 1861. Des. New Crin., Prelim. Not., p. 17.—*Enc.* —Burlington, Iowa.

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‡ The specimen upon which Mr. Say founded his *Pentremites globosa* was brought from the vicinity of Bath, England, by Mr. Reubens Peale. It probably does not occur in American strata, and most likely belongs to *Granatocrinus* or *Elæacrinus.*

† The great Genus *Platycrinus,* as at present constituted, embraces more than a hundred species, of which number nearly seventy are peculiar to American strata. It is, however, capable of being divided into several distinct groups, into which the species might be conveniently distributed.

The Messrs. Austin in their Monograph on Fossil and Recent Crinoidea proposed to separate the Genus into three divisions, based upon differences of structure in the superior part of the body. Those species with a central, elongated proboscis such as *Platycrinus lævis,* they proposed to arrange in one division; those with central, valvate, unobtrusive mouths in another, under the generic name of *Centrocrinus*; and those with lateral or subcentral mouths in a third, under the term *Pleurocrinus.*

A fourth division was proposed by Dr. Troost, in 1850, for some remarkably depressed species from the glades of Decatur County, Tennessee, under the name of *Cupellæcrinus,* in which the second series of radial pieces are rudimentary, occupy a small depression in the upper margin of the large first radials, and are a non-brachial bearing.

I have received through the politeness of Mr. Meek a paper just published by himself and A. H. Worthen, entitled "Descriptions of New Crinoidea, &c., from the Carboniferous Rocks of Illinois and the adjoining States," in which the authors, adopting the suggestions of the Messrs. Austins and Troost, divide the Genus into the following four sections:

"1. *Platycrinus* (typical).—With the summit terminating in a more or

PLATYCRINUS (continued).

Americanus, Owen & Shumard, 1852. Jour. Acad. Nat. Sci. Phil., 2d ser., vol. ii., p. 89, pl. 11, fig. 1.—1852. Geol. Iowa, Wisc. & Minnes., p. 594, pl. v. B., fig. 1.—*Platycrinus ornogranulus*, McChesney. Pal. Foss., p. 3, pl. 5, fig. 8.—*Enc.* —Burlington, Iowa.

Ann Dixoni,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 61.—*Niag.*—Decatur Co., Tennessee.

asper (*Pleurocrinus*), Meek & Worthen, 1861. Proc. Ac. Nat. Sci. Phil., p. 129.—*Enc.*—Burlington, Iowa.

Burlingtonensis, Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., 2d ser., vol.ii., p. 60, pl. 7, fig. 5.—1852. Geol. Iowa, Wisc. & Minn., p. 589, tab. 5 A., fig. 5.—*Platycrinus ornatus*, McChesney. Pal. Foss., p. 6, pl. 4, fig. [illegible]—*Enc.*—Burlington, Iowa.

brevinodus, Hall, 1861. Des. New Crinoidea, Prelim. Not., p. 4. —Bost. Jour. Nat. Hist., vol. vii., p. 286.—*Arch.*—Keokuk, Iowa.

calyculus, Hall, 1861. Des. New Crin., Prelim. Not., p. 16.—*Enc.*—Burlington, Iowa.

canaliculatus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 539.—*Enc.* —Burlington, Iowa.

cavus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 527, pl. 8, fig. 1.—*Enc.*—Burlington, Iowa.

contritus, Hall, 1863. Crin. Wav. Sands. Ohio, p. 5.—*Chem.*—Summit Co., Ohio.

clytis, Hall, 1861. Des. New Crin., Prelim. Not., p. 4.—Boston Nat. Hist., vol. 7, p. 285.—*Enc.*—Burlington, Iowa.

corrugatus, Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., 2d ser., vol. ii., p. 59, pl. 7, fig. 2.—1852. Geol. Iowa, Wis. & Minn., p. 589, pl. v. A., fig. 2.—*Enc.*—Burlington, Iowa.

depressus,* Owen, 1843. Cat. Geol. Form. Ohio Val., No. 279. —*Kas.*(?)—Monroe Co., Indiana.

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less elongated, central or subcentral proboscis, bearing the opening on one side near the upper extremity.

Type.—*P. lævis*, Miller.—Also includes *P. spinosus* and *P. 30-dactylus*, Austin, *P. Mullerianus*, Koninck, and *P. granulatus*, Miller.

"2. *Centrocrinus*, Austin.—Opening of summit nearly or quite central, but not elevated upon a proboscis.

Type.—*P.* [*Centrocr.*] *gigas*, Gilbertson.

"3. *Cupellæcrinus*, Troost.—Differs from the last only in having its second radial pieces merely rudimentary, or so small as to allow the first brachials to rest partly upon the first radials.

Type.—*P. Tennesseensis*, Rœmer.

"4. *Pleurocrinus*, Austin.—Differs from *Centrocrinus* only in having the opening of the summit lateral and nearly or quite on a line with the arm bases.

Examples.—*P.* [*Pleurocr.*] *mucronatus*, Austin; *P.* [*Pleurocr.*] *tuberculatus*, Miller; *P.* [*Pleurocr.*] *tuberosus* and *P.* [*Pleurocr.*] *subspinosus*, Hall, and *P.* [*Pleurocr.*] *asper*, Meek & Worthen."

There can be no doubt as to the utility of a separation such as is here proposed, but unfortunately the upper part of the body has not been discovered in a large proportion of the described species, and therefore until larger and more perfect collections are accessible to the student it will be impossible to distribute all of the known species in their proper sections.

PLATYCRINUS (continued).

discoideus, Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., 2d ser., vol. ii., p. 58, pl. 7, fig. 1.—1852. Geol. Iowa, Wis. & Minn., p. 581, pl. 5 A., fig. 1.—Hall, 1858. Geol, Iowa, vol. i., pt. 2, p. 535, pl. 8, fig. 8.—*Enc.*—Burlington, Iowa.

Eboraceus, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 119.—*Ham.*—Livingston Co., New York.

elegans, Hall, 1861. Des. New Crin., Prelim. Not., p. 4.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 285.—*Enc.*—Burlington, Iowa.

Eriensis, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 119. —*Ham.*—Livingston Co., New York.

eminulus, Hall, 1861. Des. New Crin., Prelim. Not., p. 17.—*Enc.*—Burlington, Iowa.

excavatus, Hall, 1861. Des. New Crin., Prelim. Not., p. 4.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 286.—*Enc.*—Burlington, Iowa.

exsertus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 539, fig. 61.—*Enc.*—Burlington, Iowa.

Georgii, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 82.—*Arch.*—Warsaw, Illinois.

glyptus, Hall,, 1861. Des. New Crin., Prelim. Not., p. 116.—*Enc.* —Burlington, Iowa.

graphicus, Hall, 1863. Crin. Wav. Sands. Ohio, p. 6.—*Chem.*—Summit Co., Ohio.

hemisphericus, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 162.—*Arch.*—Niota, Hancock Co., Illinois.

incomptus, White, 1863. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 503.—*Enc.*—Burlington, Iowa.

Huntsvillæ,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 61.—*Kas.*—Huntsville, Alabama.

Halli, Shumard—*P. olla*, Hall, 1861. Des. New Crin., Prelim. Not., p. 16. (Not *P. olla,* De Koninck & Le Hon.)—*Enc.*—Burlington, Iowa.

inornatus, v. P. Burlingtonensis.

insculptus,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 62.—Tennessee.

multibrachiatus, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 135.—*Enc.*—Burlington, Iowa.

Niotensis, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 162.—*Arch.*—Hancock Co., Illinois.

nodobrachiatus (Troost), Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 542, fig. 63. (Not *P. nodobrachiatus,* Hall, 1861.)—*Enc.*—Burlington, Iowa.

nodobrachiatus, Hall, 1861; *v. P. perasper.*

nodulosus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 541.—*Enc.*—Burlington, Iowa.

nucleiformis, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 540.—*Enc.* —Burlington, Iowa.

olla, v. P. Halli.

PLATYCRINUS (continued).

ornogranulus, *v.* P. Americanus.

Oweni, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 120.—*Enc.*—Burlington, Iowa.

parvinodus, Hall, Feb., 1861. Des. New Crin., Prelim. Not., p. 17.—*Enc.*—Burlington, Iowa.

parvulus, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 163.—*Kas.*—Pope Co., Illinois.

parvus, Hall, 1862. Pal. N. York, vol. iii., pt. 2, p. 114, pl. 4, fig. 6–9.—(*Tr.*) *L. H.*—Herkimer Co., New York.

penicillus, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 380.—*St. L.*—Hardin Co., Illinois.

perasper—*P. nodobrachiatus*, Hall, Feb., 1861. Des. New Crin., Prelim. Not., p. 17. (Not [Troost] Hall, 1858. Gèol. Iowa.) *P. perasper*, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 161.—*Enc.*—Burlington, Iowa.

pileiformis, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 529, pl. 8, fig. 3.—*Enc.*—Burlington, Iowa.

planus,† Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., n. ser., vol. ii., p. 57, pl. 7, fig 4.—1852. Geol. Iowa, Wis. & Minn., p. 587, pl. 5 A., fig. 4.—De Koninck & Le Hon, 1854. Rech. Crin. Ter. Carb. Belg., p. 173, pl. 5, fig. 6.—*Enc.*—Burlington, Iowa; near Monmouth, Illinois; Tournay, Belgium.

plenus, Meek & Worthen, 1861. Proc. Ac. Nat. Sci. Phil., p. 380. —*St. L.*—Hardin Co., Illinois.

pleurovimenus, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 17.—*Enc.*—Burlington, Iowa.

plumosus, Hall, 1859. Pal. N. York, vol. iii., pt. 2, p. 113, pl. 4, fig. 1–5.—*L. H.*—Herkimer Co., New York.

pocilliformis, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 528, pl. 8, fig. 2.—*Enc.*—Burlington, Iowa.

polydactylus,* Troost, 1850. List Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 62.—Tennessee.

Prattenianus, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 379.—*St. L.*—Randolph Co., Illinois.

pumilis, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 82.—*Arch.*—Warsaw, Illinois.

quinquenodus, White, 1862. Proc. Boston Soc. Nat. Hist., vol. ix., p. 18.—*Enc.*—Burlington, Iowa.

ramulosus, Hall, 1859. Pal. New York, vol. iii., p. 115, pl. 4, fig. 10–13.—*L. H.*—Herkimer Co., New York.

regalis, Hall, 1861. Des. New Crin., Prelim. Not., p. 16.—*Enc.* —Burlington, Iowa.

Saffordi, (Troost,) Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 634, pl. 18, fig. 5 & 6.—Dana, 1863. Man. Geol., p. 312, fig.

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† This is one of the few species of American Crinoids which has been observed in European strata. According to De Koninck, it is found in the Carboniferous Limestone of Tournay, Belgium; it is also cited by Morris (*Cat. Foss.*) from the same formation of Bolland.

PLATYCRINUS (continued).

528.—*Arch.*—Keokuk, Iowa; White's Creek Springs, Tennessee; Allen Co., Kentucky.

Saræ Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 673, pl. 17, fig. 4. —*St. L.*—St. Louis, Missouri.

scobina, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 129.—*Enc.*—Burlington, Iowa,

sculptus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 536, pl. 8, fig. xi.—*Enc.*—Burlington, Iowa.

Shumardanus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 532, pl. 8, fig. 5.—*Enc.*—Burlington, Iowa.

striobrachiatus, Hall, 1861. Des. New Crin., Prelim. Not., p. 4.—1861. Boston Jour. Nat. Hist., vol. vii., p. 287.—*Enc.*—Burlington, Iowa.

subspinosus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 536, pl. 8, fig. 9 & 10.—*Enc.*—Burlington, Iowa.

subspinulosus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 81.—*Enc.*—Burlington, Iowa.

tentaculatus, Hall, 1859. Pal. N. York, vol. iii., p. 116, pl. 5, fig. 1–4.—*L. H.*—Schoharie, New York.

Tennesseensis, *v.* Cupellæcrinus Tennesseensis.

truncatus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 537, fig. 59. —*Enc.*—Burlington, Iowa.

truncatulus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 538, fig. 60. —*Enc.*—Burlington, Iowa.

tubærosus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 534, pl. 8, fig. 7.—*Enc.*—Burlington, Iowa.

verrucosus, White, 1863. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 502.—*Enc.*—Burlington, Iowa.

Wortheni, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 530, pl. 8, fig. 4.—*Enc.*—Burlington, Iowa.

Yandelli, Owen & Shumard, 1850. Jour. Acad. Nat. Sci. Phil., vol. ii., p. 58, pl. 7, fig. 6.—1852. Geol. Iowa, Wis. & Min., p. 587, tab. 5 A., fig. 6.—*Enc.*—Burlington, Iowa.

PLEUROCYSTITES, Billings, 1854. Canad. Journal, vol. ii., p. 250.

Anticostiensis, Billings, 1857. Geol. Surv. Canada, p. 288.—1858. Can. Org. Rem., Dec. iii., p. 52.—*H. R.*—Charleton Point, Canada.

elegans, Billings, 1857. Rep. Geol. Surv. Canada, p. 287.—1858. Canad. Org. Rem., Dec. iii., p. 51, pl. 3, fig. 2.—*Tr.*—Ottawa, Canada.

exornatus, Billings, 1858. Canad. Org. Rem. Dec. iii., p. 52.—*Tr.*—Montreal, Canada.

filitextus, Billings, 1857. Canada Jour., vol. ii., p. 252.—1857. Geol. Surv. Canada, p. 286.—1858. Can. Org. Rem., Dec. iii., p. 50, pl. 2, fig. 1.—*Tr.*—Ottawa, Canada.

robustus, Billings, 1854. Canad. Jour., vol. ii., p. 252.—1857. Geol. Surv. Canada, p. 286.—1858. Can. Org. Rem., Dec. iii., p. 49, pl. 1, fig. 2.—*Tr.*—Ottawa, Canada.

PLEUROCYSTITES (continued).

squamosus, Billings, 1854. Canad. Jour., vol. ii., p. 251.—1857. Geol. Surv. Canada, p. 286.—1858. Can. Org. Rem., Dec. iii., p. 49, pl. 1, fig. 1.—Dana, 1863. Man. Geol., p. 211, fig. 285.—*Tr.*—Ottawa, Canada.

POROCRINUS, Billings, 1857. Rep. Geol. Canada, p. 279.

conicus, Billings, 1857. Rep. Geol. Surv. Canada, p. 279.—1858. Canad. Organ. Rem., Dec. iv., pl. 2, fig. 5.—*Tr.*—Ottawa, Canada.

crassus, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 115.—*H. R.*—Oswego, Kendall Co., Illinois.

pentagonus, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 146.—*Tr.*—Dixon, Illinois.

POTERIOCRINUS (Poteriocrinites), Miller, 1821. Nat. Hist. Crin., p. 67.—Encrinites, Schlotheim, 1823. Nachtr. z. Petref. —Cu-pressocrinus, McCoy, 1849. Ann. & Mag. Nat. Hist.

æqualis, Hall, 1860. Geol. Iowa, Sup., p. 63.—*Enc.*—Burlington, Iowa.

alternatus, v. Homocrinus alternatus.

Barrisi, Hall, 1861. Des. New Crin., Prelim. Not., p. 6.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 303.—*Enc.*—Burlington, Iowa.

(Scaphiocrinus) Bayensis, Meek & Worthen, 1865. Proc. Ac. Nat. Sci. Phil., p. 157.—*Kas.*—Bay City, Pope Co., Illinois.

bursæformis, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 10.—*Enc.*—Burlington, Iowa.

calyculus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 553, pl. 9, fig. 6.—*Enc.*—Burlington, Iowa.

(Zeacrinus) carbonarius — *Poteriocrinus* (*Scaphiocrinus*) *carbonarius*, Meek & Worthen, 1861. Proc. Ac. Nat. Sci. Phil., p. 140. — 1865. *Poteriocrinus* (*Zeacrinus*) *carbonarius.* Proc. Acad. Nat. Sci. Phil., p. 152. — *C. M.* — Springfield, Illinois.

carinatus—Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 139.—*Enc.*—Burlington, Iowa.

Corycia, Hall, 1863. Crin. Waverly Sands. Ohio, p. 8.—*Chem.*—Summit County, Ohio.

Crineus, Hall, 1863. Crin. Waverly Sands. Ohio, p. 7.—*Chem.*—Summit Co., Ohio.

cultidactylus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 62.—*Enc.*—Burlington, Iowa.

(Scaphiocrinus) decadactylus, Meek & Worthen, 1860. Proc. Ac. Nat. Sci. Phil., p. 394.—*Arch.*—Warsaw, Illinois.

diffusus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 121. —*Ham.*—Ontario Co., New York.

dilatatus, v. Cœliocrinus dilatatus.

POTERIOCRINUS (continued).

(?) enormis,† Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 137.—*Enc.*—Burlington, Iowa.

florealis, v. Zeacrinus (Poteriocrinus) florealis.

fusiformis, Hall, 1861. Des. New Crin., Prelim. Not., p. 6.—1861. Boston Jour. Nat. Hist., vol. vii., p. 302.—*Enc.*—Burlington, Iowa.

gracilis, v. Homocrinus gracilis.

indentus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 122. *Ham.*—Ontario Co., New York.

Indianensis, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 155.—*Arch.*—Crawfordsville, Indiana.

Keokuk, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 64.

lepidus, Hall, 1861. Des. New Crin., Prelim. Not., p. 6.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 304.—*Enc.*—Burlington, Iowa.

longidactylus, v. P. Missouriensis.

maniformis, v. Zeacrinus maniformis.

Meekianus, Shumard, 1855. 2d Rep. Geol. Surv. Missouri, pt. 2, p. 188, pl. A, fig. 7 *a. b.*—*Chem.*—Mt. Vernon, Moniteau Co., Missouri.

Missouriensis—*P. longidactylus*, Shumard, 1855. 2d Rep. Geol. Missouri, pt. 2, p. 188, pl. B., fig. 5. (Not *P. longidactylus*, Austin.)—*P. Missouriensis*, 1857. Trans. Acad. Sci. St. Louis, vol. i., p. 80.—Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 669, pl. 17, fig. 7.—Dana, 1863. Man. Geol., p. 312, fig. 523.—*St. L.*—St. Louis, Missouri.

municipalis,* Troost, 1850. List Crin. Tenn. in Proc. Am. Assoc. Camb. Meet., p. 61.—Tennessee.

nassa, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 120.—*Ham.*—Canandaigua Co., New York.

nereus, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 121. —*Ham.*—Ontario Co., New York.

(Scaphiocrinus) Norwoodi, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 159.—*Kas.*—Pope Co., Illinois.

nycteus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 120. —*Ham.*—Ontario Co., New York.

obuncus, White, 1862. Proc. Bost. Soc. Nat. His., vol. ix., p. 10. —*Enc.*—Burlington, Iowa.

occidentalis, v. Agassizocrinus occidentalis.

pisiformis,‡ Rœmer, 1860. Sil. Faun. West. Tenn., p. 54, pl. 4, fig. 7.—*Niag.*—Perry Co., Tennessee.

Pleias, Hall, 1863. Crin. Wav. Sands. Ohio, p. 8.—*Chem.*—Summit Co., Ohio.

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† This species has been recently transferred by the authors to the Genus *Cyathocrinus*.—(*Proc. Acad. Nat. Sci. Phil., p.* 152, *Aug.*, 1865.)

‡ This is probably one of the species enumerated, in Troost's Catalogue of Crinoidea of Tennessee, under *Haplocrinus*.

POTERIOCRINUS (continued).

(Scaphiocrinus?) rhombiferus, Owen & Shumard, 1852. Jour. Ac. Nat. Sci. Phil., n. ser., vol. ii, p. 89, pl. xi., fig. 2.—*Enc.*—Burlington, Iowa; near Monmouth, Illinois.

saliginoides, White, 1862. Proc. Bost. Soc. Nat. Hist., vol. ix., p. 10.—*Enc.*—Burlington, Iowa.

(Scaphiocrinus) solidus, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 140.—*Enc.*—Burlington, Iowa.

spinosus, v. Zeacrinus spinosus.

subimpressus, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 138.—*Enc.*—Burlington, Iowa.

subtumidus, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 159.—*Kas.*—Pope Co., Illinois.

Swallovi, Meek & Worthen, 1860. Proc. Ac. Nat. Sci. Phil., p. 137.—*Enc.*—Burlington, Iowa.

tenuibrachiatus, Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Phil., p. 138.—*Enc.*—Burlington, Iowa.

(Scaphiocrinus) tenuidactylus, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 156.—*Enc.*—Burlington, Iowa.

tumidus, v. Agassizocrinus tumidus.

ventricosus, v. Cœliocrinus ventricosus.

verticillus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 122. —*Ham.*—Ontario Co., New York.

(Scaphiocrinus) Wachsmuthii, Meek & Worthen, 1861. Proc. Ac. Nat. Sci. Phil., p. 141.—*Enc.*—Burlington, Iowa.

PROTASTER, Forbes, 1849. Mem. Geol. Surv. Great Britain, Dec. i. (Compare Aspidosoma, Goldfuss, Petref. Germ., 1848.)

Barrisi, Hall, 1861. Des. New Crin., Prelim. Not., p. 18.—*Enc.*—Burlington, Iowa.

Forbesi, Hall, 1859. Pal. N. York, vol. iii., p. 134, pl. 7 A., fig. 8–10.—*L. H.*—Herkimer Co., New York.

PTEROTOCRINUS (Subgenus of Dichocrinus) — Asterocrinus, Lyon, 1857. Geol. Kentucky, vol. iii., p. 472. (Not Munster.)— Pterotocrinus, Lyon & Casseday, 1860. Amer. Jour. Sci., 2d ser., vol. 29, p. 68.—Codonocrinites, Troost, 1850. Cat. Foss. Tenn., p. 60.—Dæmonocrinites, *id. ibid*, p. 62.

capitalis—*Asterocrinus capitalis*, Lyon, 1857. Geol. Kentucky, vol. iii., p. 472, pl. 3, fig. 1.—Pterotocrinus, Lyon & Casseday, 1859. Syn. List Pal. Echinod., Proc. Amer. Acad. Arts & Sci., p. 302.—*Kask.*—Crittenden Co., Kentucky.

Chesterensis—*Dichocrinus* (*Pterotocrinus*) *Chesterensis*, Meek & Worthen, 1860. Proc. Ac. Nat. Sci. Phil., p. 383.—*Kas.*—Chester, Illinois.

cornigerus — *Dichocrinus cornigerus*, Shumard, 1857. Trans. Acad. Sci. St. Louis, vol. i., p. 72, pl. 1, fig. 1.—*Kas.*—Franklin Co., Alabama.

cornutus*—*Dæmonocrinites cornutus*, Troost, 1850. Cat. Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 62.—*Kas.*(?) —Tennessee.

PTEROTOCRINUS (continued).

coronarius—*Asterocrinus coronarius*, Lyon, 1857. Geol. Kentucky, vol. 3, p. 476, pl. I, fig. 1.—*Pterotocrinus coronarius*, Lyon & Casseday, 1859. Syn. List. Pal. Echinod., Proc. Amer. Acad. Arts & Sci., vol. iv., p. 302.—*Kas.*—Crittenden Co., Kentucky.

crassus—*Dichocrinus* (*Pterotocrinus*) *crassus*, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 382.—*Kas.*—Hardin Co., Illinois.

depressus, Lyon & Casseday, 1860. Amer. Jour. Sci., n. ser., vol. 29, p. 68.—*Kas.*—Grayson Springs, Grayson Co., Kentucky.

pyramidalis, Lyon & Casseday, 1860. Amer. Jour. Sci., vol. 29, p. 69. — *Kas.* — Grayson, Edmondson and Breckenridge Counties, Kentucky.

rugosus, Lyon & Casseday, 1860. Amer. Jour. Sci., vol. 29, p. 71. —*Kas.*—Kentucky.

sex-lobatus—*Dichocrinus sex-lobatus*, Shumard, 1857. Trans. Acad. Sci. St. Louis, vol. i., p. 73, pl. I, fig. 3.—*Kas.*—Russellville, Kentucky.

PYGORHYNCHUS, Agassiz, 1839,

Gouldi, Bouve, 1846. Proc. Bost. Soc. Nat. Hist., p. 192.—*Kas.*(?)

RETEOCRINUS, Billings, 1859. Can. Org. Rem. Dec. iv., p. 63.

(?) fimbriatus, Billings, 1859. Canad. Org. Rem., Dec. iv., p. 65. —*H. R.*—Charleton Point, Anticosti, Canada.

stellaris, Billings, 1859. Canad. Org. Rem., Dec. iv., p. 64, pl. 9, fig. 4.—*Tr.*—Ottawa, Canada.

RHODOCRINUS—Encrinus, Cumberland, 1819. Trans. Geol, Soc. London, vol. v. — Rhodocrinites, Miller, 1821. Nat. Hist. Crin.—Ollacrinus, Cumberland, 1826. App. Rel. Conserv. —Rhodocrinus, Agassiz, 1835. Mem. Soc. Neuch., vol. i. —Gilbertsocrinus, Phillips, 1836. Geol. Yorks., vol. ii.—Rhodocrinus, Koninck, Hall, and others.

asperatus, Billings, 1859. Canad. Org. Rem., Dec. iv., p. 27, fig. 4.—*Cha.*—Near Montreal, Canada.

Barrisi, Hall, Feb., 1861. Des. New Crin., Prelim. Not., p. 9.— —1861. Bost. Jour. Nat. Hist., vol. vii., p. 322.—*Enc.*—Burlington, Iowa.

var. divergens, Hall, 1861. Des. New Crin., Prelim. Not., p. 9. —1861. Bost. Jour. Nat. Hist., vol. vii., p. 324.—*Enc.*—Burlington, Iowa.

(Acanthocrinus) gracilis, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 127.—*Ham.*—Ontario Co., New York.

Halli, Lyon, 1861. Proc. Ac. Nat. Sci. Philad., p. 412, pl. 4, fig. 5.—*L. H.*(?)—Jefferson Co., Kentucky.

Melissa, Hall, 1863. Trans. Alb. Inst., vol. iv., p. 198.—*Niag.*—Waldron, Indiana.

microbasalis, v. Thysanocrinus microbasalis.

(Acanthocrinus) nodulosus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 126.—*Ham.*—Ontario Co., New York.

RHODOCRINUS (continued).

pyriformis, *v.* Thysanocrinus pyriformis.

spinosus, Hall, 1862. 15th Rep. Reg. State Cab. N. York, p. 127. —*Ham.*—Ontario Co., New York.

Varsoviensis, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 80.—*Arch.*—Warsaw, Illinois.

Wachsmuthii, Hall, 1861. Des. New Crin., Prelim. Not., p. 18. —*Enc.*—Burlington, Iowa.

Whitei, Hall, 1861. Des. New Crin., Prelim. Not., p. 9.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 324.—*Enc.*—Burlington, Iowa.

var. Burlingtonensis, Hall, 1861. Des. New Crin. Prelim. Not., p. 9.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 325. —*Enc.*—Burlington, Iowa.

Wortheni, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 566, pl. 9, fig. 8.—*Enc.*—Burlington, Iowa.

SACCOCRINUS, Hall, 1852. Pal. N. York, vol. ii., p. 205.

speciosus, Hall, 1852. Pal. New York, vol. ii., p. 205, pl. 46, fig. 1 & 2.—Rœmer, 1860. Sil. Faun. West. Tenn., p. 42, pl. 3, fig. 3.—*Niag.*—Lockport, New York, and Decatur Co., Tennessee.

SCAPHIOCRINUS (Subgenus of Poteriocrinus), Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 550. (Compare with Graphiocrinus.)

æqualis, Hall, 1861. Des. New Crin., Prelim. Not., p. 8.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 316.—*Arch.*—Crawfordsville, Indiana.

carinatus, Hall, 1861. Des. New Crin., Prelim. Not., p. 8.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 310.—*Enc.*—Burlington, Iowa.

dactyliformis, Hall, 1858. Geol. Iowa, vol. i., p. 670, pl. 17, fig. 6. —*St. L.*—St. Louis, Missouri.

divaricatus, Hall, 1860. Geol. Iowa, Sup. to vol. i., p. 65—*Arch.* —Warsaw, Illinois.

dichotomus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 553, fig. 72. —*Enc.*—Burlington, Iowa.

doris, Hall, 1861. Des. New Crinoid., Prelim. Not., p. 7.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 312.—*Enc.*—Burlington, Iowa.

Halli, Hall, 1861. Des. New Crinoid., Prelim. Not., p. 7.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 308.—*Enc.*—Burlington, Iowa.

longidactylus, McChesney, 1859. New Pal. Fossils, vol. i., p. 7. —*Kas.*—Kaskaskia, Illinois.

Lyriope, Hall, 1863. Crin. Waverly Sands. Ohio, p. 9.—*Chem.*—Summit Co., Ohio.

nodobrachiatus, Hall, 1861. Des. New Crin., Prelim. Not., p. 8. —1861. Jour. Boston Soc. Nat. Hist., vol. vii., p. 314.—*Arch.*—Crawfordsville, Indiana.

orbicularis, Hall, 1861. Jour. Bost. Society Nat. Hist., vol. vii., p. 311.—*Arch.*—Keokuk, Iowa.

SCAPHIOCRINUS (continued).

ramulosus, Hall, 1861. Des. New Crinoid., Prelim. Not., p. 7.—1861. Jour. Boston Soc. Nat. Hist., vol. vii., p. 307.—*Enc.*—Burlington, Iowa.

robustus, Hall, 1861. Des. New Crin., Prelim. Not., p. 7.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 315.—*Arch.*—

rusticellus, White, 1863. Proc. Bost. Soc. Nat. Hist., vol. vii., p. 505.—*Enc.*—Burlington, Iowa.

simplex, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 551, pl. 9, fig. 10. —*Enc.*—Burlington, Iowa.

spinobrachiatus, Hall, 1861. Des. New Crin., Prelim. Not., p. 8. —1861. Bost. Jour. Nat. Hist., vol. vii., p. 306.—*Enc.*—Burlington, Iowa.

subcarinatus, Hall, 1863. Crin. Wav. Sands. Ohio, p. 9.—*Chem.*—Summit Co., Ohio.

subtortuosus, Hall, 1863. Crin. Wav. Sands. Ohio, p. 10.—*Chem.*—Summit Co., Ohio.

tortuosus, Hall, 1861. Des. New Crin., Prelim. Not., p. 7.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 309.—*Enc.*—Burlington, Iowa.

unicus, Hall, 1861. Des. New Crin., Prelim. Not., p. 8.—1861. Jour. Bost. Soc. Nat. Hist., vol. vii., p. 312.—*Arch.*—Crawfordsville, Indiana.

Whitei, Hall, 1861. Des. New Crin., Prelim. Not., p. 7. 1861. Bost. Jour. Nat. Hist., vol. vii., p. 306.—*Enc.*—Burlington, Iowa.

SCHIZOCRINUS, Hall, 1847. Pal. N. York, vol. i., p. 81.

nodosus, Hall, 1847. Pal. N. York, vol. i., p. 81, pl. 27, fig. 1.

SCYPHOCRINUS, Hall, 1847. Pal. N. York, vol. i., p. 85. (Not *Scyphocrinus*, Zenker.)

heterocostalis, Hall, 1847. Pal. New York, vol. i., p. 85, pl. 28, fig. 3.

SPHÆROCRINUS, Meek & Worthen, 1866. Proc. Acad. Nat. Sci. Phil., p. 154. (Proposed Subgenus of ACTINOCRINUS.)

SPHÆROCYSTITES, Hall, 1859. Pal. N. York, vol. iii., p. 130.

multifasciatus, Hall, 1859. Pal. N. York, vol. iii., p. 130, pl. 7, fig. 1–4.—*L. H.*—Cumberland, Maryland.

STENASTER, Billings, 1858. Can. Org. Rem., Dec. 3, p. 77.

Huxleyi, Billings, 1865. New Sp. Pal. Foss., p. 213, fig. 197.—*Queb.*—Point Rich, Newfoundland.

pulchellus—*Palæaster pulchellus*, Billings, 1856. Geol. Surv. of Canada, p. 292.—*Stenaster pulchellus*, Billings, 1858. Can. Org. Rem., Dec. iii., p. 79, pl. 10, fig. 2.—*Tr.*—Ottawa, Canada.

Salteri, Billings, 1858. Canad. Org. Rem., Dec. iii., p. 78, pl. 10, fig. 1.—*Tr.*—Belleville, Canada W.

STEPHANOCRINUS, Conrad, 1842. Jour. Acad. Nat. Sci. Phil., vol. 8, p. 279.—Rœmer, 1850. Archiv. fur Naturgeschicht, p. 365.—Hall, 1852. Pal. N. York, vol. ii., p. 212.

STEPHANOCRINUS (continued).

angulatus, Conrad, 1842. Jour. Ac. Nat. Sci. Phil., vol. viii., p. 279, pl. 15, fig. 18.—Hall, 1852. Pal. N. York, vol. ii., p. 212, pl. 48, fig. 1.—*Niag.*—Lockport, New York.

gemmiformis, Hall, 1852. Pal. New York, vol. ii., p. 215, pl. 48, fig. 2.—*Niag.*—Lockport, New York.

SYRINGOCRINUS, Billings, 1859. Can. Org. Rem., Dec. 4, p. 65.

paradoxicus, Billings, 1859. Canad. Org. Rem., Dec. iv., p. 65, pl. 10, fig. 14.—*Tr.*—Beauport, Canada.

SYNBATHOCRINUS, Phillips, 1836. Geol. Yorks., pt. 2, p. 206.

dentatus, Owen & Shumard, 1852. Jour. Acad. Nat. Sci. Phil., new ser., vol. ii., p. 93, pl. 11, fig. 7.—1852. Geol. Iowa, Wis. & Minn., p. 597, pl. v. B., fig. 7.—*Enc.*—Burlington, Iowa.

granulatus,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 61.—Tennessee.

matutinus, Hall, 1858. Geol. Iowa, vol. i., p. 483, pl. 1, fig. 2.—*Ham.*—New Buffalo, Iowa.

Oweni, Hall, 1860. 13th Rep. Reg. State Cab. N. York, p. 111.

papillatus, Hall, 1861. Des. New Crin., Prelim. Not., p. 18.—*Enc.*—Burlington, Iowa.

Tennesseeæ,* Troost, 1850. List Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 61.—*Niag.*—Decatur Co., Tennessee.

Tennesseensis, Rœmer, 1860. Sil. Faun. West. Tenn., p. 55, pl. 4, fig. 5.—*Niag.*—Decatur Co., Tennessee.

robustus,† Shumard, 1865 (n. sp.)—*Arch.*—Button-mould Knob, Jefferson Co., Kentucky.

Wortheni, Hall, 1858. Geol. Iowa, vol. i., p. 560, pl. 9, fig. 9.—*Enc.*—Burlington, Iowa.

TÆNIASTER, Billings, 1858. Can. Org. Rem., Dec. iii., p. 80.

cylindricus—*Palæocoma cylindrica*, Billings, 1856. Geol. Surv. Canada, p. 292.—*Tæniaster cylindricus*, 1858. Can. Org. Rem., Dec. iii., p. 81, pl. 10, fig. 4.—*Tr.*—Ottawa, Canada.

spinosus—*Palæocoma spinosa*, Billings, 1856. Geol. Surv. Canada, p. 292.—*Tæniaster spinosus*, 1858. Canad. Org. Rem., Dec. iii., p. 81, pl. 10, fig. 3.—Dana, 1863. Man. Geol., p. 211, fig. 283.—*Trent.*—Ottawa, Canada.

TAXOCRINUS (Subgenus of RHODOCRINUS), Phillips.

gracilis, Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Phil., p. 142.—*Ham.*—New Buffalo, Iowa.

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† *Synbathocrinus robustus.—Description.*—Body below the 2d radials depressed conical, enlarging rapidly from base, width not quite double the height, plates thick, surface finely granulose. Base pentagonal above, short, widely truncated and excavated below by the upper joint of the column, margin of excavation finely but distinctly crenulate. First radials wider than high, quadrangular, gently convex, double the height of base; facets for 2d radials broad.

Geol. Pos. & Loc.—Rather abundant in the blue marl layers, interstratified with the fine-grained Sandstone at Button-Mould Knob, seven miles south of Louisville, Kentucky.

TAXOCRINUS (continued).

interscapularis, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 482, pl. 1, fig. 3.—*Ham.*—New Buffalo, Iowa.

nuntius—*Forbesiocrinus nuntius*, Hall, 1862. 15th Rep. Reg. State Cab. New York, p. 124.—*Ham.*—Ontario Co., New York.

Thiemei—*Forbesiocrinus Thiemei*, Hall, 1861. Des. New Crin., Prelim. Not., p. 8.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 317.—*Enc.*—Burlington, Iowa.

TECHNOCRINUS, (Subgenus of MARIACRINUS,) Hall, 1859. Pal. N. York, vol. iii., p. 139.

Andrewsi, Hall, 1859. Pal. N. York, vol. iii., p. 141, pl. 86, fig. 1–4.—*Orisk.*—Cumberland, Maryland.

sculptus, Hall, 1859. Pal. N. York, vol. iii., p. 143, pl. 86, fig. 1–18.—*Orisk.*—Cumberland, Maryland.

spinulosus, Hall, 1859. Pal. N. York, vol. iii., p. 140, pl. 85, fig. 1–18.—*Orisk.*—Cumberland, Maryland.

striatus, Hall, 1859. Pal. New York, vol. iii., p. 142, pl. 86, fig. 12 and 5–11.—*Orisk.*—Cumberland, Maryland.

THYSANOCRINUS† (Subgenus of RHODOCRINUS), Hall, 1852. Pal. N. York, vol. ii., p. 188.

aculeatus, Hall, 1852. Pal. New York, vol. ii., p. 190, pl. 42, fig. 3.—*Niag.*—Lockport, New York.

canaliculatus, Hall, 1852. Pal. N. York, vol. ii., p. 189, pl. 42, fig. 2.—*Niag.*—Lockport, New York.

immaturus, Hall, 1852. Pal. N. York, vol. ii., p. 191, pl. 42, fig. 4.—*Niag.*—Lockport, New York.

liliiformis, Hall, 1852. Pal. N. York, vol. ii., p. 188, pl. 42, fig. 1.—*Niag.*—Lockport, New York.

microbasalis—*Thysanocrinus* (*Rhodocrinus*) *microbasalis*, Billings, 1856. Rep. Geol. Surv. Canada, p. 264.—*Rhodocrinus microbasalis*, 1859. Canad. Org. Rem., Dec. iv., p. 63, pl. 6, fig. 2.—*Trent.*—Ottawa, Canada.

pyriformis—*Thysanocrinus* (*Rhodocrinus*) *pyriformis*, Billings, 1856. Geol. Surv. Canada, p. 263.—*Rhodocrinus pyriformis*, 1859. Canad. Org. Rem., Dec. iv., p. 61, pl. 6, fig. 1. *Trent.*—Ottawa, Canada.

TREMATOCRINUS, *v.* GONIASTEROIDOCRINUS.

VASOCRINUS, *v.* CYATHOCRINUS.

ZEACRINUS, (Subgenus of POTERIOCRINUS,) Troost, 1850. Catalog. Crin. Tenn. in Proc. Amer. Assoc. Camb. Meet., p. 62.—CUPRESSOCRINUS, McCoy, 1852. Pal. Foss., p. 117. (Not of Goldfuss.)—ZEACRINUS, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 543. (Comp. with GRAPHIOCRINUS, Koninck & Le Hon.)

† For the present I retain *Thysanocrinus* as a subgenus of *Rhodocrinus*, from which, however, it does not appear to present any very essential differences of structure. The principal variation from *Rhodocrinus* consists mainly in the form of the summit, which is turbinate instead of globose or subglobose; there are also fewer interradial plates, and the basals are rudimentary

ZEACRINUS (continued).

bifurcatus, McChesney, 1859. New Pal. Foss., p. 9.—*Kask.*—Kaskaskia, Illinois.

crateriformis*—*Cyathocrinus crateriformis*, Troost, 1850. List Crin. Tenn. (Trans. Amer. Assoc., Cambridge Meeting.)—*Kask.*—Tennessee and Grayson County, Kentucky.

discus, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 390.—*C. M.*—Sangamon Co., Illinois.

elegans, Hall, 1858. Geol. Iowa, vol. i., p. 547, pl. 9, fig. 1 & 2.—*Enc.*—Burlington, Iowa.

florealis—*Cyathocrinus florealis*, Yandell & Shumard, 1847. Cont. Geol. Kentucky, p. 24, pl. 1, fig. 1.—*Poteriocrinus florealis*, Shumard, 1855. 2d Rep. Geol. Missouri, pt. 2, p. 217.—*Kask.*—Grayson Springs, Grayson Co., Kentucky.

intermedius, Hall, 1858. Geol. Iowa, vol. i., p. 68, pl. 25, fig. 4.—*Kask.*—Chester, Illinois.

maniformis—*Cyathocrinus maniformis*, Yandell & Shumard, 1847. Cont. Geol. Kentucky, p. 22, pl. 1, fig. 2.—*Poteriocrinus maniformis*, Shumard, 1855. 2d Rep. Geol. Missouri, pt. 2, p. 217.—*Zeacrinus maniformis*, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 682, pl. 25, fig. 8.—*Kask.*—Grayson Co., Kentucky; Golconda, Illinois; Ste. Genevieve Co., Missouri.

magnoliaformis‡—*Cyathocrinus magnoliaformis*, Owen & Norwood, 1846. Research. Pot. Carb. Rocks Cent. Kentucky.—*Zeacrinus magnoliaformis*, Troost, 1850. Cat. Crin. Tenn., Proc. Amer. Assoc. Camb. Meet., p. 61.—Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 684, fig. 112.—*Kask.*—Grayson Co., Kentucky; near Huntsville, Alabama.

mucrospinus, McChesney, 1859. New Pal. Foss., p. 10.—*C. M.*—McCoupin Co., Illinois.

ovalis, Lyon & Casseday, 1860. Amer. Jour. Sci., n. ser., vol. 29, p. 71.—*Kask.*—Grayson, Breckenridge, Edmondson and Todd Counties, Kentucky.

paternus, Hall, 1863. Crin. Wav. Sands. Ser. Ohio, p. 10.—*Chem.*—Summit Co., Ohio.

planobrachiatus, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 391.—*Arch.*—Monroe Co., Illinois.

ramosus, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 548, pl. 9, fig. 3.—*Enc.*—Burlington, Iowa.

scoparius, Hall, 1861. Des. New Crin., Prelim. Not., p. 8.—1861. Bost. Jour. Nat. Hist., vol. vii., p. 305.—*Enc.*—Burlington, Iowa.

spinosus—*Poteriocrinus spinosus*, Owen & Shumard, 1852. Jour. Acad. Nat. Sci. Phil., n. ser., vol. ii., p. 91, pl. 11, fig. 4. *Kask.*—Kaskaskia, Illinois.

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‡ A species very nearly allied to, if not identical with, *Zeacrinus magnoliaformis*, occurs in the St. Louis Limestone of the bluffs of the Mississippi, five miles below St. Louis. It is a very rare fossil in Missouri, a single specimen only having been found: it is now preserved in the State Collection at Columbia.

ZEACRINUS (continued).

Troostanus, Meek & Worthen, 1860. Proc. Acad. Nat. Sci. Phil., p. 390.—*Enc.*—Warren Co., Illinois.

Wortheni, Hall, 1858. Geol. Iowa, vol. i., pt. 2, p. 683, fig. 111. —*Kask.*—Chester, Illinois.

From the foregoing Catalogue it appears that, up to the present time, there have been described from the Palæozoic Rocks of the United States and Canadas seven hundred and sixty-four species belonging to the class Echinodermata, after excluding about eighty doubtful species and varieties.* These are included in one hundred and two genera and subgenera. Many of the forms now regarded as doubtful are known only as catalogue names, and we may reasonably expect that some of these will prove to be good species, though it is well known that a large number of them have been described under other names. It is also probable that some of the so-called varieties will, upon careful revision, be found to possess characters of full specific value. On the other hand, there can be no doubt that as materials for more extended examination and comparison accumulate in our museums, it will appear that some of the forms now recognized as distinct, are either identical with, or are merely varieties of, previously described species.

Although the number of species already found in our Palæozoic strata very greatly exceeds that of all other countries combined, we know that the list will be very much extended by future investigations. New forms are being constantly discovered, and many undescribed species yet remain in the public and private collections of the country.

The distribution of species in the several Geological Systems may be stated as follows:

In the Lower Silurian,	97	species.
" Upper Silurian,	86	"
" Devonian,	115	"
" Carboniferous,	452	"

The following Tables show their number and distribution in the subdivisions of the Systems.

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* It is a remarkable fact that a single locality in the Encrinital Limestone, occupying but a few acres in extent—Burlington, Iowa—has yielded 261 species, or more than one-third of the entire number described from our Palæozoic rocks. From another locality, a few yards square, in Grayson County, Kentucky, the writer has collected in a few minutes upwards of 150 good examples of the cup of *Zeacrinus crateriformis*.

A TABLE *exhibiting the number and distribution of Genera and Species of* ECHINODERMATA *in the Geological Formations of North America.*

Names of Genera.	*Total No. of Species.*	*Potsdam Sandstone.**	*Calciferous. Chazy.* } *Quebec Group.*	*Birdseye and Black River Groups.*	*Trenton Group.*	*Galena Limestone.*	*Utica Slate.*	*Hudson River Group.*	*Middle Silurian.*	*Clinton Group.*	*Niagara Group.*	*Onondaga Group.*	*Water-lime Group.*	*Lower Helderberg Gr.*	*Oriskany Sandstone.*	*Upper Helderberg Gr.*	*Hamilton Group.*	*Chemung Group.*	*Encrinital Limestone. (Burlington Group.)*	*Archimedes Limest.*	*St. Louis Limestone.*	*Kaskaskia Limestone.*	*Low. & Upp. Coal M.*	*Permian.*	REMARKS.
Acrocrinus	2																					2			
Actinocrinus	157										2					2	6	3	115	29		2			Besides the number of species here given, there are 10 varieties and 7 doubtful species.
Agaricocrinus	14																		11	3					and 1 variety from Encrinital Limestone.
Agassizocrinus	6																					6			
Agelacrinus	5				1			1			2											1			
Alloprosallocrinus	2																			2					and 1 doubtful species.
Amygdalocystites	2																								
Ancyrocrinus	2															1	1								
Anomalocystites	2													1	1										
Apiocystites	3										2			1											
Archæocidaris	14																	1	1	1	2	2	6	1	and 1 doubtful species.
Aspidocrinus	3													3											
Astrios	0																								Undescribed Genus and species.
Ateleocystites	1				1																				
Belemnocrinus	1																		1						
Blastoidocrinus	1		1																						
Brachyocrinus	1													1											

* The columns of a Crinoidean, or rather Cystidean, were found by the author in the Potsdam Sandstone of La Grange Mountain, near the head of Lake Pepin, on the Upper Mississippi, during the summer of 1849, associated with *Dikellocephalus Minnesotiensis*, *D. Pepinensis*, and a large undescribed *Orthis*. Mention of this discovery was made by Prof. Yandell in the Proceedings of the Amer. Scientific Association, Cincinnati Meeting, 1851. This is the earliest notice of the occurrence of Crinoidean or Cystidean remains so low down in the geological series.

Table exhibiting the number and distribution of Genera and Species of Echinodermata, *&c.* (*continued.*)

Names of Genera.	*Total No. of Species.*	*Potsdam Sandstone.*	*Calciferous. Chazy.* } *Quebec Group.*	*Birdseye and Black River Groups.*	*Trenton Group.*	*Galena Limestone.*	*Utica Slate.*	*Hudson River Group.*	*Middle Silurian.*	*Clinton Group.*	*Niagara Group.*	*Onondaga Limestone.*	*Water-lime Group.*	*Lower Helderberg Gr.*	*Oriskany Sandstone.*	*Upper Helderberg Gr.*	*Hamilton Group.*	*Chemung Group.*	*Encrinital Limestone. (Burlington Group.)*	*Archimedes Limest.*	*St. Louis Limestone.*	*Kaskaskia Limestone.*	*Low. & Upp. Coal M.*	*Permian.*	REMARKS.
Bursacrinus	2																		2						
Callocystites	1										1														
Campanulites	0																								
Carabocrinus	3				2			1																	
Caryocrinus	1										1														and 6 doubtful species.
Catillocrinus	1																			1					
Cheirocrinus	9										2						1		3	3					
Cleiocrinus	3				3																				
Closterocrinus	1									1															
Coccocrinus	1										1														
Codaster	6																3		2	1					
Cœliocrinus	3																		3						
Comarocystites	2				1	1																			
Cotyledonocrinus	1																			1					
Crinocystites	2										2														
Crumenacrinites	0																								and 1 doubtful Genus and species.
Ctenocrinus	3										3														
Cupellæcrinus	1										1														and 9 doubtful species.
Cyathocrinus	46										4					5		1	17	16		2	1		and 11 doubtful species.
Cyclocystoides	2				2																				
Cystocrinus	1										1														
Dendrocrinus	11				10			1																	
Dichocrinus	20																		11	3		6			
Dictyocrinus	1													1											
Dolatocrinus	6															3	3								

Names of Genera.	*Total No. of Species.*	*Potsdam Sandstone.*	*Calciferous. Chazy.* } *Quebec Group.*	*Birdseye and Black River Groups.*	*Trenton Group.*	*Galena Limestone.*	*Utica Slate.*	*Hudson River Group.*	*Middle Silurian.*	*Clinton Group.*	*Niagara Group.*	*Onondaga Group.*	*Water-lime Group.*	*Lower Helderberg Gr.*	*Oriskany Sandstone.*	*Upper Helderberg Gr.*	*Hamilton Group.*	*Chemung Group.*	*Encrinital Limestone. (Burlington Group.)*	*Archimedes Limest.*	*St. Louis Limestone.*	*Kaskaskia Limestone.*	*Low. & Upp. Coal M.*	*Permian.*	REMARKS.
Echinocystites	1																	1							
Echinoencrinites	1				1																				and 1 doubtful species..
Edrioaster	1				1																				
Edriocrinus	3													1	1	1									
Elæacrinus	5															3	2								
Eleutherocrinus	2															1	1								
Eretmocrinus	1																		1						
Erisocrinus	4																						4		
Eucalyptocrinus	8										8														and 10 doubtful species.
Forbesiocrinus	21																1	2	9	5	1	3			and 2 doubtful species.
Glyptocrinus	12			1	5			1		1	4														
Glyptocystites	4		1		3																				
Glyptaster	4										4														
Gomphocystites	3										3														
Goniasteroidocrinus	8																1		5	1		1?			
Granatocrinus	9																	2	3	2	1	1			
Graphiocrinus	1																				1				and 1 var. Encrinital Limestone.
Haplocrinus	1																								and 4 doubtful species.
Hemicosmites	1										1														
Heterocrinus	9				4			5																	
Heterocystites	1										1														
Holocystites	6										6														
Homocrinus	7				2			1			2			1	1										
Hybocrinus	3		1		2																				
Icthyocrinus	5									1	2								1	1					
Lampterocrinus	2										2														

Table exhibiting the number and distribution of Genera and Species of ECHINODERMATA, *&c.* (*concluded.*)

Names of Genera.	*Total No. of Species.*	*Potsdam Sandstone.*	*Calciferous.* } *Quebec Chazy.* } *Group.*	*Birdseye and Black River Groups.*	*Trenton Group.*	*Galena Limestone.*	*Utica Slate.*	*Hudson River Group.*	*Middle Silurian.*	*Clinton Group.*	*Niagara Group.*	*Onondaga Group.*	*Water-lime Group.*	*Lower Helderberg Gr.*	*Oriskany Sandstone.*	*Upper Helderberg Gr.*	*Hamilton Group.*	*Chemung Group.*	*Encrinital Limestone. (Burlington Group.)*	*Archimedes Limest.*	*St. Louis Limestone.*	*Kaskaskia Limestone.*	*Low. & Upp. Coal M.*	*Permian.*	REMARKS.
Lecanocrinus	6				2						4														
Lepidechinus	1																		1						
Lyriocrinus	2										2														
Malocystites	2		2																						
Mariacrinus	7													7											
Megistocrinus	11															4	3		4						
Melocrinus	5										3					1						1?			
Melonites	1																				1				
Mespilocrinus	2																		2						
Myelodactylus	3										3														
Myrtillocrinus	1															1									
Oligoporus	1																			1					
Palæaster	2				1						1														
Pachyocrinus	1		1																						
Palasterina	5				1			3													1				
Palæocystites	4		4																						
Palæchinus	1																		1						
Palæocrinus	4		1		3																				
Pentremites	33										1						6		3	10		13			
Petraster	4				3						1														
Platycrinus	65										2			4			2	2	42	6	4	3			
Pleurocystites	6				5			1																	
Porocrinus	3				2			1																	

Names of Genera.	Total No. of Species.	Potsdam Sandstone.	Calciferous. Chazy. } Quebec Group.	Birdseye and Black River Groups.	Trenton Group.	Galena Limestone.	Utica Slate.	Hudson River Group.	Middle Silurian.	Clinton Group.	Niagara Group.	Onondaga Group.	Water-lime Group.	Lower Helderberg Gr.	Oriskany Sandstone.	Upper Helderberg Gr.	Hamilton Group.	Chemung Group.	Encrinital Limestone. (Burlington Group.)	Archimedes Limest.	St. Louis Limestone.	Kaskaskia Limestone.	Low. & Upp. Coal M.	Permian.	REMARKS.
Poteriocrinus	35										1						6	4	17	2	1	3	1		
Protaster	2													1					1						
Pterotocrinus	10																					10			
Pygorhynchus	1																					1?			
Reteocrinus	2				1			1																	
Rhodocrinus	10		1								1			1			3		4						
Saccocrinus	1										1														
Scaphiocrinus	20																	3	10	5	1	1			
Schizocrinus	1				1																				
Scyphocrinus	1				1																				
Sphærocystites	1													1											
Stenaster	3		1		2																				
Stephanocrinus	2										2														
Syringocrinus	1				1																				
Synbathocrinus	8										2						1	1	3	1					and 2 doubtful species.
Tæniaster	2				2																				
Taxocrinus	4																3		1						
Technocrinus	4														4										
Thysanocrinus	6				2						4														
Zeacrinus	16																		4	1		8	2		
	763	1	13	1	65	1		16		3	83			33	7	22	43	20	278	95	13	66	14	1	

APPENDIX.

The following paper was omitted in the List of Publications:

1859—Sidney S. Lyon and S. A. Casseday. Descriptions of nine New Species of Crinoidea from the Sub-carboniferous Rocks of Indiana and Kentucky.—[Amer. Jour. Sci., vol. 23, p. 233.

The following have been received since the first sheet was printed:

1861-1865—E. Billings. Palæozoic Fossils, vol. i., containing Descriptions of New or little known Species of Organic Remains from the Silurian Rocks.—[Geol. Surv. Canada.

1865—F. B. Meek and A. H. Worthen. Remarks on the Genus Taxocrinus (Phillips), McCoy, 1844, and its relations to Forbesiocrinus, Koninck & Le Hon, 1854, with Descriptions of New Species.—[Proc. Acad. Nat. Sci. Phil.

1865—*Id.* Descriptions of New Species of Crinoidea from the Palæozoic Rocks of Illinois and some of the adjoining States.—[*Ibid.*

1865—*Id.* Descriptions of New Crinoidea, &c., from the Carboniferous Rocks of Illinois and some of the adjoining States.—[*Ibid.*

1865—F. B. Meek. Notes on the Genus Gilbertsocrinus, Phillips.—[*Ibid.*

Descriptions of several American Species have been published since the earlier sheets of this Catalogue were printed. These are now added.

GENUS ACTINOCRINUS.

A. pistillus, Meek & Worthen, August, 1865. Proc. Acad. Nat. Sci. Phil., p. 153.—*Enc.*—Burlington, Iowa.

A. (Alloprosallocrinus) euconus. *Id. ibid.* p. 164.*

GENUS COMAROCYSTITES.

C. Shumardi, Meek & Worthen, August, 1865. Proc. Acad. Nat. Sci. Phil., p. 143.—*Trent.*—Cape Girardeau, Missouri.

C. Shumardi—*var.* obconicus. *Id. ibid.* p. 144.—*Trent.*—Cape Girardeau, Missouri.

GENUS CYATHOCRINUS.

C. arboreus. *Id. ibid.* p. 160.—*Arch.*—Crawfordsville, Indiana.

C. crassibrachiatus. [This species was by mistake omitted in its proper place among the *Cyathocrini* and transferred to p. 360, where the specific name wrongly stands for a Genus.]

GENUS CYCLOCRINUS, Eichwald. Lethæa Ross. — Pasceolus, Billings, 1857. Geol. Rep. Canada, p. 342.—1865. Pal.

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* It is quite possible that this species is not distinct from *A. conicus* of Lyon & Casseday, as has been suggested by Meek & Worthen in their paper.

Foss. Canada, p. 390.†—CYCLOCRINITES, Niles, 1865. Proc. Bost. Soc. Nat. Hist., p. 19.

C. globosus—*Pasceolus globosus*, Billings, 1857. Geol. Rep. Canada, p. 343.—1865. Palæozoic Foss. Canada, vol. i., p. 391.—*Trent.*—Ottawa, Canada.

C. Halli—*Pasceolus Halli*, Billings, 1857. Geol. Rep. Canada, p. 342.—1865. Geol. Rep. Canada, p. 390.—*Cyclocrinites Halli*, Niles, 1865. Proc. Bost. Soc. Nat. Hist., vol. x., p. 19.—*Mid. Sil.*—Anticosti, Canada.

NOTE.—In the Proceedings of the Academy of Natural Sciences, Philadelphia, for December, 1865, just received, I observe (p. 273) that Meek & Worthen change their name *Sphærocrinus*, proposed for a section of *Actinocrinus*, to that of *Cœlocrinus*, the former name having been previously used by Rœmer for another group. As the term *Cœliocrinus*, however, was employed by White in 1863 to designate a subgenus of *Poteriocrinus*, it will be necessary for Meek & Worthen to give another name to their proposed subgenus.

The publication of this Catalogue will be continued in the next number of the Transactions of the Academy, which it is proposed to commence without delay. This number will embrace the *Bryozoa* and *Brachiopoda*. It is also expected that it will contain a Catalogue of our Palæozoic Plants, which Prof. Leo. Lesquereaux, the eminent fossil botanist, has kindly consented to prepare in aid of the work.

† In this place Mr. Billings expresses the opinion that his Genus *Pasceolus* may be congeneric with *Cyclocrinites*, Eichwald, though he considers the question yet unsettled as to whether its affinities are with the *Ascidians* or *Cystideans*. Messrs. Niles and Verrill, however, after a study of some well preserved specimens of *Pasceolus Halli* from Anticosti, unhesitatingly refer them to the *Cystidea*.

Some New Varieties of SPIRIFER LINEATUS, *Martin;* SPIRIFER CAMERATUS, *Morton;* SPIRIFER KENTUCKENSIS, *Shumard;* SPIRIFER LEIDYI, *Norwood and Pratten;* SPIRIFER INCREBESCENS, *Hall, and* SPIRIFER KEOKUK, *Hall.* By G. C. SWALLOW.

SPIRIFER LINEATUS, *Martin.*

Although this fossil appears to be characteristic of the Mountain Limestone of Europe, all the specimens in the Missouri Collection, and indeed all the American specimens which I have observed, came from the Coal Measures. Our State Collection contains many specimens, which cannot be distinguished, by the form, markings, or size, from those figured by Sowerby (Min. Con., Vol. IV., Pl. 334), or from specimens before me from Ireland and Derbyshire. Like those, our fossils have no concentric striæ on the transverse bands; and, like the European specimens above cited, the wider forms usually have an obsolete sinus on the ventral valve, which renders the margin slightly sinuous.

Length, .95; width, 1.11; thickness, .68.

This fossil is common in the Coal Measures of the Mississippi Valley.

Variety, perplexa, McChesney.

Prof. McChesney has described what appears to be a small variety of this fossil under the name *perplexa;* but I can see only one or two slight differences. The *perplexa* is usually wider than long, while the Russian fossil is longer than wide, as described and figured by M.M. Verneuil and Kutorga (*Ge. Rus.*, Vol. II., p. 147, Pl. vi., figs. 6, *a*, *b*); in this particular our shell has a closer affinity to the true *lineatus*, which is usually transverse.* It has no sinus, and very seldom a depressed line along the middle of one or both valves. It is much smaller than the other varieties, and very closely resembles the Russian fossils of this species.

This is by far the most abundant fossil of the Coal Measures of the Mississippi Valley.

Variety, striato-lineatus.

This fossil is usually larger than the true *lineatus;* it is generally transverse, but sometimes elongated and very gibbous. Its surface is ornamented with numerous imbricating

* The description of M. De Koninck, "*cette coquille est ordinairement d'une forme arondie et globuleuse, quelquefois transverse et elliptique,*" is more than counterbalanced by Sowerby, McCoy, Phillips, and others. And besides, nearly all the specimens are transverse which I have observed, whether from collections made in this country or in Europe.

concentric lamellæ or folds, whose edges are fringed with small thick set spines; the bases of these spines form short costæ on the transverse folds, most distinct on the lower edge, usually becoming obsolete on the upper part. The folds are also marked with numerous concentric striæ. This variety is also marked with small, distant, radiating costæ, which are distinct from those formed by the bases of the spines on the concentric folds, and are more obvious when the shell is partially exfoliated. It often has an obsolete or sparingly developed sinus.

This variety is common in the upper and middle Coal Measures of Missouri; it is seldom found in the lower beds.

SPIRIFER CAMERATUS, *Morton.*

Variety, Kansasensis.

This fossil is much wider in proportion; lateral extremities often very much prolonged and mucronate; it has more and much smaller radiating costæ, often as many as fifty on each side of the mesial sinus. In other respects it resembles the *S. cameratus.*

This variety was collected by Maj. Hawn in the Upper Coal Measures of Kansas.

Variety, percrassus.

This shell is smaller, thicker, more convex, cardinal line shorter than width of shell, area smaller, costæ less numerous (about sixteen on each side of the mesial sinus).

This fossil may be a distinct species, though it much resembles the *S. cameratus.*

Length, 1.13; width, 1.31; thickness, .88.

This shell is common in the Upper Coal Measures of Missouri and Kansas.

SPIRIFER KENTUCKENSIS, *Shumard.*

Variety, propatulus.

This shell is three times as wide as long, and has ten sharp plications on each side of the sinus. In other respects it agrees with the *S. Kentuckensis* of Dr. Shumard.

Length, .28; width, .84; thickness, .25.

It is a rare fossil in the Upper Coal Measures of Missouri.

SPIRIFER LEIDYI, *Nor. & Prat.*

Variety, Chesterensis.

This fossil is larger, more gibbous, the mesial fold and sinus are not so abruptly depressed and elevated, but are more rounded, and the lateral plication on the fold and in the sinus are larger than in the true *Leidyi.*

This fossil is very similar to the *Spirifer Keokuk, var.* of Prof. Hall (Iowa Report, Pl. xxiv., fig. 4, *a*, *b*, *d*); but it occurs in the Ste. Genevieve Limestone, associated with the *S. Leidyi*, above the St. Louis Limestone.

Variety, Merimacensis.

This variety has the general appearance of the *Leidyi;* but its plications are much larger, about seven on each side of the mesial fold and sinus; mesial fold high, with two plications—no smaller ones on the sides as in the *Leidyi.*

It is a rare fossil in the Archimedes Limestone at Barrett's Station on the Pacific Railroad, Missouri.

SPIRIFER INCREBESCENS, *Hall.*

Variety, Americana.

This shell is much smaller than the true *increbescens;* has fewer costæ; the mesial fold and sinus are much more sharply defined; the sinus is more depressed and the fold more elevated. It is more semi-elliptical, and is not so full on each side between the mesial sinus and the lateral margins.

The *Americana* is easily distinguished by its size, form, number of plications, and its more sharply defined mesial fold and sinus. This shell is found at the base of the Kaskaskia Limestone, in Missouri and Illinois.

SPIRIFER KEOKUK, *Hall.*

Variety, Shelbyensis.

Shell larger, plications higher and more numerous—about fourteen on each side of the sinus.

This fossil occurs in the Archimedes Limestone in Shelby county, Missouri.

Descriptions of New Species of BRYOZOA. By DR. HIRAM A. PROUT.

[The following descriptions of new species of *Bryozoa* were placed in my hands for publication by M. L. Gray, Esq., administrator of the estate of the late Dr. Prout.—B. F. SHUMARD.]

8–10 L. 10–12 T.	FENESTELLA NODOSA, Prout.

Bryozoum, a fan-shaped expansion, with small, round, longitudinal rays, regularly distributed, and without the appearance of dissepiments or nodes to the naked eye.

Longitudinal rays uniform, straight, round, bifurcating from one to one and a half lines apart, presenting under the microscope regular lines of nodes or tubercles, slighty longer than broad, about their own length apart and having no correspondence with the dissepiments, being to the number of 14–15 in each of the two lines in the length of the rays.

Dissepiments depressed, short, round, thickened at junction with longitudinal rays.

Fenestrules mostly quadrangular, but occasionally suboval from thickening of the dissepiments at their junction.

Cells or *chalices* small, tapering upwards, placed in a line above the insertion of dissepiments and about midway between the obverse and reverse. In worn specimens the chalices become distinct, showing three to each fenestrule, while the tubercles disappear entirely.

Reverse, striated where worn.

Geol. Pos. & Loc.—This delicate and beautiful species is found in the Hamilton Group, on a broad slab literally covered with *Crinoidea*, *Brachiopoda*, and the following species of *Bryozoa.*—[*Illinois State Collection.*]

8 L.
8–9 T.

FENESTELLA DILATA, Prout.

Bryozoum delicate, fan-shaped, about one inch long by one and a fourth inches wide.

Longitudinal rays irregular, not straight, rapidly diverging, branching often at the distance of about two-thirds of a line apart, or at the top of every second fenestrule, curving rapidly outward on both sides, plumose.

Dissepiments thick, nearly as wide as longitudinal rays, dilated at junction with the latter, arched and slightly depressed near the borders.

Fenestrules mostly broad oval, sometimes irregular and arched where most expanded towards the border: 8 in longitudinal and 8 or 9 in transverse lines in a space of two lines, indicating nearly equal dimensions in the fenustrular spaces.

Chalices or *cells* large, irregularly placed near each other upon the two sides of a fine line or keel, usually two, sometimes one, and sometimes three to each fenestrule.

Reverse unknown.

Geol. Pos. & Loc.—This beautiful and delicate species was found on the same slab with the *F. nodosa*, and belongs to the Hamilton Group.

FENESTELLA BIFURCATA, Prout.

Polyzoum or *Bryozoum*, a fan-like expansion, with large longitudinal rays and oscules distinctly visible to the naked eye.

Longitudinal rays large, basaltiform, with a middle keel and two rows of chalices; bifurcating seldom towards the base, but frequently and mostly in opposite series towards the middle; four to five in each series.

POLYPORA IMBRICATA, Prout.

Bryozoum a funnel-shaped expansion, about one inch long by one and a quarter inches wide, having a distinct, flattened, irregular, rounded, hollow pedicle, with a round, narrow neck. *Chalices* on the inner face.

Longitudinal rays nearly straight, on reverse being somewhat smaller than the dissepiments, seldom branching, branching about two lines apart, minutely granular on reverse or outer aspect of the bryozoum.

Dissepiments short, broad, much dilated at junction, finely granular in reverse.

Fenestrules mostly round or slightly oval (5 long.–6 trans. in space of 2 lines), deeply and conically depressed on reverse; irregularly round or oblong oval on medallion face, sometimes becoming obliterated, and opening obliquely upwards to the plane of expansion.

Chalices small, moderately long, tubular, imbricate, placed very obliquely, looking upward and outward to the plane of expansion, somewhat irregular, but generally in three to four lines upon each ray, which seems to swell more or less above each fenestrule; mouths, where seen, thin, round, and slightly raised.

This beautiful and delicate species is characterized by the obliquity of the chalices to the plane of expansion. The chalices are more or less irregular, less than their own diameter apart horizontally, and twice their diameter apart longitudinally; often appearing to be imbricated when we look down obliquely upon them.

Geol. Pos. & Loc.—Mountain Limestone, Indiana.

POLYPORA RIGIDA, Prout.

Polyzoum a semicircular, flat, flabelliform expansion, radiating from a central axis.

Longitudinal rays small, sharply defined; straight, rigid and wire-like upon the reverse; seldom branched, sometimes anastomosing; mostly branching from dissepiments, by which the fenestrules are much diminished in size.

Dissepiments, on the reverse, small and sharply defined; mostly opposite, in straight or curved lines; sometimes alternate.

Fenestrules large, longer than broad, mostly quadrangular, sometimes rounded at angles and more or less irregular in size. On the medallion face the fenestrules are crowded by the growth of the cells, and are more or less oblong oval.

RETEPORA HAMILTONENSIS, Prout.

Bryozoum a broad, funnel-shaped expansion, with longitudinal rays frequently branching and rapidly diverging so as to give an explanate or flat form to the funnel, which only shows the reverse or lower surface.

Longitudinal rays more or less irregular in size, full, round, and appearing under the microscope as minutely cellular, in a thickened, strong basis.

Dissepiments nearly as large as longitudinal rays, and not depressed, being on a level with the rays.

Fenestrules or *oscules* slightly oval, giving the appearance of a perforated plate rather than of regular partitions by rays and dissepiments, arranged in beautiful waved lines.

Medallion face.—Longitudinal rays with about three lines of minute pores, and about three to each oscule, much crowded, so as to nearly fill the open spaces of the oscules, and, as far as can be seen, with chalices upon the dissepiments; oscules oblong oval; 5 long. and 6 trans. in a space of 2 lines.

Hamilton Group.—[*Illinois State Collection.*]

PTILODICTYA (STICTOPORA) VARIABILIS, Prout.

Bryozoum branched once, celluliferous on both sides; cells oval, outer row as large as those in the middle, but terminating sooner on the round and smooth margin of the bryozoum. The body and branches marked by from six to ten lines of oval cells, which, when perfect, have somewhat elevated round borders. Cells originate from the opposite sides of a central lammella or plate, which is probably double from the partial cementation of the cells at their bases. Celluliferous portion moderately thick, though flattened.

This species is certainly very closely allied to, if not identical with, *P. acuta*, Hall. It has the same form and arrangement of the cells, with the exception of the cells being as large on the outside as on the middle rows. It differs, moreover, in the edges of the branches not being acute but rounded, but above all by the existence of a central lammella or plate which separates the opposite and less flattened portions of the bryozoum.

Geol. Pos. & Loc.—Upper Silurian, Columbus, Ohio.—[*Illinois State Collection.*]

Atmospheric Electricity.

BY A. WISLIZENUS, M.D.

The delayed publication of this volume allows me to add to my observations of atmospheric electricity for 1861–64 those of 1865.

I.—*Monthly Mean of Positive Atmospheric Electricity in* 1861, 1862, 1863, 1864 *and* 1865, *at St. Louis, Mo., based upon daily observations at* 6, 9, 12, 3, 6 *and* 9 *o'clock, from morning till night.*

YEAR.	JAN.	FEB.	MAR.	APRIL	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	MEAN OF YEAR.
1861...	16.5	12.1	9.8	8.8	7.8	4.0	3.7	3.4	3.0	7.1	10.0	14.3	8.4
1862...	12.1	16.0	9.4	10.6	7.5	3.0	2.2	2.3	3.0	7.7	12.6	13.9	8.4
1863...	16.9	15.9	13.6	8.8	4.7	2.0	2.8	4.4	4.8	12.5	12.1	11.5	9.2
1864..	15.8	11.3	11.0	8.5	5.1	4.0	2.3	0.9	1.8	5.4	6.6	9.0	6.8
1865...	12.2	9.5	5.9	3.3	2.4	3.4	2.6	5.9	1.2	5.3	10.1	6.4	5.7
Mean	14.7	13.0	9.9	8.0	5.5	3.3	2.7	3.4	2.8	7.6	10.3	11.0	7.7

II.—*Monthly Mean of Temperature and Relative Humidity in* 1861, 1862, 1863, 1864 *and* 1865, *at St. Louis. Mo., based upon daily observations, contemporaneous with those of Atmospheric Electricity.*

TEMPERATURE.

YEAR.	JAN.	FEB.	MAR.	APRIL	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	MEAN OF YEAR.
1861...	32.2	40.4	44.8	58.1	64.1	76.9	77.5	78.6	69.1	57.9	46.0	39.7	57.1
1862...	28.9	30.2	43.2	55.0	69.7	75.1	81.2	80.7	72.1	57.3	42.6	41.3	56.4
1863...	36.8	35.7	43.6	57.4	65.5	71.9	77.2	77.5	69.2	48.0	43.7	35.9	55.2
1864...	29.2	38.3	40.7	51.4	69.4	78.9	83.5	78.8	72.9	53.1	44.9	30.4	56.0
1865...	28.1	38.4	46.7	56.8	68.8	80.7	77.7	78.1	77.8	58.8	48.0	30.8	57.5
Mean	31.0	36.6	43.8	55.7	67.5	76.7	79.4	78.7	72.2	57.0	45.0	35.6	56.4

RELATIVE HUMIDITY.

1861...	72.2	63.3	64.5	61.5	66.3	70.8	66.3	69.6	77.3	76.6	69.0	74.3	69.5
1862...	85.3	73.9	70.8	67.0	57.3	67.0	66.8	64.3	74.2	67.2	69.5	74.6	69.8
1863...	79.2	81.7	68.1	57.2	59.4	67.7	68.6	70.7	68.2	74.4	67.4	79.5	70.2
1864...	75.6	62.7	70.0	69.8	56.4	61.5	62.8	69.0	64.1	67.9	74.2	75.5	67.4
1865...	74.6	72.0	66.1	66.8	62.1	67.9	77.4	71.7	76.8	74.1	62.3	78.8	70.9
Mean	77.4	70.7	67.9	64.5	60.3	67.0	68.4	69.1	72.1	72.0	68.5	76.5	69.6

III.—*Yearly Mean of Positive Electricity, of Temperature, and of Relative Humidity of the Atmosphere at the hours of* 6, 9, 12, 3, 6 *and* 9, *from morning till night, based upon daily observations at those hours in* 1861, 1862, 1863, 1864 *and* 1865, *at St. Louis, Mo.*

ELECTRICITY.

YEAR.	6 A. M.	9 A. M.	12 M.	3 P. M.	6 P. M.	9 P. M.
1861	8.5	9.9	9.0	7.7	8.5	6.8
1862	8.9	10.0	9.1	7.3	8.1	6.8
1863	10.5	10.6	10.0	7.5	9.1	7.4
1864	7.9	8.8	7.4	5.4	5.9	5.5
1865	6.4	7.1	6.0	5.3	5.4	3.8
Mean....	8.4	9.3	8.3	6.6	7.4	6.1

TEMPERATURE.

1861	48.9° F.	54.9	61.6	63.6	59.3	54.3
1862	48.9	55.0	60.9	62.3	58.0	53.6
1863	47.5	53.6	59.7	61.0	57.2	52.2
1864	48.0	54.1	60.5	62.2	58.1	53.0
1865	50.4	55.8	61.8	63.3	59.3	54.7
Mean....	48.7	54.7	60.9	62.5	58.4	53.6

RELATIVE HUMIDITY.

1861	86.4	71.3	60.3	57.2	65.1	77.3
1862	85.3	70.6	60.0	57.5	67.6	78.0
1863	86.8	71.4	60.2	58.0	66.7	77.9
1864	83.9	69.3	57.7	55.0	64.0	74.8
1865	84.7	71.7	61.3	59.0	68.3	78.9
Mean....	85.4	70.9	59.9	57.3	66.3	77.4

IV.—*Direction and Frequency of Winds in* 1861–65, *at St. Louis, Mo.*

									Prevailing Wind.
1861.	E.	N.	N.E.	S.W.	N.W.	S.	W.	S.E.	
	136	169	190	279	293	293	324	522	S.E.
1862.	E.	S.W.	N.	N.E.	W.	S.	N.W.	S.E.	
	112	191	211	230	259	265	351	530	S.E.
1863.	E.	N.	N.E.	S.	W.	S.W.	N W.	S.E.	
	148	180	228	271	282	302	307	458	S.E.
1864.	E.	N.	N.E.	S.	N.W.	S.W.	W.	S.E.	
	53	176	234	245	319	327	330	492	S.E.
1865.	E.	N.	N.W.	N.E.	W.	S.W.	S.	S.E.	
	53	164	242	250	287	296	308	572	S.E.
Mean:	E.	N.	N.E.	S.	S.W.	W.	N.W.	S.E.	
	100	180	226	276	279	296	302	519	S.E.

V.—*The relative proportion of Positive Electricity, of Negative Electricity, and of no Electricity, in my observations.*

	POSITIVE ELECTRICITY.	NEGATIVE ELECTRICITY.	NO ELECTRICITY.
In 1861, was observed............	2,046 times....	78 times....	59 times.
" 1862, " "	1,883 "	67 "	225 "
" 1863, " "	1,627 "	88 "	461 "
" 1864, " "	1,410 "	61 "	709 "
" 1865, " "	1,422 "	61 "	689 "
	8,388 "	355 " ...	2,143 "
Mean per year	1,678 times....	71 times....	429 times.

VI.—*Number of Thunderstorms.*

In 1861.	In 1862.	In 1863.	In 1864.	In 1865.
32	50	40	26	40

REMARKS.

The *daily* as well as the *monthly* periodicity of positive atmospheric electricity is as apparent in these observations of five years as in the former ones; but a new peculiarity is manifested in them by the gradual diminution in the annual mean of positive atmospheric electricity, and by the annual increase of observations exhibiting no electricity at all. May not this peculiarity give us, perchance, a clue to the *annual* periodicity of atmospheric electricity? If my supposition should prove correct, that atmospheric electricity is closely allied with and principally caused by terrestrial and solar magnetism, we may expect also a corresponding annual periodicity with that higher force. Professor Wolf in Zurich has, after laborious researches, calculated the average periodicity of the declination of the magnetic needle and of the solar spots at $11\frac{1}{9}$ years; and while the maxima, according to his calculation, are in our times represented by the years 1837, 1848, 1859 and 1870, the minima coincide with 1843, 1854 and 1865. It is therefore a possibility, that the great falling off in positive electricity in 1865 may represent the lowest point in the wave-like line of annual periodicity from 1859 to 1770. For the present I consider this view as merely hypothetical, but observations, continued about five years longer, will prove its fallacy or correctness.

Observations of Ozone, made in Highland, Madison Co., Ills. By AD. F. BANDELIER.

Having made regular observations of ozone with the usual ozone-papers and the colored scale of Professor Schönbein, I present herewith to the Academy the result of my observations for the year 1865. They were made twice in 24 hours, from 7 in the morning to 7 in the evening, and from 7 in the evening to 7 in the morning, to show the difference of ozone during day-time and night.

1865.	MEAN OF MONTH. DAY.	NIGHT.
January	3.2	5.0
February	2.6	4.1
March	3.1	4.7
April	4.3	5.1
May	4.6	4.2
June	4.8	3.3
July	5.0	3.3
August	5.4	3.2
September	5.9	1.5
October	3.0	3.5
November	2.9	3.3
December	2.0	3.5
Mean	3.9	3.7

Calculated from the daily observations (621), the mean of all the observations in day-time is 3.87, of those in the night 3.64, and the mean of the whole year 3.75. The yearly mean of the observations made in day-time is therefore 0.23 greater than that of the night observations. But this difference is still greater in different months: while January, February, March, April, October, November, and December, give as

Mean of day observations 3 05, and for the night 4.14;

the months of May, June, July, August, and September, show as

Mean of day observations 5.14, and for the night 3.10.

The first group consists, with the exception of April, of those months in which the days are shortest; and the second group, of those with longest daylight. The shorter or longer daylight seems, therefore, to act an important part in the formation of ozone. The quantity of ozone in day and night time is in the first group as 1 in day to 1.39 in night; and in the second group, as 1 to 0.60.

The formation of ozone seems to be affected, also, by atmospheric humidity. Great humidity is generally accompanied by a considerable quantity of ozone. In continued dry weather the ozone-paper is hardly colored.

The highest point in the scale, No. 10, was reached bu once in the year—on April 20th, in the night. In the whole year, the paper showed no reaction at all 19 times in day-time and 28 times in the night. In September, from 1st to 10th and from 11th to 17th, the night observations gave constantly 0, while the average quantity in day-time was about 6.

I take this occasion to make a remark further about thunderstorms. Having noted for years the precise time of their appearance, I have come to the conclusion that by far the greatest number appear in the hottest part of the day, between 2 and 4 o'clock P. M., and next from 12 to 2 o'clock A. M.; but that very few appear in the morning from 8 to 10, and still less at the same hours in the evening. The course of thunderstorms may form therefore a curve, with 2 maxima and 2 minima, similar to the barometrical and positive electrical curves, but in opposite direction, and representing perhaps the curve of negative electricity of the atmosphere.

Notice of remains of the Horse in the Altered Drift of Kansas. By. Prof. G. C. Swallow.

Columbia, Mo., March 10, 1866.

Dr. Shumard—My Dear Sir: The following facts are of sufficient importance to find a place in the proceedings of the Academy. These remains are especially interesting in connection with the announcement of Francis S. Holmes, of Charleston, S. C., made in 1858, of the remains of the Horse and other animals from the Post-pliocene of South Carolina, and of Prof. Emmons of the discovery of similar remains in deposits of the same age in North Carolina. I have seen and carefully examined and compared a portion of the lower jaw containing two molar teeth, which differ in no respect, so far as I can determine, from the living species of the horse. Other portions of the skeleton were obtained, but I have not been able to see them. These interesting fossils were obtained by the Hon. E. C. Manning, at Marysville, Kansas, while sinking a well, forty-five feet below the surface, in beds of stratified sand which lie beneath the Bluff formation and above the Drift. These sand deposits, containing small pebbles, are found extending over large areas in Missouri, Kansas, Nebraska, and Iowa, and are called *Altered Drift* in the geological reports of Missouri and Kansas. I have observed these beds of sand in hundreds of places in the States mentioned above, and I feel very certain there can be no doubt of the geological position of these fossils in the sands between the Bluff and the Drift.

I did not see the locality, but Mr. Manning's descriptions of the strata passed through were so distinct and definite that I am satisfied there can be no mistake in the matter.

METEOROLOGICAL TABLE FOR 1865—ST. LOUIS, MO.—By Dr. G. Engelmann.

MONTHS.	BAROMETER. (Reduced to Freezing Point.) Mean of the observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.	THERMOMETER. (Fahrenheit.) Mean of the observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.	Evaporation.*	Force of Vapor.	Relative Humidity.	Quantity of Rain and melted Snow in inches.	Prevailing Winds.	Proportion of Cloudiness.	No. of Thunderstorms.
Jan.	**29.652**	30.035	29.236	0.799	**27 5**	**47.5**	–1.5	49.0	2.2	**0.112**	75.5	0.87	S.E., then N.W.	5.3	0
Feb.	29.565	30.022	**28.769**	**1 253**	37.3	60.5	16.0	44.5	3.1	0.159	72 4	3.75	W. & N.E., S.E. & N.W. & E.	**6 0**	1
Mar.	29.494	29.905	28.928	0.977	45.5	71.5	10.5	61.0	5.1	0.186	62.1	**8.61**	S.E., then N.W.	4.6	3
April	29.553	30.091	29.112	0.979	54.9	82.5	30.0	52.5	5.7	0.270	64.0	3.31	S.E., then N.W. and S.	4.9	4
May	**29.446**	29.737	29.131	0.606	66.8	88.0	41.5	46.5	**7.7**	0.401	62.2	5.66	S.E. and N.W.	3.8	6
June	29.497	**29.684**	29.274	**0.410**	**77.5**	95.5	55.0	40.0	7.4	0.637	68.9	5.21	S.E.	4.6	5
July	29.532	29.765	29.161	0.604	75.4	**97.0**	**56.0**	41.0	6.3	0.628	72 2	7.94	S.W., then N.W.	4.7	11
Aug.	29.571	29.755	**29 277**	0.478	75.9	92.5	55.0	**37.5**	6.3	0 639	72 6	1.96	N.E., then S.E. & S.W.	3.2	5
Sept.	29.547	29.770	29.141	0.629	75.5	93.5	51.0	42.5	4.6	**0.697**	**80.1**	2.60	S.E.	4.9	5
Oct.	29.546	29.938	29.215	0.723	57.3	79.5	30.0	49.5	4.6	0.339	73.3	3.33	S.E., next N.W.	3.9	0
Nov.	29.628	29.977	29.098	0.879	47.1	70.0	25.0	45.0	5.6	0.195	**60.4**	**0.00**	N.W. and S.E.	**2.9**	0
Dec.	29.604	**30.268**	28.906	**1.362**	30.4	62.5	**–2 0**	**64.5**	**2 0**	0.135	79.6	3.63	S.E.	5.3	0
1865.	29.553	30.268	28,769	1.499	55.9	97.0	–2.0	99.0	5.0	0.366	70.3	46.87	S.E., next N.W.	4.5	40

* Mean difference of dry and wet bulb Thermometers.

The Variations in the Stage of the Mississippi River at St. Louis.

By George Engelmann, M.D.

The desire expressed in our Transactions (Vol. I., p. 667, note) to have official observations made on the daily changes of the stage of the Mississippi river at this point was realized soon afterwards. From January 7, 1861, the efficient city engineer, T. J. Homer, Esq., has been making these observations, and publishes them in the daily city papers. With these measurements, now carried on during five years, I have incorporated guage results obtained during 24 months (from May, 1843, to May, 1845) at the St. Louis Arsenal, just below the city, by Capt. T. J. Cram, Top. Eng., which I find in the highly valuable "Report on the Physics and Hydraulics of the Mississippi River, by Capt. Humphreys and Lieut. Abbot." Philadelphia, 1861, Appendix B., p. 24. As these observations embrace the year of our great flood, 1844, they are of particular importance to us. Including these, we have now tables comprising a period of seven years from which to draw general conclusions.

The 1st diagram on Plate XII. gives a general view of the stage of the river from January, 1861, to December, 1864; as it was engraved a year ago, it does not include the year 1865, which, as the tables below will show, varied considerably from the four preceding ones.

On the diagram, the level of the so called City Directrix—the top of the curbstone at the intersection of Market street and the Levee—is marked 33 feet $9\frac{3}{4}$ inches, or 33.8 ft. above the low water mark established December 21, 1863; to this low water mark all the observations made before that date have been reduced, Above the line of the City Directrix, the diagram exhibits the highest point reached by the flood of 1844, on June 27.

The curve above the shaded line of the stage of the river indicates the quantity of rain which fell in every month during those four years. Comparing both lines, it becomes evident that the quantity of rain *at St. Louis* has very little to do with the stage of the river there, as very little correspondence between them can be recognized. The quantity of rain in the upper countries, drained by the affluents of the Missisippi, on which the stage of the river here and below must depend, does not therefore correspond with that falling here; or, rather, some of the rains must extend over a large district of country, while others, especially those of the latter part of summer and autumn, are more local, not materially affecting the height of water here.

The diagram very graphically exhibits the great elevation the river attains between March and July, and its low stage between August and February. In the first two years of the series this is quite striking, while the last two, 1863 and 1864, showed an unusually low stage throughout; but, of course, always lower in fall and winter than in spring and summer.

The long accepted notion that the melting snows of the Rocky Mountains and the elevated plains at their eastern base were the principal cause of the great annual rise in our river, which has been thought to occur generally in June and was therefore popularly known as the "June rise," is undoubtedly erroneous; for the rise commences and often attains its flood height before the snow water could reach here; in 1863 in March, in 1862 in April; the highest rises however, those above 30 feet, have mostly occurred in June, if we except the rise of April, 1862, and that of April, 1785. Moreover, this snow water in many years amounts to very little; it may, and no doubt does, swell the upper affluents of the Missouri, but can have a very secondary effect on the great Mississippi itself, as is also proved by the ordinary fallacy of the predictions of high or low water, based upon the quantities of winter snows in the Rocky Mountains.

The spring and summer rains, which extend over the great plains of the Mississippi valley, are undoubtedly the main source of the rise of the river at that period of the year. The variations of the stage of the river in 1865 present a good illustration of this, as both floods, that of March to May, and the second greater one of July and August, correspond with the heavy and *extensive* rains of those months, especially of March and July. But I repeat that, as a general thing, the rains falling at St. Louis give by no means a sure indication of their volume and extent throughout the upper countries.

The year 1844 was the year of our great flood, and in it the "June rise" was not to be mistaken. The river reached a height of 20 feet not before April 26, and continued above that stage till August 10, 3½ months; on May 14 it reached 25 feet, and continued at or above that until August 5, over 2½ months; over a month, from June 13 to July 17, it was higher than 30 feet; for 16 days, from June 20 to July 6, it ranged above 35 feet, and for 8 full days, June 24 to July 1, it maintained itself above 40 feet. Accounts of the extent of that flood and the damage done by it may be read in the daily papers of the time; but they ought to be more permanently preserved.

Mean Stage of the Mississippi River at St. Louis above the Low water mark of December, 1863, in every month from May, 1843, to April, 1845, and from January, 1861, to December, 1865.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.
1843					23.8	23.3	18.3	12.1	7.4	8.4	5.3	3.5	
1844	5.6	8.3	17.8	17 9	28.6	33.2	31.6	19.0	13.2	10.0	8.6	7.7	16.8
1845	9.1	10.4	14.5	15.3									
1861	2 8	7.0	15 9	19.7	20.8	17.8	17.6	9.6	8.3	10.7	7.1	6.6	12.0
1862	6 6	7.7	12.3	26 9	24.3	19.6	19.2	13.5	10.5	11.4	8.4	7 6	14.0
1863	11.9	12.7	15 2	14.1	12.4	11.1	8.7	7.3	5.9	3.7	4.7	2.2	9.2
1864	5.4	7.7	9.2	12.8	14.8	10.7	10.3	5.7	3.3	2.9	3.9	5.0	7.7
1865	2.4	5.8	15.6	19.8	16.7	14.5	19.4	20.6	13.4	11 0	10.8	8.2	13.2
Mean	6.2	8.5	14.4	18.1	20.3	18.6	17.9	12.5	8.9	8.3	7.0	5.9	12.2

Highest and Lowest Stage of the Mississippi River at St. Louis above the Low water mark of December, 1863, in every month from May, 1843, to April, 1845, and from January, 1861, to December, 1865.

YEAR.	JANU'Y.		FEBR'Y.		MARCH.		APRIL.		MAY.		JUNE.	
	min.	*max.*	*min.*	*max.*	*min.*	*max.*	*min.*	*max.*	*min.*	*max.*	*min.*	*max.*
1843......									20.4	27.3	20.5	25.1
1844......	3.5	6.7	5.2	9.7	10.5	20.0	15.7	26.5	24.5	33.0	30.1	41.4
1845......	7.7	11.7	9.2	13.7	13.3	15.3	12.7	19.3				
1861......	1.6	3.6	1.9	13.8	14.7	18.2	16.6	22.0	17.6	25.5	16.5	20.0
1862.....	3.5	11.9	6.4	11.4	6.6	18.5	18.0	31.4	21.0	30.1	18.4	20.9
1863.....	9.4	15.2	7.5	16.6	11.8	18.0	12.0	16.4	9.1	14.4	8.8	14.8
1864.....	1.2	7.0	5.1	9.8	6.2	11.1	8.1	19.4	9.7	20.4	8.9	11.8
1865.....	1.5	3.2	1.1	15.4	10.0	23.4	16.7	25.1	12.2	20.0	11.3	18.7
7 years...	1.2	15.2	1.1	16.6	6.2	23.4	8.1	31.4	9.1	33.0	8.8	41.4

	JULY.		AUG.		SEPT.		OCT.		NOV.		DEC.		Whole y'r.	
	min.	*max.*	*min.*	*max.*	*min.*	*max.*	*min.*	*max.*	*min*	*max.*	*min*	*max.*	*min*	*max.*
1843	14.9	21.0	8.9	14.6	6.4	9.1	6.6	11.0	4.3	6.8	2 6	5.0	2.6	27.3
1844	25.1	39.3	14.7	26.7	11.1	14.7	8.7	11.1	7.9	9.1	7.3	8.3	3.5	41.4
1861	12.6	23.9	7.8	14.5	7.0	11.0	7.6	14.3	6.4	8.3	4.1	9.8	1.6	25.5
1862	16.4	20.6	11.4	16.1	9.8	11.2	10.7	12.4	7.6	10.1	4.7	14.7	3.5	31.4
1863	6.6	11.9	6.6	11.9	4.3	6.8	3.6	4.2	4.0	5.3	0.0	4.2	0.0	18.0
1864	7.6	12.5	3.8	7.3	3.0	3.9	2.3	3.3	2.3	6.8	2.8	6.7	1.2	20.4
1865	16.0	26.8	15.1	25.8	11.1	17.1	9.2	14.1	8.2	13.5	5.1	10 2	1.1	26.8
7 y'rs	6.6	39.3	3.8	26.7	3.0	17.1	2.3	14.3	2.3	13.5	0.0	14.7	0.0	41.4

The mean results of these seven years' observations show the average height of the Mississippi at St. Louis to be twelve feet; in the six months from September to February it ranges below, and in the five months from March to July above that mean elevation, and in August it is about equal to it. The mean lowest stage takes place in December, and is not quite six feet high; its greatest average volume of water is reached in May, with more than twenty feet. The mean annual stage in these seven years ranged from 7.7 feet in 1864 to 16.8 feet in 1844, and the mean monthly stage from 2.2 feet in December, 1863, to 33.2 feet in June, 1844.

It was thought best to add a second table, giving the extremes of every month and every year in those seven years, as the extremes are of more practical importance for the boatmen, as well as the inhabitants of the banks, than the means. The table shows that from September to February the river has never been higher than 17 feet, from March to July never lower than 6 feet, and in April, May, and June never lower than 8 feet above low water mark. The lowest stage, zero, was observed on December 21, 1863, and the highest, 41.4 feet, on July 27, 1844.

In the subjoined table are given all the high water guages and the dates of their occurrence which I could find. They are partly taken from the above mentioned work of Humphreys and Abbott, partly from Mr. Homer's tables, and those between the years 1838 and 1858 have been observed by myself or by Mr. A. Kayser, when City Engineer. They have all been reduced to the standard adopted at present, the low water mark of December, 1863.

High water	1785, April, ab't	42.0 ft.	High water	1852, May 20,	28.0 ft.
" "	1828, March, (?)	36.3 "	" "	1853, May 7,	30.0 "
" "	1838, May 8,	27.0 "	" "	1854, June 29,	
" "	1839, May 28,	27.5 "	" "	1856, May 9,	27.5 "
" "	1843, May 2,	27.3 "	" "	1858, June 14,	37.0 "
" "	1844, June 27,	41.4 "	" "	1861, May 15,	25.4 "
" "	1845, June 27,	32.5 "	" "	1862, April 26,	31.4 "
" "	1846, May 10,	25.0 "	" "	1863, March 4,	18.0 "
" "	1849, March 10,	27.5 "	" "	1364, May 14,	24.4 "
" "	1851, June 10,	37.0 "	" "	1865, July 28,	26.8 "

In this list, embracing twenty years, the highest rise took place in March three times, in April twice, in May nine times, in June five times, and once (last year) in July; but all the greater floods, with the exception of that of 1785, took place in June.

One word more about the rain curve on the diagram. This curve was, in all those four years, much less regular than it usually is with us. While, commonly, the greatest quantity of rain descends in May and June, the rains of those months in all those four years, and especially in the last three, were unusually light, and sometimes even the lightest of all the twelve months of the year. The meteorological table for the year 1865 (p. 419) shows that we have returned to a period of greater regularity and heavier summer rains.

A Revision of the North American Species of the Genus Juncus, *with a Description of new or imperfectly known Species.* By George Engelmann, M.D.

The difficulty I found in arranging the species of *Juncus* of my own herbarium, the doubts in which the authors left me by incomplete and unsatisfactory descriptions and by confusion in the names and synonyms, the want of confidence which all my correspondents, even such as had paid a good deal of close attention to it, seemed to place in themselves and their own judgment when this genus was under discussion—all this induced me to enter upon a critical study of our *Junci*. I was greatly aided by the most liberal contribution of specimens and of observations from all sides; among those to whom I am thus indebted I mention Prof. Asa Gray, of Cambridge, and Messrs. E. Durand, C. E. Smith, and Prof. Leidy, of Philadelphia, who sent me their own and the herbaria of the institutions under their care; Dr. J. W. Robbins, of Massachusetts; Rev. O. Brunet, of Quebec; Dr. H. P. Sartwell, of New York; Prof. T. C. Porter, of Pennsylvania; Mr. M. S. Bebb, of Washington; Rev. M. A. Curtis, of North Carolina; Mr. W. H. Ravenel, of South Carolina; Dr. A. W. Chapman, of Florida; Mr. E. Hall, of Illinois; and last, but not least, Prof. W. H. Brewer, of the Calafornia State Survey, and my indefatigable and ever obliging friend, Mr. H. N. Bolander, of San Francisco. In Europe I was greatly assisted by Prof. Caspary, of Kœnigsberg, who compared E. Meyer's herbarium, and by Prof. A. Braun and Dr. Garcke, of Berlin, who examined Willdenow's and Kunth's herbaria for me. My very particular thanks are due to all of them. Michaux's and Lamarck's plants have, thus far, been inaccessible to me, and thus some questions of synonymy must remain unsettled for the present.

A very conscientious examination of over a thousand specimens from all parts of the country, with careful dissections of their flowers and fruits, and drawing of these details, has enabled me, I believe, to place the proper value on the characters derived from the different organs of these plants, and to arrive at definite conclusions in regard to their species and varieties and their affinities among themselves.

These investigations, to be sure, were all made "in the closet" since the end of last summer, but I trust that they are not the less reliable, and that those who have the opportunity will follow them up in the field, and will enable me not only to improve upon this paper, but also to publish, with their aid — which some have already promised me — an *Herbarium Juncorum Boreali-Americanorum normale*, which will stand in place of expensive plates, and will, it is believed, be far preferable to them.

Arrangement.—The numerous species of the Genus *Juncus** have been divided into sections according to characters taken from their organs of vegetation, their stems and leaves and also their inflorescence, more than from the differences found in their flowers or fruits. In these most essential parts all the species show a remarkable uniformity, which will only permit us to make use of them to characterize minor divisions, and for specific diagnosis. Desvaux (Journ. Bot., Vol. I., Paris, 1808) had already separated our *Juncus repens*, on account of a peculiarity in the dehiscence of the capsule, and some alpine species, because of their long-tailed seeds, as two distinct genera, *Cephaloxys* and *Marsippospermum*. But we know now that other species of far different alliance form a transition from the ordinary loculicidal to the septifragal dehiscence, and that species of all forms and sections, and otherwise very dissimilar among themselves, have tailed seeds, and that others exhibit all the transitions from the tailed and loosely tunicated to the merely pointed and closely coated seed. From the following it will appear that these genera cannot stand even as sections.

Vegetative Organs.—The different forms of the rootstalks, and of the stems and leaves of these plants, are so well known that I need not here dwell upon them; by their differences the principal types of *Junci* are best characterized; those that produce no leaves or leaves equal to the stem itself, those that have channelled or flattened leaves, and those that bear knotted leaves. But I must say that we have forms that seem to bridge over these apparently well marked distinctions, and which again prove that nature knows nothing of our systematic subtleties, and that our systems are only an imperfect aid for our limited comprehension. To give an example —no section of *Juncus* seemed to be better characterized and more natural than that of the true *Junci* with naked stems and so-called lateral inflorescence. To this section we are bound to refer *J. Drummondi* and J. *Hallii*, while *J. biglumis*, which can scarcely be separated from them, is, in all our systematic works, far removed from them. Again, *J. Vaseyi* comes so close to *J. Hallii* that we would hesitate whether to class it with this or with the similar looking but flat-leaved *J. tenuis*, if *J. Greenii* did not unite it more directly with the latter one.

The form of leaves is not quite constant. While those of the articulate *Junci* are usually described as terete or compressed-terete, the observations of our southern botanists prove

* Steudel, in his Plantæ Glumaceæ, 1855, enumerates 196 species, many of them, however, undoubtedly nominal ones.

that in some species, at least, soil and moisture have a most important influence on them, as they also have on the development of the inflorescence; the overgrown forms of *J. scirpoides*, as I understand that species, have large, laterally compressed, gladiate leaves, while in the forms grown on drier and poorer soil the leaves become almost or entirely terete. On the other hand, the peculiar tribe of articulate *Junci* of the Pacific slope, which I have called *Ensifolii* from their characteristic sword-shaped leaves, exhibits, in alpine situations, such narrow leaves that they might inadvertently be mistaken for terete ones.

Inflorescence.—The inflorescence offers us important but, to a surprisingly great extent, variable characters. All *Junci* have, as is well known, a terminal inflorescence, even where it is seemingly lateral. In the Californian sub-genus *Juncellus*, and in a few South American and antarctic species which form the sub-genus *Rostkovia* (gen. *Rostkovia*, Hook. f., *Rostkovia*, Desv., and *Marsippospermum*, Desv., in part), a single flower terminates the stem or scape; but all the true *Junci* have a more or less compound inflorescence of single flowers or of flowers crowded into larger or smaller heads.

In the inflorescence we observe numerous bracts, usually of a membranaceous texture; the uppermost bracts bear in their axils the flowers, which are always lateral, though in the species with single flowers they appear terminal. In these the lower of the two highest bracts, which are always found at the base of the flower and which were therefore termed "calyx" by Rostkovius, bears the flower in its axil, the upper one remaining sterile; but the trace of an axillary product, an abortive flower or a leaf-bud, ought occasionally to be found, as is regularly the case in *J. pelocarpus*. In the single flowered forms of this species the uppermost bract usually bears an abortive bud, or this bud grows out into a leafy branch, or it becomes a second flower; and then a third bract is formed, often again with a leaf-bud, but never, so far as I know, with a third flower. Thus we have the complete transition from the single flowered to the species in which the flowers are grouped into heads. In these each bract bears in its axil a flower in centripetal succession, the uppermost minute bracts remaining sterile in the center of the head.

The single flowered *Junci* bear panicles, or, as E. Meyer and many botanists after him called them, *anthelæ*, of different form and development. In some species (*e. g.* in the common forms of *J. tenuis* and *J. dichotomus*) the panicle has often the shape of an almost regularly dichotomous cyme, or at least the main branches are dichotomously divided; in most other species this regularity is considerably obscured by the development of many elongated branches from a short axis, which often almost seem to constitute an umbel, but which are mostly of very different length, the lowest ones being by far the longest. These rays or branches often repeat the development of the main axis several times, or are regularly dichotomously divided, or they assume the appearance of one-sided spikes with lateral inflorescence, somewhat after the fashion of the *Borragineæ*. A remarkable example of this is furnished by *J. tenuis*, var. *secundus*, which form also proves that this uni-lateral development of the inflorescence can by no means constitute specific distinction, as a series of intermediate forms are not wanting. We observe a similar condition in *J. Balticus* and the var. *Pacificus;* the eastern form has the ordinary panicle, while that of the Pacific coast bears on the branches uni-lateral flowers.

In many others, and especially in all those that have knotted leaves, the flowers are arranged in heads. These heads consist of few, or are (often in *J. pelocarpus*) reduced to single, flowers, or they bear a great many, and the different forms of the same species often vary immensely in this respect. Thus we find from 2 or 3 to 50 flowers in each head of the different forms of *J. pallescens*, 6 or 9 to 100 in the forms of *J. nodosus*, and 2 or 3 to 80 or 90 in *J. Canadensis*. These heads are single, or composed of several heads crowded together, when they appear lobed. I have seen the axis of the heads abnormally elongated, thus changing them into spikes 9–12 lines in length in three different species, all found in the southern States. In all of them the lower flowers seem to remain sterile, and only the uppermost ones bear fruit; or, after the earliest flowers have performed their functions, the axis, perhaps in a wet season, continues to grow and produces a second crop of flowers. *J. cylindricus*, Curtis, is such a spicate form of *J. marginatus;* I have also seen it in *J. pallescens*, var. *fraternus*, and most beautifully developed in *J. Canadensis*, var. *longicaudatus*. In this last specimen numerous rays form a rather compact almost level-topped umbel, and each ray bears a head of 3 to 5 or 6 sessile, diverging spikes. The heads are either single, terminating the stem like the head of an *Allium*, or they form a more or less compound inflorescence similar to that of the single flowers.

Flowers.—The flowers of these plants consist normally of 5 circles, each of 3 component parts; 3 outer and 3 inner perigonial leaves, which we call, on account of their herbaceous texture, sepals; 3 outer and 3 inner stamens and 3 carpellary leaves; each of the circles alternating with the next one, so that the 6 stamens stand before the 6 sepals, and the 3 carpels before the 3 outer sepals; but the 3 stigmas, as well as the valves of the capsule, before the 3 inner sepals. The third circle, consisting of the 3 inner stamens, is sometimes wanting. Only in one instance, in the only species of the sub-genus *Juncellus*, I find each circle consisting of two parts only, a curious and rare arrangement in a monocotyledonous plant.

In place of flowers we find, in some species with articulate leaves, leafy buds or shoots as the result of retrograde metamorphosis, or as the morbid product of the oviposition of the *Livia Juncorum* or some allied insect. They are most common in *J. pelocarpus*, which, from this peculiarity, has been named *viviparus* and *abortivus;* in *J. pallescens*, var. *fraternus*, which therefore got the name *J. paradoxus*, and in *J. nodosus genuinus.*

Sepals.—The always persistent sepals furnish important characteristics. The exterior and interior ones are sometimes similar but more frequently dissimilar; the former usually carinate or naviculate, more herbaceous, more strongly ribbed and sharper pointed; the latter more delicate, with a wider membranaceous margin, flat or slightly concave but not naviculate, and more frequently obtuse or only mucronate, but more variable in their outline than the exterior ones. Both sets of sepals are either equal in length or one exceeds the other, but neither their proportion nor the form of the inner sepals offer perfectly reliable characters in all species; in some they are more constant, while in others they vary considerably. In examining dried, and even living, specimens, the error of mistaking an involute sepal for an acute one must be avoided, an error into which even careful botanists have sometimes fallen. The nerves of the sepals, which are of such diagnostic importance in *Gramineæ* and even *Cyperaceæ*, are of minor value in *Junci*, as they vary considerably in different forms of the same species.

Stamens.—E. Meyer had already paid attention to the number of stamens and their proportion, and in many species valuable characters are derived from them, but they alone cannot constitute specific distinction. They are generally persistent, which permits us to examine them in all stages of development of the flower and fruit; only in *J. Smithii* and in *J. Rœmerianus* the anthers fall away early and the filaments only persist. The number of stamens is normally six, but in many, principally American, species, it is, by suppression of the inner circle, reduced to three; those three stamens stand, therefore, before the outer sepals and at the angles of the ovary or capsule. We have only two species in which their number regularly varies between three and six, *J. Buckleyi* and *J. caudatus;* in them the inner circle of stamens is incompletely present. In many tri-androus species we find occasionally a fourth or fifth stamen, and that often smaller than the rest; but where both circles are regularly developed I have never seen them unequal in size or shape, which we notice so often in other allied families.

The proportion of stamens and sepals, and of anthers and filaments, is often very constant, but in some species they vary very much, as may be seen in *J. scirpoides*, the different forms of which bear stamens of different length and anthers of different size without exhibiting other characters of sufficient specific value.

In a rare form of *J. Rœmerianus* I find both circles of stamens suppressed or rather undeveloped and in a rudimentary state, so that those plants become uni-sexual. Corresponding male plants may perhaps yet be discovered.

Filaments are always present; in some species they are very short, in others elongated, in all dilated at base, and, at least in the hexandrous ones, more or less united. Their base, which in the young flower adheres to the base of the pistil, after fecundation remains attached to the base of the sepals.

The shape of the anthers is of slight importance; they are longer or shorter, linear or oblong, in some species pointed or cuspidate, in most others obtuse or emarginate, more or less sagittate at base, but these characters show little constancy.

Pistil.—The pistil exhibits great differences in its form and furnishes good and generally constant characters. The ovary is obtuse or acute, gradually or abruptly elongated into the style; this organ is often very short but in many species it has the length of the ovary, or even exceeds it; in a few species only it is variable, *e. g.* in *J. scirpoides*, which in this as in most other organs offers a degree of variability scarcely seen in any other species. The stigmas are longer or shorter than the ovary with the style, always (except in *Juncellus*) three in number, very slender and more or less twisted; in *J. acutus* they are short and thick, and in *J. stygius*, as already Linnæus remarks, short and recurved. In just expanding flowers the length of the stamens is often equal to that of the ovary and style together, so that the stigmas only emerge from between the anthers, or they are equal to the ovary alone when the whole style with the stigmas protrudes over the anthers.

Capsule.—The capsule is diagnostically one of the most important organs in *Junci*. It varies from globose to ovate, obovate, prismatic, pyramidal or subulate, terete or angular, retuse, obtuse or acute, mucronate or rostrate; it is shorter or longer than the sepals or equal to them; but all these characters vary within certain limits, in some species more than in others, and only the examination of a large number of specimens can decide about their constancy and value in a given species. The capsule is always three-valved (excepting again *Juncellus*), opening into the cells, the valves bearing on their median line the placentæ either immediately (parietal placentæ and one-celled capsule) or on a fold which extends to the centre and forms the dissepiments (central placentæ and three-celled capsule); shorter dissepiments make semi-trilocular capsules. Very fragile dissepiments, which break off when the capsule opens, leaving the placentæ central and detached (septifragal dehiscence), are found in *J. repens* (therefore generically distinguished by Desvaux), and to some extent also in *J. Parryi*, *J. patens*, and *J. setaceus*. The placentæ of *J. Rœmerianus* are enormously developed into a spongy mass, which fills the greater part of the capsular cavity.

The capsule opens almost always from top to the middle or to the base; only in some of our species with subulate capsules (*J. scirpoides*, *J. nodosus*) the separation of the valves commences in the middle, while at the top they remain united for some time.

Seeds.—The seeds, when perfectly ripe, furnish some of the most interesting and constant characters, but they are so small and their markings so delicate that only a strong glass, or, better, a microscope with a magnifying power of fifty or sixty diameters, will properly exhibit them. It may not be useless to caution botanists not to be deceived by seeds loosely lying about with the specimens, as they very often will be found mixed.

The seeds are ascending or (the elongated ones) more or less erect, with a lower end at the insertion of the funiculus and an upper one at the chalaza, both ends united by the raphe and often by a distinct fold of the testa. The seeds are usually obovate or oblanceolate, thicker at the upper than at the lower end, mostly terete, or, in rare cases (*J. trifidus*), angular, when a few large seeds are pressed upon one another. The ends are sometimes obtuse (*J. bufonius*), but commonly either abruptly or more gradually pointed, apiculate or even fusiform (*J. pallescens*, *nodosus*, *scirpoides*). Very frequently the testa is slightly elongated beyond both ends of the body of the seed and forms a small, membranaceous appendage (*J. effusus*, *tenuis*, *marginatus*); in such seeds the longitudinal fold of the testa, mentioned above, also becomes more distinct. In many, and apparently more in American and in alpine or arctic, species (*J. Drummondii*, *Greenii*, *Canadensis*, etc.) these appendages become more conspicuous, and extend beyond the seed itself as empty, shrivelled, tail-like, white, or, rarely, reddish sacs. Such seeds have been called scobiform; their seed-coat is more loosely adhering and sometimes (*J. stygius*) can be readily removed. This elongation of the testa is of great diagnostic value, but the absolute or proportionate length of the appendages is extremely variable; even in the same capsule I find the lower seeds with shorter tails than the upper ones, and in *J. Canadensis* we see forms with such different length of tail that only the absence of any other diagnostic characters can induce us to consider them as belonging to one and the same species. Much less can generic distinction be based upon this character, as was done by Desvaux, who comprised in his genus *Marsippospermum* all *Junci* with tailed seeds. Even E. Meyer's (in Synopsis Juncorum, 1822, and in Ledebour's Flora Rossica, 1853) separation of the species with tailless seeds as a second section is unnatural, as not only tail-seeded kinds are found in all the great groups, but also species with intermediate seeds exist, which it would be difficult enough to place properly. R. Brown (Prod. Nov. Holl., p. 258) settles the whole question in the following pithy sentence: *Nec secernendæ sunt eæ quæ seminibus gaudent scobiformibus, testa silicit, quæ in pluribus utrinque laxa, in hisce valde elongata.*

The size of the seed varies from 0.1 to 2.0 lines in length, it mostly ranges between 0.2 and 0.3 lines, and rarely reaches 0.4 lines; the tailed seeds are usually larger than the others, averaging from 0.5 to 2.0 lines in length; even without the appendage, *J. trifidus* has the bodies of the seeds of 0.5, *J. castaneus* of 0.5–0.6, and *J. stygius* of 0.7–0.8 line in length.

The delicate markings of the seeds are so various, and in the same species so constant, that it will be useful to dwell a little longer on them. Their surface appears never quite, and rarely nearly, smooth, when magnified fifty or sixty times. We can almost always discover longitudinal ribs, more or less close together, from 8 or 12 to 30 or 40 or more around the seed; as it is difficult to count the ribs all around these small bodies, and as an approximate designation is quite sufficient, only the number visible on one side may be counted. These ribs are very marked, sharply elevated, in *J. marginatus* (*semina costata*), or they are reduced to more delicate lines in *J. Canadensis* and most tail-seeded species (*semina multicostata* and *striato-costata*). These ribs or lines are usually united by very delicate transverse lines (*lineolæ*), when such seeds may be termed *costato-lineolata*, or by fewer, more prominent cross-bars, semina *costato-reticulata*.

When the ribs are fewer and wider apart, and united by transverse ridges so as to form somewhat rectangular meshes, I call the seeds *semina reticulata*. The area of these meshes is sometimes quite smooth (*J. militaris*), or crossed with very few transverse or longitudinal lines (*J. scirpoides*)—*semina areis lævibus reticulata*—or it is distinctly marked by numerous delicate transverse lines, sometimes, also, with one or two perpendicular lines: *semina areis lineolatis reticulata*. In very few instances I find an irregular and indistinct reticulation: *semina irregulariter sub-reticulata*.

A large number of *Junci* exhibit a very delicate but regular transverse reticulation without (in fully ripe seeds) very distinct ribs—*semina lineolata.* In some species the marks are coarser, in others more delicate.

We divide the seeds, then, into *semina reticulata*, *lineolata*, and *costata;* to both the former belong the tailless, to the latter the tailed seeds.

I arrange all the species, the seeds of which I have been able to study, according to their surface markings, in the following table. Our species are in italics, the foreign ones in Roman type:

I. SEMINA RETICULATA, vix seu distincte apiculata.,

1. Semina levissime irregulariter reticulata seu læviuscula, non costata nec lineolata. *Omnes e Juncorum genuinorum sectione.*
   J. Pacificus, compressus, filiformis, Smithii.
2. Semina regulariter reticulata, areis lævibus seu levissime longitudinaliter lineolatis. *Nostrates e Juncorum articulatorum sectione, pauci exotici graminifolii.*
   J. militaris, Elliottii, scirpoides, phæocephalus; J. Tasmanicus,* squarrosus capitatus.
3. Semina regulariter reticulata, areis tenuiter transverse lineolatis. *Omnes ad J. articulatos pertinent.*
   J. pelocarpus, articulatus, alpinus, pallescens, Bolanderi, brachycarpus, nodosus, xiphioides, Mertensianus; J. sylvaticus, atratus, obtusiflorus, rudis, oxycarpus, supinus, Leschenaultii.

II. SEMINA TRANSVERSE LINEOLATA, levissime costata ; vix seu distincte apiculata seu breviter caudata.

1. Semina areis latioribus fere transverse reticulata. *E Juncorum genuinorum et graminifoliorum sectionibus.*
   J. Balticus, setaceus, dichotomus.
2. Semina areis angustissimis transverse lineolata. *E Juncorum genuinorum et graminifoliorum sectionibus et Juncelli species unica.*
   J. effusus, patens, tenuis, Gerardi, bufonius, repens, saginoides; J. glaucus, pauciflorus, bulbosus.

III. SEMINA COSTATA, plus minus caudata.

1. Semina inter costas plerumque pauciores conspicuas lineolata; apiculata seu breviter caudata. *E Juncorum genuinorum et graminifoliorum sectionibus.*
   J. Rœmerianus, acutus, marginatus, longistylis, Buckleyi; J. maritimus.
2. Semina inter costas plures distincte reticulata ; apiculata seu plus minus caudata. *Ex omnibus Juncorum sectionibus.*
   J. arcticus, Drummondii, Hallii, biglumis, Greenii, Canadensis, var. *sub-caudatus.*
3. Semina inter costas numerosissimas tenues seu tenuissimas transverse lineolata seu lævia; caudata. *Ex omnibus Juncorum sectionibus.*
   J. Parryi, Vaseyi, triglumis, castaneus, stygius, trifidus, Canadensis, caudatus, asper; J. Jacquini.

It will be observed that in this arrangement some forms which I consider as belonging to one specific type had to be separated; thus, the Pacific form has been removed from *J. Balticus*, and the sub-caudate variety from *J. Canadensis*, proving that differences in the surface or in the shape of the seed alone are not sufficient to establish specific distinction.

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* The Tasmanian *J. falcatus*, which I consider a distinct sepcies.

What constitutes a species.—The specific character lies not in any single organ of the plant, however essential it may be; only sufficient and corresponding differences in a series of organs can authorize us to recognize specific distinction. But as such discrimination is of course left to individual judgment, different investigators will arrive at different conclusions. Some species, to be sure, vary very little, and will, by every botanist, be recognized as distinct from all others, and as indivisible; such are, e. g., *J. filiformis*, *J. militaris*, *J. stygius*, *J. repens;* but other species exercise the botanists considerably, some forms being held distinct by some, while they are united by others; such are among our species, especially *J. pallescens*, *J. scirpoides*, *J. nodosus*, and *J. Canadensis*, all belonging to the group *Articulati.* I have no doubt that some botanists, especially such as have not the means of comparing the bewildering quantity of transition forms now before me, will find my views in this respect too contracted, but careful investigation in the field will, I trust, bear me out.

After these preliminary remarks I submit a list of our North American *Junci* and their principal varieties, as I understand them, followed by an account of their geographical distribution.

Systematic Arrangement.

GENUS JUNCUS, *Lin.*

Sub-Genus I. JUNCUS.

I. Junci genuini, caule aphyllo basi vaginis aphyllis seu rarius folia ipso cauli similia gerentibus stipato.

A. Glomeruliflori.

Maritimi

1. *J. acutus*, Lin., California, New Jersey. (?)
2. *J. Rœmerianus*, Scheele (J. maritimus, Auct. Am.), New Jersey to Texas.

B. Singuliflori.

a. Pluriflori, panicula plus minus composita.

a. Robustiores, capsulis ovatis seu obovatis.

1. Foliiferi.

Communes.

3. *J. compressus*, H. B. K., California, Mexico.

2. Aphylli.

* Hexandri.

4. *J. Breweri*, n. sp., California.
5. *J. Balticus*, Dethard.
   - *β. littoralis*, coast of New England to the Mississippi.
   - *γ. montanus*, Western deserts and Rocky Mountains.
   - Sub-species *J. Pacificus*, Pacific coast.

** Triandri.

6. *J. procerus*, E. Mey.(?), California.
7. *J. effusus*, Lin., over the whole country.*

β. Graciliores, floribus plerumque paucioribus, sæpe viridulis, sepalis fructiferis sæpe patentibus, capsula subglobosa.

1. Aphylli.

8. *J. patens*, E. Mey., California.
9. *J. filiformis*, Lin., northward.

2. Foliiferi.

10. *J. Smithii*, n. sp., Pennsylvania.
11. *J. setaceus*, Rostk., Virginia to Louisiana.

Communes.

b. Pauciflori, panicula vix usquam composita.

a. Apiculati.

12. *J. arcticus*, Willd., Greenland.
Sub-sp. *J. Sitchensis*, north-western coast.

β. Caudati.

1. Aphylli.

13. *J. Drummondii*, E. Mey., Rocky Mountains and north-westward.

2. Foliiferi.

14. *J. Hallii*, n. sp., Colorado.
15. *J. Parryi*, n. sp., Rocky Mountains, and mountains of California and Oregon.

Arctici.

II. Junci graminifolii, caule nudo seu foliato; foliis planis seu semi-teretibus canaliculatis seu raro sub-teretibus.

A. Macrospermi, alpini, seminibus paucis magnis caudatis, foliis fistulosis.

a. Pauciflori.

16. *J. trifidus*, Lin., north-eastern mountains.
17. *J. biglumis*, Lin., Arctic regions.

b. Capitellati.

18. *J. triglumis*, Lin., Rocky Mountains to Arctic regions.
19. *J. stygius*, Lin., Western New York to Maine and New Brunswick.
20. *J. castaneus*, Smith, Rocky Mountains to Arctic regions.

Alpini.

B. Singuliflori.

a. Simplices, nudicaules, erecti.

a. Caudati.

21. *J. Vaseyi*, n. sp., Lake Michigan to Colorado.
22. *J. Greenii*, Oakes & Tuck., New England.

Tenues.

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* The triandrous *J. Pylæi*, La Harpe, which is entirely unknown to me, seems to belong here or near *J. arcticus*.

β. Apiculati.

23. *J. tenuis*, Willd.
 α. *communis*, all over the country.
 β. *secundus*, Pennsylvania to New England.
 γ. *congestus*, California.
24. *J. dichotomus*, Ell., Dist. Columbia to Louisiana.
25. *J. Gerardi*, Lois., eastern sea and lake coasts, and salines.

b. Ramosi, caulophylli, diffusi.

26. *J. bufonius*, Lin., all over the country.

Tenues.

C. Glomeruliflori.

* Hexandri (No. 30, 3–6-andrus).

27. *J. repens*, Michx., Maryland to Louisiana.
28. *J. falcatus*, E. Mey., Pacific coast.
29. *J. longistylis*, Torr., Rocky Mountains and north-westward.
30. *J. Buckleyi* (J. filipendulus, Buckl.), Texas.

** Triandri.

31. *J. marginatus*, Rostk., Atlantic and central States to Texas.

Graminei.

III. Junci articulati, caule folioso; foliis septis transversis interceptis inde nodoso-articulatis.

A. Articulati veri, foliis teretibus seu leviter (in No. 40 var. forte) tereti-compressis.

a. Apiculati.

1. Sub-singuliflori.

32. *J. pelocarpus*, E. Mey. (J. Conradi, Tuck.), Newfoundland to South Carolina, and along the great Lakes.
 β. *crassicaudex* (J. abortivus, Chap.), Florida.
 γ(?). *subtilis*, Canada.

2. Pauciflori (No. 37, var. δ, ad multifloros accedens).

* Hexandri.

33. *J. articulatus*, Lin., Northern New York & New England.
34. *J. alpinus*, Vill. (J. pelocarpus, Gray), North-western New York to the Rocky Mountains and the Arctic regions.
35. *J. militaris*, Bigel., New England and southward.

** Triandri.

36. *J. Elliottii*, Chapm., N. Carolina to Florida & Alabama.
37. *J. pallescens*, Lam.
 α. *diffusissimus*, Texas.
 β. *debilis* (J. acuminatus, Mx.), middle and southern States east of the Mississippi.
 γ. *robustus*, Mississippi valley from Illinois to Louisiana.
 δ. *fraternus* (J. paradoxus, Mey.), Michigan and Massachusetts to the Rio Grande.

Articulati.

3. Multiflori.

* Triandri.

38. *J. brachycarpus*, n. sp., Mississippi valley and to the Rio Grande.
39. *J. Bolanderi*, n. sp., California.
40. *J. scirpoides*, Lam.
    - *α. macrostemon.*
        - A. *macrostylus*, South Carolina to Texas.
        - B. *brachystylus*, New Jersey to Arkansas and Texas.
    - *β. brachystemon.*
        - A. *echinatus*, Maryland to Florida and Texas.
        - B. *gladiatus*, North Carolina to Arkansas and Texas.

** Hexandri.

41. *J. nodosus*, Lin.
    - *α. genuinus*, Pennsylvania to Canada and to the north-west coast.
    - *β. Texanus*, Texas.
    - *γ. megacephalus*, Western New York, south-westward to Texas and California.

Articulati.

b. Caudati.

* Hexandri (No. 43, 3–6-andrus).

42. *J. asper*, n. sp., New Jersey.
43. *J. caudatus*, Chapm., S. Carolina to Florida & Louisiana.

** Triandri.

44. *J. Canadensis*, Gay.
    - *α. brevicaudatus* (J. acuminatus, Gray).
        - A. *coarctatus*, Pennsylvania, northward and north-westward.
        - B. *patulus*, Pennsylvania to Western New York & Ohio.
    - *β. subcaudatus*, Connecticut to Georgia.
    - *γ. longicaudatus* (J. paradoxus, Gray), Massachusetts southward to Louisiana, and north-westward to Minnesota.

Caudati.

B. Ensifolii, foliis iridaceis compressis equitantibus.

45. *J. Mertensianus*, Bong., Rocky Mountains north-westward to the coast.
46. *J. xiphioides*, E. Mey.
    - *α. auratus*, California.
    - *β. littoralis*, California.
    - *γ. montanus*, Rocky Mountains and eastward into the plains.
    - *δ. macranthus*, Oregon and to the north-west coast.
    - *ε. triandrus* (J. ensifolius, Wick.), California to Unalaschka.
47. *J. oxymeris*, n. sp., California.
48. *J. phæocephalus*, n. sp., California.
49. *J. chlorocephalus*, n. sp., California.

Ensifolii.

Sub-Genus II. JUNCELLUS.

50. *J. saginoides*, n. sp., California.

Juncellus.

Geographical Distribution.

Of the fifty species above enumerated, thirty-three, or two-thirds, are peculiar to our country, and seventeen, or one-third, occur also in other parts of the world. Two of these seventeen (*J. effusus* and *bufonius*) are cosmopolitan species, which are found almost in all countries of our globe; six (*J. arcticus, trifidus, biglumis, triglumis, stygius*, and *castaneus*) are alpine or arctic forms, which also inhabit appropriate localities in the old world; three (*J. acutus, Balticus*, and *Gerardi*) grow principally near salt water, and also occur in Europe, and the former, also, in Africa and South America; three others (*J. filiformis, articulatus*, and *alpinus*) make their home in the northern parts of the northern hemisphere; one (*J. tenuis*) is also found in middle America and western Europe; and two extend southward over our limits, *J. compressus* into Mexico, and *J. procerus*, if our plant is correctly referred, to Chili.

The different forms of *J. Balticus, nodosus*, and *Canadensis*, grow in different regions. The eastern and northern *J. Balticus* is distinct from the form of the interior plains, and very much so from that of the Pacific coast; the Texan form of *J. nodosus* is very different from the northern one, and that of the western States and territories is quite unlike the others; *J. Canadensis* has a northern, an eastern, and a third form, which is more generally distributed.

None of the eight southern species are found anywhere else, and of the nine Pacific species only the two above mentioned extend beyond our territory to other parts of America, adding another proof of the well known fact, that of all our Floras that of the southern and that of the Pacific States are the most peculiar and exclusive ones.

From their geographical distribution our species may be arranged thus:

1. Over the whole country grow *J. effusus, tenuis, bufonius*, and *nodosus*. Of these only the last one does not extend into other Floras.

2. Over the whole country, with the exception of the western Plains and Mountains and the Pacific slope: *J. marginatus* and *pallescens*, both peculiarly North American.

3. Over the whole country with the exception of the great interior valley and the Pacific region: *J. pelocarpus* and *Canadensis*; both only found in North America.

4. In the great interior valley from Michigan to the Rio Grande: *J. brachycarpus*, and, with more extensive limits, one of the forms of *J. nodosus* (the var. *megacephalus*).

5. Northward—*J. filiformis* and the northern varieties of *J. nodosus* and *Canadensis*; north-eastward—*J. articulatus*,

Greenii, and, very locally, *J. Smithii;* north-westward, extending to the Rocky Mountains—*J. alpinus* and *Vaseyi.*

6. Southward, mostly south-eastward and to the Gulf, some of the species extending south-westwardly to Arkansas and Texas—*J. setaceus*, *dichotomus*, *repens*, *Elliottii*, *scirpoides*, *caudatus*, and *asper*, the latter only in the most north-eastern limits of the region; *J. scirpoides* as far north and south-west as any of these species; south-westward, *J. Buckleyi* and a form of *J. nodosus* (the var. *Texanus*).

7. On the Pacific slope, in the low country—*J. compressus*, *Breweri*, *patens*, *arcticus* (var.), *Bolanderi*, and *oxymeris.* The following extend from the coast to the mountains: *J. Mertensianus*, *xiphioides*, and *phæocephalus*, the two former spreading eastward to and beyond the Rocky Mountains.

8. Maritime species, north-east—*J. Balticus*, *Gerardi*, and *militaris*, the two former extending inland along the lakes, the two latter also southward; south-east—*J. Rœmerianus;* Pacific coast—*J. acutus*, *procerus*, *Balticus*, sup-sp., and *falcatus.*

9. Alpine and arctic species; eastern—*J. arcticus*, *trifidus*, and *stygius;* western—*J. Drummondii*, *Hallii*, *Parryi*, *triglumis*, *castaneus*, *longistylis*, *chlorocephalus*, *saginoides;* the two last only on the Californian Alps. *J. biglumis* has been found thus far soley in the highest arctic regions of our continent.

The following table exhibits at a glance the geographical distribution of our species:

	Peculiar to our country.	Common with other countries.	Total.
1. Whole country....................	1	3	4
2. " " except Pacific region	2	..	2
3. " " " " " and Mississippi Valley..........	2	..	2
4. Interior valley....................	1	..	1
5. Northward..........................	3	3	6
6. Southward..........................	8	..	8
7. Pacific Slope......................	7	1	8
8. Maritime species..................	3	4	7
9. Alpine and Arctic species........	6	6	12
Total..........................	33	17	50

Notes on the North American Species of Juncus.

1. J. acutus, Lin., has been found by Prof. Brewer near San Luis Obispo, California, "where it is abundant in a stream in the hills between the town and the landing of the same name, a few miles from the sea, growing in dense tufts."

His specimens were collected in April in full bloom; the stem is nearly four feet high, the panicle six inches long; the flowers, absolutely identical with European specimens, are easily recognized by their broadly margined sepals, the inner ones being deeply emarginate, and by their thick and short subulate stigmas. I have also seen specimens said to have come from the coast of New Jersey; Baldwin collected it on the La Plata in South America, and Chamisso and Gaudichaud brought it from the same regions. *J. macrocarpus*, Nees, from the Cape of Good Hope is the same species.

2. J. Rœmerianus, Scheele, Linnæa, 22, 348; Walp. Ann. 3, 655: rhizomate longe repente; foliis caules (2–3 pedales) robustos rigidos teretes æquantibus; spatha paniculam supradecompositam patulo-effusam longe superante; glomerulis 3–5-floris; sepalis ovato-lanceolatis 5-nerviis exterioribus acutatis, interioribus brevioribus obtusis sæpe mucronatis; antheris six late linearibus filamento ter quaterve longioribus demum deciduis; stylo ovario ovato multo breviore; capsula ovata obtusa mucronulata sepala exteriora æquante placentis tumidis triloculari; seminibus late obovatis obtusis vix apiculatis tenuissime (sub lente) costato lineolatis (*J. maritimus*, auct. Amer.).

Atlantic coast of the United States from New Jersey to Florida and Texas.—Closely allied to the European *J. maritimus*, for which it has always been taken, until Scheele, without discovering its distinctive characters, gave it a new name. It is well marked by an open spreading panicle with slender, flexible branches, deciduous anthers; a very short style, which is not half as long as the obtuse ovary; an obtuse, short, deep brown capsule; remarkably large, spongy placentæ, which fill the greater space of the capsular cavity, and the like of which I have not seen in any other species; and obtuse, tailless seeds, marked with very slight, wavy ribs and slighter cross lines.—*J. maritimus* bears a rigid, fastigiate panicle, persistent anthers, an ovary attenuated into a style of nearly its own length, a greenish, acute capsule which usually exceeds the sepals, placentæ of ordinary size, and seeds with distinct tails and stronger ribs.

The light, brownish flowers are 1.5 lines, and the seeds 0.3 line, long, and nearly 0.2 line thick.

This is the only *Juncus* in which occasionally unisexual specimens occur (Georgia, Le Conte, in Hb. Acad. Philad., and Florida, Chapman, in Hb. A. Gray); these plants, pistillate by abortion of the stamens, have a stricter but fewer flowered panicle, and thus present a very unusual aspect; our southern botanists ought to find out under which conditions this form occurs, and whether any corresponding staminate plants grow with them.

3. J. compressus, H. B. K. nov. gen. 1, 235; Kunth. En. 3, 317: rhizomate repente, caulibus (palmaribus sesquipedalibus) compressis farctis siccis tenuiter striatis; vaginis aphyllis muticis seu sæpius folia culmo simillima breviora gerentibus; spatha paniculam compositam seu decompositam ad ultimos ramos secundifloram æquante seu superante; sepalis lanceolatis, exterioribus acutis seu subulato-acutatis, interioribus paulo brevioribus obtusiusculis stamina six dimida seu tertia parte superantibus; antheris late linearibus filamento brevi multo (quadruplo quintuplo) longioribus; stigmatibus ovarium cum stylo fere æquilongo subæquantibus; capsula ovata acuta (inclusa?) triloculari; seminibus ovatis obtusis vix apiculatis læviusculis.

Salinas valley, in sandy river bottoms, May 1 in flower; Calif. State Survey No. 529, the only locality in our flora known to me. Dr. J. Gregg collected the same species in northern Mexico, smaller forms, eight inches high, with very short spathe, and a stouter one, 12–18 inches high, with longer spathe and larger panicle. The Californian specimens are 10–15 inches high, with a spathe 2–4 inches long; panicle small, rather simple, only the extreme branchlets with one-sided flowers; the reddish streaks on the sepals very pale; the only capsule seen (not ripe) was shorter than the sepals and contained a few large seeds, 0.37 line long and apparently very slightly lineolate.—This plant is evidently closely allied to *J. Balticus;* it bears very similar but paler flowers, with the same stout anthers on very short filaments; but the flattened stem and the frequent occurrence of leaves distinguish it. Among Fendler's Sante Fé plants, however, I find under No. 860, with the legitimate *J. Balticus*, var. *montanus*, small specimens 6–7 inches high, with the darker flowers of the former, but with a slightly compressed stem, and occasionally with a leaf from the vaginæ. Is that a form intermediate between and connecting both species?

4. J. Breweri, n. sp.: rhizomate perpendiculari; caulibus cæspitosis (pedalibus) compressis lævibus farctis; vaginis nervosis muticis; spatha paniculam paucifloram in ultimis ramis secundam longe superante; sepalis subæqualibus ovatis late marginatis abrupte acuminatis; antheris late linearibus filamento brevi multo (quadruplo quintuplo) longioribus; stigmatibus ovarium cum stylo æqui-longo æquantibus exsertis; capsula . . . .

Wet, sandy soil, near Monterey, California, the same unfortunate locality that has so often been confounded by botanical writers with Monterey in Nuevo Leon, Real del Monte in Mexico, and even Montreal in Canada; Calif. State Survey No. 651, in flower in the latter part of May.—The perpendicular rhizoma (if a constant character) and the strongly compressed stem, together with the broad and apruptly acuminate sepals, distinguish it from the smaller forms of *J. Balticus*, the absence of leaves and the form of the sepals from *J. compressus*, with both of which it is closely allied by the form of the stamens, so different from those of any other American or European *Juncus* of this section.—Stems a foot high, four or five inches of which belong to the spathe; inflorescence small, rather compact; flowers 2½ lines long; sepals dark brown, greenish in the middle, membranaceous on margin.—I have named this plant for Prof. Wm. H. Brewer in acknowledgment of his services in the cause of science in California.

5. J. Balticus, Dethard. ap. Willd., is well characterized by its long and large anthers, which it has in common only with the two last mentioned species, and its terete stem and leafless vaginæ. Originally found on the shores of the Baltic, it has been traced to those of north-western Europe and to our north-eastern coasts from Newfoundland to Massachusetts; but here it leaves its seaside home and appears in several swamps in Lancaster county in the interior of Pennsylvania; all along the great lakes it is a common plant, not unexpected, to be sure, as on their shores we meet with many other marine plants, such as *Cakile*, *Lathyrus maritimus*, *Euphorbia polygonifolia*, and others, while they are quite free from saline matter. Is it the ocean-like spray of the waves of these immense bodies of fresh water, is it the ever-varying sand formation of the downs, which invites sea-strand plants, or are they the remnants of an ocean-coast vegetation left from a period when the beds of these lakes were filled by an immense arm of the sea? Be that as it may, our species is not confined by the line of the lakes, but appears again on the upper Mississippi and St. Peters rivers, hence northwestward into the British possessions, and westward to the Mauvaises Terres and to the head waters of the Missouri, and then southward along the Rocky Mountains to Colorado and New Mexico, and farther west to the Cascade Mountains in Oregon. We find it again as a true maritime plant on the Pacific coast from the northern Russian islands to California and in Chili. This Pacific form is so different from the others that some will regard it as a distinct type. The different forms may be thus characterized:

J. Balticus genuinus: caulibus tenuioribus rigidis farctis; paniculæ laxioris ramis dichotomis; floribus minoribus; capsula obtusa mucronata, seminibus grosse lineolatis.

Var. *a. Europæus:* sepalis exterioribus acutioribus longioribus capsulam late ovatam obtusam mucronulatam subæquantibus; antheris minoribus filamento duplo longioribus;

seminibus ovatis obtusis brevissime apiculatis. — Northern Europe.

Var. *β. littoralis:* sepalis ut in Europæo capsulam angustiorem acutius angulatam longius mucronatam æquantibus; antheris majoribus filamento brevissimo quadruplo longioribus; seminibus ut in Europæo.—Atlantic coast to the upper Mississippi.

Var. *γ. montanus:* sepalis fere æquilongis æqualibus seu interioribus obtusioribus; antheris ut in littorali; capsula ovato-pyramidata angulata rostrata; seminibus minoribus angustioribus longius apiculatis.—Western plains and mountains.

Sub-sp. *J. Pacificus:* caulibus crassioribus mollioribus sæpe fistulosis; paniculæ densifloræ ramis secundis; floribus majoribus; sepalis exterioribus acutissimis interiora obtusa paulo superantibus capsulam ovatam acutam mucronatam subæquantibus; antheris majoribus filamento brevissimo quadruplo quintuplo longioribus; seminibus magnis ovatis obtusis breviter seu vix apiculatis tenuissime irregulariter reticulatis seu lævisculis.—*J. Lesueurii*, Bolander in Proc. Ac. Calif. 2, 179; *J. Balticus*, Benth. Pl. Hartw. p. 341; *J. compressus*, E. Mey. Pl. Chamisso in Linn. 3, 368, planta Chilensis.—*J. Hænkei*, E. Mey. Syn. Junc. p. 10, forma borealis pauciflora.

6. J. PROCERUS, E. Mey.? Linn. 3, 367; Kunth En. 3, 322: culmo erecto elato (tripedali) tereti striato farcto basi vaginis atrofuscis obtusis breviter aristatis stipato; spatha paniculam decompositam densifloram multiradiatam corymbiformem longe superante; sepalis æquilongis lanceolatis, exterioribus acutato-subulatis, interioribus obtusis mucronatis capsulam ovatam subacutam trilocularem æquantibus; staminibus 3 sepalis quarto parte brevioribus, antheris linearibus filamento paulo longioribus; seminibus majusculis ovatis.

In brackish marshes, San Francisco, Cal., *H. Bolander.*—In its technical character, especially in the form of the sepals and the capsule, this plant corresponds well with Meyer's Chilian species, but a specimen in the royal herbarium at Berlin, brought from Chili by D'Urville, has much smaller flowers, a more compound, loose-flowered panicle; smaller flowers, and smaller, narrow, long apiculate, finely lineolate seeds, and is in all respects similar to *J. effusus*, with the exception of the inner sepals and the capsule. But unwilling to give a new name to a plant so incompletely known, I provisionally refer this Californian to the Chilian species; I suggest, however, the possibility of the Californian plant being a hybrid between *J. effusus* and *J. Pacificus*, which both occur in its neighborhood; it seems that only very few and imperfect seeds can be found in the otherwise well developed specimens now before me, and that in size and form these seeds, as well as the flowers, anthers and capsules, are intermediate between those of the supposed parents, while the number of stamens is that of *J. effusus.* The panicle is remarkably compact, and consists of 10–15 secondary branches of nearly equal length.

7. J. EFFUSUS, Lin., is found from Maine to the Rio Grande and to the Pacific, but is wanting in some districts. It has *always* three stamens, the small anthers of which are of nearly equal length with the filaments. The most prominent and very constant character consists in the number of stamens and in the obovate or even clavate, upwards almost tricoccous, *retuse* capsule; seeds apiculate and finely lineolate.

8. J. PATENS, E. Mey. Syn. Luzul. p. 28; Rel. Hænk. 1. 141; Kunth. En. 3, 318; *J. compressus*, E. Mey. Syn. Junc, p. 16, non H. B. K. This very distinct species seems not to have fallen under the observation of botanists since about seventy years ago Hænke discovered it near Monterey, Cal., until Mr. Bolander and Prof. Brewer again obtained it near San Francisco and in the Santa Lucia mountains of that State. Meyer's description in Rel. Hænk. l. c. is so complete that very little can be added. I find, however, the densely cespitose, slender, but wiry stems, not compressed but terete, and distinctly striate; they are 15 inches to 2½ and 3 feet high including the spathe, which has a length of 3 or 4 to 8 or 10 inches; their base is enclosed by elongated sheaths, brownish-red below and greenish straw-colored upwards, tipped with a conspicuous awn; the panicle, 1–2 inches long, consists of 3–5 larger branches, with the ultimate branchlets one-sided, spreading, or recurved, whence the specific name. The flowers are not quite as large as those of *J. Balticus*, and much lighter colored; sepals lanceolate, acute, exterior ones subulate at tip, equalling, or slightly exceeding, the inner ones, spreading in fruit; stamens about half the length of the sepals, and anthers nearly equal to the filaments; ovary with the short style about the length of the stigmas. The subglobose, mucronate capsule, a little shorter than the sepals, opens with septifragal dehiscence, the three placentæ with their membranaceous wings, remnants of the dissepiments, remaining in the center. The very numerous seeds are ovate, obtuse, usually oblique, obliquely apiculate, delicately lineolate, 0.22–0.30 lines long.

9. J. FILIFORMIS, Lin., which was formerly often taken for *J. setaceus* by American botanists, extends from Oneida lake in western New York to the White Mountains in New Hampshire, and to Maine, is common in Lower Canada and in the Hudson Bay region, and has also been found from the northern Rocky Mountains to the Cascade Mountains. The

American specimens are in nowise different from the European ones; the seeds are obovate, strongly apiculate, with a very distinct raphe, and are irregularly and rather indistinctly reticulated.

10. J. SMITHII, n. sp.: rhizomate? vaginis? foliis? caulibus bipedalibus teretibus farctis siccis striulatis; paniculæ laxæ subsimplicis pauciflore spatha longissima; sepalis æquilongis, exterioribus acutatis, interioribus obtusis; staminibus 6; capsulæ exsertæ subglobosæ acutæ mucronatæ (fuscatæ) trilocularis dissepimentis tenuissimis fragilibus; seminibus magnis obovato-oblongis obtusis vix apiculatis irregulariter reticulatis.

Pennsylvania, in a sphagnous swamp on Broad Mountain near Pottsvillle, Schuylkill county, where *Mr. Charles E. Smith*, of Philadelphia, for whom this species is named (*J. Smithii*, Kunth, is the English *J. tenuis*), discovered it in June, 1865, with nearly ripe fruit, and where he expects to obtain more complete specimens in the coming season, as it grows in a very accessible, but, thus far, little explored part of Pennsylvania. We will then learn whether I am correct in my surmise that it is a leaf-bearing species, closely allied to *J. setaceus.* The question may even arise, whether our plant is not the true *J. setaceus* of Rostkovius, as he credits it to Pennsylvania, and, so far as I know, the plant we take to be *setaceus* has not lately been found so far north. The figure of Rostkovius is too poor to decide the question, but his description is full enough to point to our *setaceus;* the "three-leaved calyx"—*i. e.*, the three bracts under the flower by which he distinguishes his species from *J. filiformis*—are found in most flowers of both *J. Smithii* and *J. setaceus*, and also in some other species, e. g., *J. tenuis*, but not in *J. filiformis;* the lowest of those three bracts generally bears an abortive bud in its axil, and has, therefore, another morphological value than the two upper ones.—The thin and wiry stems before me are two feet high, eight or nine inches of which belong to the spathe; the flowers are scarcely more than one line long, not much more than half as long as those of *J. setaceus;* the anthers had fallen off and only the six filaments remained; the thick but sharply angled and pointed capsule is light brown and shining; its valves seem to tear away from the dissepiments when it opens. The seeds are few and of large size, 0.4 line long, and irregularly ribbed and reticulated.—The small flower, the form of the sepals, the exsert, angular capsule, and the more elongated and differently marked seeds distinguish it abundantly from the next.

11. J. SETACEUS, Rostk. Mon. Junc. 13, t. 1, f. 2, is a regularly leaf-bearing species, though neither its author nor

most of the later writers make mention of the leaves, while E. Meyer (Syn. Junc. 1822, p. 18) already describes them, and Gray and Chapman are fully acquainted with them. Though its author credits the species to Pennsylvania, it is not now known to grow there; in all the herbaria examined by me I have seen no specimens found north of North Carolina, whence it extends as a common species to Florida and Louisiana.—It is well characterized by its terete leaves; a very long spathe; a compact or, sometimes, spreading, few-flowered panicle; smooth and shining sepals; a globose, scarcely angled, but conspicuously rostrate capsule, the dissepiments of which separate from the valves; and by the sub-globose, obtuse, coarsely lineolate or almost transversely reticulate seeds, with short appendages and distinct raphe, and seldom over 0.3 line long.

12. J. ARCTICUS, Willd. The only American specimens I have seen were brought from Greenland by Dr. Kane; they differ in no respect from the European plant. The seeds are 0.4 line long, obovate, oblique, obtuse, with very short appendages and distinct raphe; 12–16 ribs are visible on one side, with very faint cross lines.

Of the plant which is found on the Russian islands Kodiak and Sitcha, on the north-west coast of America, I have seen too few and too incomplete specimens to form a definite opinion. It seems to me to constitute a sub-species of *J. arcticus*, which might be designated as *Sitchensis*, and which can be distinguished by the much elongated spathe, the larger flowers, nearly equal sepals, turbinate pyriform capsules, with very few and apparently smaller seeds.

13. J. DRUMMONDII, E. Mey. in Ledeb. Flor. Ross. 4, 235: cæspitosus; caulibus (pedalibus sesquipedalibus) teretibus filiformibus; vaginis setaceo-aristatis; spatha paniculam simplicem (subtrifloram) plus minus superante; sepalis lanceolatis acutis vel exterioribus interiora vix superantibus acutatis stamina 6 plus quam duplo excedentibus; antheris linearibus filamento paulo longioribus; stigmatibus ovario gracili prismatico stylo perbrevi coronato brevioribus inclusis; capsula ovato-oblonga triangulari retusa triloculari sepala æquante seu eis breviore; seminibus ovatis striato-reticulatis longe caudatis.—*J. compressus, γ subtriflorus*, E. Mey. Linn. 3, 368, and Rel. Hænk. 1, 141; *J. arcticus*, Hook. Fl. Bor. Am. 2, 189; Gray, Pl. Hall & Harb. in Proc. Ac. Phil. 1863, p. 77.

Var. *β. humilis:* caulibus digitalibus; spatha brevissima 1–2-flora; sepalis obtusiusculis.

On the alpine heights of the Rocky Mountains of Colorado, *Hall & Harb.*, 563; to California, *Hillebrand;* the Cascade Mountains, *Lyall;* and to Unalaschka; the variety on Mount Shasta, Calif., at an altitude of 8,400 feet, *Brewer.*—The soft, compressible stems are 8–17 inches high, and always, as far as I have seen, leafless; and when Meyer (Fl. Ross. l. c.) says that they occasionally bear leaves, he had probably one of the allied leaf-bearing species before him, which are, at first glance, so much like our plant that they have been almost constantly confounded with it. The spathe is ½–1½ inches long and usually exceeds the flowers; in the variety it measures only 2 or 3 lines and is shorter than the flowers, of which the primary one is sessile and the accessory one peduncled, just as we see it in *J. biglumis.* Flowers 3 lines or more long; sepals green on the back, brown on the sides, pale and membranaceous on the margins; outer ones with 5–7 nerves; stamens less than one-half, often only one-third as long as the sepals; capsule deep chestnut-brown and shining; seeds 0.3 line, or including the tails, about 1 line long; appendages as long as, or longer than, the body of the seed, which is delicately striate, with 10 or 12 ribs visible (on one side), and distinctly cross-lined; it is one of the very few species in which we find the appendages as long as, or longer than, the seed itself.

14. J. Hallii, n. sp.: cæspitosus; caulibus (spithameis pedalibus) teretibus filiformibus folia teretia setacea longe superantibus; spatha paniculam subsimplicem paucifloram coarctatam vix seu parum superante; sepalis lanceolatis acutis, exterioribus paulo longioribus stamina 6 bis superantibus; antheris linearibus filamento paulo brevioribus; stigmatibus subsessilibus ovarium ovatum æquantibus inclusis; capsula ovata angulata retusa triloculari vix exserta; seminibus oblongo-linearibus striato-reticulatis longe caudatis.—*J. arcticus,* var. *gracilis?* Gray in Pl. Hall & Harb. l. c. p. 77, ex parte.

Near Lake Ranch, Colorado, *Hall & Harbour,* Rocky Mountain Flora, No. 562; for the former of whom, Mr. E. Hall, of Athens, Menard county, Ill., who discovered this and many other plants in that region, it is named. It seems to be a rare plant, as neither Dr. Parry nor any one else, so far as I know, has obtained it.—Stems very slender, 6–12 inches high; leaves from 2–5 inches long, grooved just above the vaginal part, terete upwards; spathe as long as, or a little longer than, the compact inflorescence, which consists of 2–5 flowers about 2 lines long; capsule deep brown, as long as, or longer than, the acute but not subulate-pointed, chestnut-brown, white-margined sepals; seeds 0.5–0.6 line long, the body of the seed being about 0.3 line long, and the appendages half as long as the body, or often shorter; I notice on one side of the seed about 10 delicate ribs.

15. J. Parryi, n. sp.: cæspitosus; caulibus setaceis humilibus (digitalibus spithameis) folia sulcata sursum teretia superanti-

bus; spatha paniculam simplicissimam (1–3-floram) superante; sepalis lanceolato-subulatis, exterioribus longioribus aristatis stamina 6 ter superantibus; antheris linearibus filamento bis terve longioribus; stigmatibus ovarium lineari-prismaticum in stylum attenuatum vix æquantibus inclusis; capsula prismatica acutata exserta triloculari; seminibus oblongis tenuiter striato-costatis longe caudatis.—*J. arcticus*, var. *gracilis?* Gray in Pl. Parry, p. 34, and in Pl. Hall. & Harb. l. c., ex parte.

On the western and north-western mountains; *Dr. C. C. Parry*, the indefatigable explorer of those mountain regions, who has been so often mentioned in the pages of these Transactions, and for whom I have named this interesting little plant, discovered it in Colorado in 1861 (coll. No. 360); *Messrs. Hall & Harbour* found it in the same region (No. 561), *Dr. Hillebrand* in the Sierra Nevada, and *Dr. Lyall* in the Cascade Mountains; it is generally, as it seems, associated with *J. Drummondii.*—Stems very thin and wiry, 4–8 inches high, leaves one-half to two-thirds as long, deeply grooved for over half their length, terete upwards; spathe usually overtopping the flowers, often 1 inch or more long; flowers mostly two, very rarely three in number, 2½–3½ lines long, larger than those of the two last species, and distinguished by their bristle-pointed exterior sepals, which are greenish, with brown sides and white margin, and strongly nerved. After maturity the placentæ of the slender and very acute brown capsule become detached from the valves and persist in the center. The whole seed is about 1 line, and the body alone about 0.4 line long; longitudinal ribs 10–12 on one side, cross-lines very faint. A Californian specimen before me has somewhat shorter capsules and smaller and thicker seeds, but shows no other difference.

16. J. TRIFIDUS, Linn., apparently a rare plant in North America; thus far found only on the highest mountains in New York, New Hampshire, and Maine, and in Newfoundland and Greenland.—American specimens do not differ from those of Europe. The seeds are few and large, irregularly compressed, very faintly striate, with very short appendages; 0.7–0.8, or even as much as 1.1 lines long, and 0.3 line or more in diameter.

17. J. BIGLUMIS, Linn.: the only American localities known to me are those given by Hooker (Fl. Bor. Am. 2, 192)—"Arctic sea coast and islands, Rocky Mountains north of Smoking River, and Behring's Straits." A specimen from the Arctic sea coast, which I had the opportunity of examining, does not differ in any respect from the Norway and Lapland plant. The body of the seed is ovate-oblong, 0.34–0.42 line, and with the appendages 0.66–0.72 line, long; these are equal to, or shorter than, the diameter of the seed. In a Scotch speci-

men I have seen a regularly tetramerous flower, with 8 sepals, 8 stamens, and a 4-valved capsule. The leaves, which botanists do not seem to agree upon, appear to me fistulous, on the lower half so deeply grooved as almost to present two cavities, and upwards nearly terete or slightly flattened. Its alliance with *J. Parryi* is indeed very close.

18. J. TRIGLUMIS, Linn., on the Arctic coast and in the Rocky Mountains; in Colorado, *Parry*, 395, and *Hall & Harbour*, 557.—The seeds are of the same size as in the last species, but the appendages are much longer, though only in a specimen from Zermatt, Switzerland, I have seen them longer than the body of the seed. The roundish leaves are channelled below and flattened upwards, and really enclose two, or even three, tubular passages.

19. J. STYGIUS, Linn. From North-western New York to Maine, New Brunswick, and Newfoundland. The seeds of this are the largest of any of our species; the body is 0.7–0.8, and the whole seed 1.5 lines long; the seed-coat, extremely loose and easily removed, is scarcely striated. Mention has already been made of the short and recurved stigmas which are peculiar to this species; the filaments are 8 or 10 times as long as the oval anther, and much longer than the pistil; the flowers, in the American specimens examined by me, are 3 lines long, while in one from Norway I find them only 2 lines long. A careful examination of the leaves proves them to be somewhat laterally compressed, with a very shallow groove on their lower part (generally a little on one side), and the interior cavity filled with very loose tissue which divides it into several (3–5) tubes.

20. J. CASTANEUS, Smith; the lower part of the terete, fistulous leaves is so deeply channelled that their base appears equitant, and that in the herbarium the pressed leaves look like the averse and ensiform leaves of *J. xiphioides;* but their back is rounded and not in the least carinate, and the upper part of the leaf is only very superficially grooved. The flowers are usually over 3 lines long, and the stamens, as well as the elongated ovary with the short style, attain the length of the sepals; linear, pointed anthers half as long as the filaments; stigmas exsert; oblong seeds, 0.4–0.5 line, or with the appendages, which considerably exceed the seed in length, 1.6 lines or more, long, the longest of any of our species.—From the Rocky Mountains of Colorado to the north-west coast, and eastward to the Hudson Bay regions and to Newfoundland.

21. J. VASEYI, n. sp.: cæspitosus; caulibus (1–2-pedalibus) tenuibus rigidis striatis basi fusco-vaginatis; foliis elongatis setaceis teretiusculis striatis versus basin sulcatis farctis;

spatha paniculam parvam contractam æquante seu raro superante; sepalis æquilongis lanceolatis, exterioribus apice subulatis, interioribus latioribus mucronatis stamina 6 plus quam duplo superantibus; antheris filamenta æquantibus; stigmatibus ovarium ovatum cum stylo brevi vix æquantibus inclusis; capsula straminea ovata sursum tricocca retusa triloculari sepala æquante seu paulo superante; appendicibus semini ipso lineari costato-lineolato paulo brevioribus.

On the banks of Fox river, near Ringwood, in Northern Illinois, "a few years ago, in an open wood, now plowed over," *Dr. George Vasey*, who paid a good deal of attention to this genus and to the botany of his neighborhood generally, and for whom this species is named; on the Saskatchawan, *Bourgeau;* in the Rocky Mountains, *Drummond;* and, mixed with *J. tenuis*, in Colorado, *E. Hall.*—The wiry stems, 1 or 1¼ to 2 or 2½ feet high, are covered at base with brown sheaths, the innermost of which bear very slender terete leaves, shorter than the stem, and channelled only near the base, so that our plant is thus most closely allied to those of the first section; its inflorescence, however, is decidedly terminal, and connects it with *J. tenuis* and its relatives. The compact panicle is ½–1 inch long, green, or, when fully ripe, of a light brownish straw color; flowers 2 lines long; seeds very slender, body about 0.3, and with the appendages, 0.5–0.7 line long. This species is the western representative of *J. Greenii,* from which it is distinguished by the longer stems, the terete, scarcely channelled leaves, the lighter colored flowers, the shorter capsule, and by the slender seeds with longer appendages.

22. J. Greenii, Oakes & Tuckerm. Sillim. Journ. 45 (1843), p. 37; Steud. Glum. 2, 305; Gray Man. ed. 2, 483; cæspitosus; caulibus (pedalibus sesquipedalibus) rigidis strictis striatis basi parce stramineo-vaginatis; foliis caule brevioribus teretiusculis totis profunde sulcatis; spatha paniculam contractam ad ramos ultimos secundifloram plerumque longe superante; sepalis (stramineo-fuscis) lanceolatis subulatis subæqualibus seu interioribus paulo brevioribus cuspidatis stamina 6 duplo superantibus; antheris filamenta æquantibus; capsula ovato-oblonga retusa sepala excedente (pallide fusca) triloculari; seminibus obovatis costato-lineolatis breviter caudatis.

On the coast of Massachusetts and Rhode Island (to Long Island?) and on the Saco river at the foot of the White Mountains.—Few and pale sheaths at the base of the stem; leaves deeply channelled all their length; panicle contracted, with erect, one-sided branches, 1–1½ inches long; flowers 1.7–1.8 lines in length; seeds 0.25–0.30 line, and with the appendages, 0.37–0.40 line long, appendages about half as long as the diameter of the seed.

23. J. TENUIS, Willd., is one of the most common and best known, but also one of the most variable species, and can always be readily distinguished from all the allied ones by its flat leaves, which only in the narrow-leaved forms are on the margin slightly involute; by the lanceolate, subulate sepals of equal length, which somewhat exceed the ovate, retuse capsule, and principally by the small, mostly oblique, delicately lineolate seeds, with distinct but short, whitish appendages; they are very similar to those of *J. effusus,* and are mostly 0.25–0.28, rarely only 0.20 line long.

Notwitstanding the great variability in the size of the plant (from a few inches to two feet), in the size and development of the one, two, or even three spathes, and in the size and fullness of the inflorescence (1–5 or 6 inches in length), I can distinguish only the following well marked varieties:

Var. β. *secundus*, ramis paniculæ spatham excedentibus erectis incurvis; floribus minoribus secundis.—*J. secundus*, Poir.

Var. γ. *congestus*, ramis paniculæ spatha brevioribus abbreviatis; floribus fere in capitulum congestis; sepalis fusco-striatis; capsula e stramineo fusca.

The legitimate *J. tenuis* is found over the whole country, from the Atlantic to the Pacific, and south into the tropical parts of America, in the West Indies, and in western Europe. —The interesting and quite distinct looking variety with unilateral flowers has usually 4 or 5, but sometimes even 6 or 7, flowers on a single* branch, which is curved inward and not backward, as is the case in *Borragineæ*, the one-sided inflorescence of which bears a great analogy to that of our plant. Most of the specimens of this variety which fell under my observation were obtained in Pennsylvania, and a few in New England; forms approaching it are found in other regions also.—The variety γ, which occurs in California (San Francisco, *Bolander; *Monterey, *Brewer*) and in Colorado, *Hall*, is very striking; its apparent heads, 4–9 lines in diameter and nearly as high, bear flowers a little larger than ordinary, with darker colored sepals. The seeds of both varieties are undistinguishable from those of the common plant.

24. J. DICHOTOMUS, Elliott, Sketch, 1, 406; Chap. Flor. 493; though closely allied to the preceding, is a well marked species, and would not have so often been confounded with it, if the characters, as given by Elliott, had not been overlooked. The terete leaves, which are marked by a shallow groove on their upper side, distinguish it at once, even when

* These branches are only apparently single axes, for in reality they are formed of many short, successive branches.

the subglobose, mucronate, but never retuse, capsule is not yet formed. The seeds are very similar to the smaller ones of *J. tenuis* (0.22–0.23 line long), and have the same oblique white appendages, but they are coarsely lineolate, the meshes being about twice as wide as in the other species; the bulbous base of the stem, indicated by Chapman, is perhaps not always so well marked. Mr. Bebb remarks that about Washington, where it is abundant, the contrast in the color of the mature plants of this and the last species is quite striking; the latter becomes pale throughout, while *J. dichotomus* remains dark green, and the ripe pods assume a mahogany color.—The northern limit of this species seems to be on the Chesapeake bay, whence it extends to Florida.

25. J. Gerardi, Lois. notic. (1810) p. 60, ex Kunth En. 3, 352; Koch syn. Germ. 731, is well distinguished from *J. bulbosus*, Linn., which has never, I believe, been found in America, by the subterete stem, the much larger flowers, which are as long as the capsule; by the large linear anthers and very short filaments, the long style, which is equal to the ovary, and by the larger seeds. These are 0.31–0.33 line long, while those of *J. bulbosus* are only 0.23 line long; both are delicately lineolate.—It is a salt water plant, and is found in brackish marshes from the British possessions to North Carolina, *Curtis*, and Florida, *Ware* (*J. Floridanus*, Raf. in Hb. Durand); inland it has been found by *Judge Clinton* about Salina, Western New York; and near Chicago by *Dr. Vasey*. On the coast of New England it is well known under the name of "black grass," and is cut in large quantities and makes pretty good hay (*Oakes*).

26. J. bufonius, Linn.; this well known weed, found all over the globe, and, perhaps with the exception of *J. saginoides*, the only annual *Juncus* of our Flora, is most variable in its size, the size and disposition of the flowers, the proportion of inner and outer sepals, and the size of the seeds. The seeds are ovate, very obtuse, and commonly very slightly apiculate, and delicately lineolate; 0.15–0.20 line is their usual length; I have rarely seen them 0.22 l. long, and in a Galveston specimen have found them only 0.13 l. long.

Only one marked variety has been distinguished under the name of *fasciculatus*, Koch, or *fasciculiflorus*, Boiss., apparently a southern form, common in our south-eastern States and in the south of Europe; it is also found in the interesting colony of southern plants near the Philadelphia navy-yard; the last three or four internodes of the branches of the inflorescence are so much shortened that the flowers become crowded into false heads, which gives the plant a very peculiar aspect.

27. J. REPENS, Michx. Fl. 1, 191; *Cephaloxys flabellata*, Desv.; Chapm. Flor. 496; a well marked south-eastern species, found from Maryland, *Canby*, to Florida, Alabama, and Louisiana; it is a true *Juncus*, as I have shown above, and evidently, notwithstanding its great difference, nearly allied with the last species. Seeds obovate, somewhat pointed, about 0.2 line long, and delicately lineolate.

28. J. FALCATUS, E. Mey. Synops. Luzul. p. 34; in Rel. Hænk. 1, 144, et in Led. Fl. Ross. 4, 228, exc. syn.; Kunth En. 3, 360: rhizomate ascendente stolonifero; caulibus (digitalibus pedalibus) erectis lævibus compressis unifoliatis seu nudis; foliis gramineis planis adversis plerumque oblique ad latus deflexis inde falcatis; capitulis sub-singulis spatha sæpius brevioribus; floribus (majoribus castaneis) extus scabris pedicellatis; sepalis ovatis, exterioribus acuminatis interiora obtusa subinde mucronulata æquantibus seu eis brevioribus; staminibus 6 dimida sepala superantibus ovarium obtusum cum stylo ei æquilongo æquantibus, antheris late linearibus filamento multo longioribus; stigmatibus elongatis exsertis; capsula obovata obtusa mucronata triloculari; seminibus (ex Hooker) testa producta lineari-oblongis.—*J. Menziesii*, R. Brown in Hook. Fl. Bor. Am. 2, 192.

From the Russian island of Unalaschka, *Chamisso*, to California, *Hænke*, *Eschscholtz*, *Douglas*, *Coulter* 808, *Bolander*, and on the Cascade Mountains, 49 deg., *Lyall*.—A very striking and much controverted plant, as distinct from *J. castaneus* as it is from *J. ensifolius* and *J. Mertensianus*, with all of which different authors have thrown it together; the perfectly flat and adverse (*i. e.* the flat surface facing the stem) leaves, the very broad and seabrous sepals, and the long anthers on short filaments, distinguish it fully from all these.—Eschscholtz's specimens in Hb. Gray are only 1½–3 inches, while those of Lyall are 15 inches high; 6 or 8 inches is their usual size. The leaves are of different lengths, shorter than, or sometimes exceeding, the stem, and are usually laterally bent so that even the stipular appendages of the sheath are unequal. Heads mostly single, sometimes two or three, ½ inch in diameter, composed of from 8 to 18 large (3 lines long) flowers; sepals remarkably broad and rough on the outside, chestnut-brown or (in Coulter's and Lyall's specimens) green, with two lateral brown stripes; this roughness seems to be constant in this species, and in no other have I seen it. Meyer (Rel. Hænk. l. c.) says of the fruit in Chamisso's specimen: *trigono-pyriformis perianthio paulo longior trilocularis; seminum testa laxior albicans sed non scobiformis;* none of the specimens before me have ripe fruit, only one, from the Cascade Mountains, shows a half developed capsule with young seeds, and these are undoubtedly tail pointed and already 0.6 line long; Dr. Hooker (Bot. Antarct. Voy. Fl. Tasm. 2, 64) speaks of the seed of this species as "linear-oblong, striate, with the testa produced beyond either end," and as the Tasmanian plant* has very different seeds, his remark must refer to the Californian species.

Hooker & Arnott, Bot. Beechey, p. 402, distinguish from the original *J. Menziesii*, with obtuse sepals, the variety *Californicus*, with acuminate ones; I have found, in all the specimens, examined by me, the outer sepals acuminate and the inner ones obtuse, with or without a mucro; but in some, as stated before, the outer ones are much shorter than, in others as long as, the inner ones.

29. J. LONGISTYLIS, Torrey in Bot. Mex. Bound. p. 223: caulibus (pedalibus bipedalibus) cæspitosis stoloniferis tereti-usculis sursum sæpius (sub lente) scabriusculis foliatis; foliis planis gramineis; capitulis paucis in paniculam contractam aggregatis seu raro singulis; floribus (majoribus viridulis fusco-striatis) lævibus pedicellatis; sepalis æqualibus ovato-lanceolatis acutatis seu cuspidatis stamina 6 duplo superantibus; antheris filamento sub-duplo longioribus; ovario stamina et stylum æquante, stigmatibus exsertis; capsula ovata obtusa mucronata seu rostrata castanea nitida triloculari calycem æquante seu paulo superante; seminibus oblanceolatis seu obovatis apiculatis costato-reticulatis.—*J. Menziesii*, Gray in Pl. Parry, p. 34, and Pl. Hall & Harb. p. 77, "the var. *Californicus*, Hook & Arn., probably an unpublished species."

Rocky Mountains from New Mexico, *Wright* 1924, *Fendler* 857, to Fort Whipple, Arizona, *Coues & Palmer*† 48, and northward to Colorado, *Parry* 631, *Hall & Harb.* 566, to the Saskatchawan, *Bourgeau*, and towards Oregon, *Lyall.*—Stems cespitose, or, probably in richer soil, stoloniferous, 1–2 feet high; panicle usually 1½–2½ or 3 inches long, consisting of 5–9 heads; heads 3–8 or 12-flowered, sometimes fewer or single, and then 12-15-flowered; flowers 2½–3 lines long;

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* The Tasmanian *J. falcatus*, Hook. f. l. c., of which I find a good specimen with ripe fruit, collected by Gunn, in Hb. Gray, is certainly very similar, but seems to be distinguished by smaller but also scabrous flowers; ovate, retuse capsules of the length of the equal, acutish sepals; and obovate, obtuse, abruptly apiculate reticulate seeds, the areæ of which are *perpendicularly* lineolate; it might be distinguished by the name of *J. Tasmanicus*.

† While this sheet was in the hands of the printer I received a most interesting collection of Arizona Plants, made last year by Drs. Elliott Coues, and Edward Palmer, in which I found good specimens of this species, and also some of *J. compressus*, unfortunately again without fruit; the leaves of this last, however, are finely developed, thus adding another proof for the opinion, that it is really a regularly leaf-bearing species. (Compare p. 440.)

stamens as long as the ovary, so that the style, which is of the same length, protrudes beyond them; seeds 0.25–0.27 line long, oblanceolate and acute, or, in the Fort Whipple specimens, obovate and upwards obtuse; these specimens are also distinguished by the absence of all traces of stolons, and by the slightly roughened surface of the upper part of the stem.—From the closely allied *J. falcatus* our plant is distinguished by the greater size, the paniculate heads, the shape, proportion, and surface of the sepals, and the shape of the seeds.

30. J. LEPTOCAULIS, Torrey & Gray in Herb. Durand: caulibus cæspitosis erectis (spithameis pedalibus) gracilibus compressiusculis fistulosis paucifoliis; foliis planis caule brevioribus; capitulis singulis seu paucis (1–3) spatham fere æquantibus 3–6-floris; bracteis ovatis aristatis flore subpedicellato plerumque brevioribus; sepalis ovato-lanceolatis acuminato-aristatis æqualibus seu exterioribus paulo brevioribus stamina 3–6 et capsulam obovatam tricoccam retusam mucronatam trilocularem quarta parte superantibus; antheris oblongo linearibus filamento bis terve brevioribus; stigmatibus ovarium obovatum cum stylo perbrevi æquantibus inclusis; seminibus obovatis apiculatis costato-lineolatis. — *J. filipendulus*, Buckley in Proc. Acad. Phil. 1862, p. 8.

Arkansas, *Herb. Durand*, Western Texas, *Lindheimer*, *Wright*, *Buckley*.—Whole plant light green; gracile stems 6 or 8 to 12 and 14 inches high, growing in dense tufts from very small but apparently perennial rhizomas; heads single or, rarely, two or three, the secondary ones pedunculate and overtopping the primary one, in fruit 4–5 lines in diameter, consisting of 3–6 or 7 light green flowers; flowers not quite 2½ lines long, remarkable for the elongated sharp points of the inner as well as the outer sepals, and for the irregular number of stamens; stamens sometimes 3, often 4 or 5, rarely 6, some of the inner ones commonly depauperate, with very slender filaments and extremely small anthers; seeds very similar to those of the next species, 0.22 line long, with about 6 strong and dark ribs visible on one side.

I had to change the only published name of this species, *J. filipendulus*, because it is absolutely wrong, the fibrous rootlets bearing no tubers at all; intending to substitute the name of the author and call it *J. Buckleyi* (p. 435), I discovered, from a label in Mr. Durand's herbarium, that Torrey and Gray had already named the species, I therefore adopt their very appropriate designation.

31. J. MARGINATUS, Rostk. Mon. Junc. 38, t. 2, f. 2; a well known species which grows all over the eastern and interior States, and down to Texas as far as woodlands extend, but has not been found in the western plains or mountains. It is

distinguished from all our other species by the purple, or, when dry, red-brown color (already noticed by La Harpe) of its three anthers, which usually exceed the outer sepals in length; it is further characterized by the acute outer sepals being much shorter than the obtuse or, sometimes, mucronate inner ones; by the ovate, obtuse ovary, with the almost sessile, enclosed stigmas of the same length; and the subglobose, obtuse, mucronulate capsule. The seeds are quite variable in size and form, but always strongly pointed or almost caudate and conspicuously ribbed, with few (4 or 5, or, at most, 6) ribs visible, lineolate or, rarely, reticulate; they are commonly slender, obliquely lanceolate or fusiform, but in Lindheimer's Fl. Tex. exsicc. 193, which has been named *J. heteranthos*, they are quite short, ovate obtuse and abruptly apiculate. The length of the seeds varies from 0.22 to 0.33 line, and their thickness from $\frac{1}{4}$ to $\frac{1}{2}$ of their length. —*J. aristulatus*, Michx. 1, 191, and *J. aristatus*, Pers. Syn. 1, 385, are exactly the same; *J. biflorus*, Ell. Sketch, 1, 407,* and *J. heteranthos*, Nutt. Pl. Arkans. in Trans. Am. Phil. Soc. V. 153, are forms of the same with fewer flowers in the head. *J. cylindricus*, Curtis, Sillim. Journ. 44, 83; Steud. Glum. 2, 304, is a form with heads elongated into spikes 6 lines long and 3 lines in diameter, sterile below, only the uppermost flowers bearing fruit; outer sepals almost as long as inner ones.

We may distinguish the following forms:

Var. *α. vulgaris*, 1½–3 feet high, with 5–8-flowered heads in a compound or decompound panicle; the common form.

Var. *β. biflorus*, as tall as the former, with 2–3-flowered heads in a decompound, often very large, panicle; a southern form, from Delaware, *A. Commons*, to Texas.

Var. *γ. paucicapitatus*, 1–1½ feet high, with few (2–6 or 8) larger 8–12-flowered heads; Long Branch, New Jersey, *C. W. Short*, and elsewhere.

32. J. PELOCARPUS, E. Mey. Synops. Luzul. p. 30; La Harpe Monog. 124; Kunth En. 3, 333, non Auct. Amer.: rhizomate horizontali tenui pallido; caulibus (spithameis pedalibus et ultra) gracilibus teretiusculis erectis paucifoliis; foliis teretiusculis indistincte nodulosis; paniculæ decompositæ laxæ ramis plerumque elongatis secundifloris demum recurvis; floribus (parvis) singulis binisve sæpe in gemmam vel ramulum foliosum abortientibus; sepalis oblongis obtusis, exterioribus plerumque brevioribus rarius mucronatis stamina 6 et ovarium acuminatum in stylum breviorem abiens vix superantibus; antheris late linearibus filamento multo (duplo

* The inner sepals, however, are not the shortest, as the usually so careful and reliable Elliott, probably by a lapse of the pen, says, but, as in all the forms of this species, the longest.

quadruplo) longioribus; stigmatibus exsertis; capsula triquetra acuminato-rostrata 1-loculari exserta; seminibus obovatis breviter apiculatis reticulatis, areis lineolatis.—*J. Muhlenbergii*, Spreng. Syst. 2, 106 (1825); *J. viviparus*, Conrad in Journ. Ac. Phil. 6, old ser. part 1, p. 105; *J. Conradi*, Tuckerm. in Torr. Fl. N. Y. 2, 328 (1843); Gray Man. ed. 2, 482; Chapm. Fl. 495; *J. dichotomus* in herb. plur.

Var. β. *crassicaudex*, e rhizomate crasso caulibus foliisque robustioribus.—*J. abortivus*, Chapm. Fl. l. c.

Var. γ? *subtilis*, caule reptante vel fluitante radicante folioso; foliis brevibus setaceis ex axillis proliferis; floribus subbinis 3-andris.—*J. fluitans*, Michx. Fl. 1, 191; *J. subtilis*, E. Mey. Syn. Luz, 31; La Harpe Mon. 135.

From Newfoundland (ex La Harpe) and Canada, *Macrae*, westward to Lake Superior, *Robbins*, and southward, chiefly along the coast, to South Carolina, *Curtis;* var. β. in Florida, *Chapman;* var. γ. in Canada, *Herb. Michaux.*—A very peculiar and, morphologically, very important plant, the synonymy of which has been quite obscure. Meyer's original diagnosis is too short, so that it permits strong doubts about the identity of the plant he had in view, and his unfortunate comparison of his species with *J. lampocarpus* and *J. paradoxus*, "*cujus habitum refert*," necessarily throws botanists on the wrong track. But La Harpe,* who wrote only two years after Meyer's publication, and who seems to have been well acquainted with Meyer and with his species, gives a full description which can leave no doubt, even if Meyer's herbarium did not settle the difficulty. Though originally the species was described from specimens in C. Sprengel's collection, which seem also to have been the originals of his *J. Muhlenbergii* (most probably received from Muhlenberg himself), several specimens, obtained later from different sources (*e. g.* E. Tuckerman and A. Gray) are preserved in Meyer's herbarium with the name of "*J. pelocarpus*" in his own handwriting; and others, named by him, are found in the royal herbarium at Berlin. Now, this plant is so peculiar that no one who has ever examined it can confound it with any other;

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* Jean de La Harpe's "Monographie des vraies Joncées" seems to be little accessible to botanists; it was published, 1825, in the third volume of Mémoires de la Société d' Histoire Naturelle de Paris, p. 89–181, and is a work of careful research, in which I believe I can trace the conscientious investigation and the critical spirit of my old and highly esteemed, now departed, friend, Jacques Gay, of Paris. La Harpe was the first to give full and careful descriptions of these plants and of all their organs, and only after the date of his publication we find in Meyer's papers similar extended accounts in place of the former short diagnoses, *e. g.* in the *Junci* of the *Reliquiæ Hænkeanæ*, published 1827. Not having been able to compare Michaux's original plants, I have with confidence relied on the critical references of La Harpe, especially in regard to species about which doubts had existed, such as *J. fluitans, acuminatus,* and *polycephalus.*

is it, then, at all probable that Meyer himself should have done so in his own herbarium? His original specimens may not have exhibited the foliaceous excrescences, so that he could not mention them in his description of this species, while he did allude to similar ones in his account of his *J. paradoxus;* his diagnosis is so short that he does not even mention the unusually small number of flowers.

The rhizoma is whitish and slender, often almost filiform, and sends out few and distant, or sometimes more crowded, slender and almost terete, not flattened, stems, 4 or 6 to 18 or 20 inches high; leaves slender, almost setaceous, scarcely compressed, and incompletely knotted. The panicle shows very different forms in different specimens; sometimes, probably in the earlier part of the season, it is only 2 or 3 inches long, and moderately spreading, with flowers more crowded; but usually, at least in the numerous herbarium specimens examined by me, and perhaps later in the season, it attains a length of 4 or 6 inches, with about the same diameter, the few slender spreading or recurved branches bearing the distant flowers on one side. The flowers are green, with a reddish tinge, especially on the inner sepals, usually 1.0–1.3 lines long, and generally single; sepals obtuse, sometimes mucronate, or, rarely, the outer ones acutish; these are generally shorter than the inner ones; but in a Lake Superior specimen the flowers are only 0.8 line long, and all the sepals equal, broadly oval and obtuse. Stamens about the length of the outer sepals, anthers always longer than filaments, sometimes scarcely twice as long, in others fully four times their length. Style shorter than the acuminate ovary. The capsule ought not to have been described as Meyer and (copying him) La Harpe did, as *triquetro-ovata mucronata;* it is rather, as Gray has it, taper beaked, and is completely one-celled, the lateral placentæ occupying only the lowest third or fourth part of the commissure of the valves. Seeds 0.25 line long, delicately but distinctly reticulate, areæ transversely lineolate.

I cannot distinguish Dr. Chapman's *J. abortivus* from the northern plant except by the not essential characters given above; the flowers are absolutely identical, and fruit I have not seen.

With some hesitation I add *J. subtilis* as a procumbent or floating variety with short internodes, and short leaves which bear leaf-buds in their axils. In American collections this form does not seem to exist, but La Harpe, who saw it in Michaux's herbarium in Paris, gives a full description of it, from which I have extracted above; the flowers are described exactly like those of *J. pelocarpus*, and there is, notwithstanding the different habit, nothing in it that would specifically distinguish it, except the smaller number of stamens, and the single, two-flowered heads; fruit and seed are unknown. I take it for a depauperate water form of our species, while Hooker, Fl. Bor. Am. 2, 191, unites it with *J. uliginosus*, which with him is what I have taken for *J. alpinus;* but that is also a 6-androus species. The botanists of Canada and of our northern border ought to find it again and clear up these doubts.

I have already (p. 426) spoken of the great morphological importance of this plant, which connects the single-flowered with the head-flowered species, and proves, as certainly might have been expected beforehand, that no absolute difference exists between them; that the flowers in all of them are really lateral; that in the former only one flower is formed, while in the others a series of them, from two to an indefinite number, are developed in centripetal order. In our species a second flower is more commonly not present, and its place is occupied by a bud, which often, and especially later in the season, grows to a leafy excrescence (whence the name *viviparus*); sometimes even the first flower is replaced by a leaf-bud, and in rare instances a leaf-bud makes its appearance between two flowers as a third axillary organ. I have never seen more than two flowers, nor more than one leaf-bud in a head. Botanists who have the opportunity ought to investigate the variations in the inflorescence of this plant according to locality, season, or other circumstances.

33. J. ARTICULATUS, Linn.; that form of the Linnean species which was distinguished by Ehrhart as *J. lampocarpus*, and which is common in northern Europe, has a very limited range in North America. All the specimens I have seen came from the New England States (Boston, *Pickering;* Amherst, *Tuckerman;* and Providence and Nantucket, *Olney*) and from western New York (Penn Yan, *Sartwell*); to these La Harpe adds Newfoundland.—Stems densely cespitose from a creeping root-stalk, with us usually erect and about one foot high; panicle short, dense-flowered, spreading, brown; sepals mostly equal, lanceolate acute and mucronate, or inner ones slightly longer and sometimes obtusish; stamens about two-thirds the length of the sepals, and anthers as long as filaments; ovary acuminate, terminating in a style about half its length; capsule longer than the sepals, acute, or even rostrate, at least in all the American specimens seen by me, and imperfectly three-celled, the placentæ not meeting in the centre. Seeds obovate, obtuse at the upper, acute at the lower, end, and at both strongly apiculate; 0.3 line or a little less long, and about half as much in diameter; reticulate, with areæ finely cross-lineolate; 7 or 8 ribs visible.

34. J. ALPINUS, Villars, Delph. 2, 233 ex Koch Syn. Germ. 730; *J. fusco-ater*, Schreb. ex Kunth En. 3, 326, *J. affinis*,

ERRATA.

Page 304,	line 7	from below,	instead of	"*absolute,*"	read	*obsolete.*
" 425,	" 23	" top,	"	"*root-stalk,*"	"	*root-stock.*
" 458,	" 15	" below,	"	"	"	"
" 432,	" 23	" top,	"	"*rudis,*"	"	*microcephalus.*
" 435,	" 16	" "	"	"*Buckleyi,*"	"	*leptocaulis,* T. & G.
" 483,	" 8	" "	"	"	"	" "

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Stems erect from a creeping rootstock, 10–18 inches high; branches of the meagre panicle, at least in the larger specimens, strictly erect and much elongated, greenish and light brown; sepals oblong, obtuse, outer ones mucronate or cuspidate, equal to, or exceeding, the rounded inner ones; stamens same as in last; ovary ovate, with a very short style; capsule as long as, or a little longer than, the sepals, obtuse, mucronate, incompletely three-celled; seeds very similar to last, but usually more slender, oblanceolate and acute at both ends, rarely obtuse at the upper one, 0.30–0.35 line long.—The alpine form of this plant, the original type of Villars, is found in our Arctic regions, and is only a few inches high, bearing very few almost black heads, and has the slenderest and longest seeds. The ordinary American plant is distinguished from the usual European form by its lower stems, still stricter panicle, and paler flowers and fruit. Fries has sent absolutely the same from Sweden, formerly as *J. sylvaticus*, and as *J. acutiflorus*, and later as *J. alpinus*, var. *insignis*, which name may be retained for it.

35. J. DUBIUS, n. sp.: rhizomate crasso horizontali; caulibus (1½–3-pedalibus) erectis cum foliis tereti-compressis; panicula supradecomposita patula; capitulis pauci-(6–10)floris stramineis; floribus subsessilibus; sepalis lanceolato-subulatis acutissimis æqualibus stamina six fere duplo superantibus; antheris linearibus filamento sublongioribus; capsula lineari-prismatica acutata uniloculari exserta; seminibus obovatis utrumque apiculatis areis lineolatis reticulatis.

Forming large tufts in wet granitic sand in Clark's meadow, near the Big Tree Grove, Mariposa, California, at an altitude of 6,500 feet, *H. Bolander*, fl. & fr. in July; Cal. State Surv., 6032, Hb. norm. 52. With a good deal of hesitation, expressed in the specific name given to this plant, I venture to separate it from the closely allied *J. oxymeris* of the same region. Its rounded and only slightly compressed leaves certainly seem to be very distinct from the flattened equitant leaves of the latter species, but otherwise the whole appearance, the rhizoma, the panicle, the flower, the stamens even, and the fruit, show scarcely any difference; only the seed proves distinct, and as, I believe, we can safely rely on characters derived from the sculpture of this organ, we must consider both as really distinct species. The seeds of *J. oxymeris* show on one side 7–9 ribs and a distinct reticulation, the areæ being smooth, and only the ribs slightly crenulate; *J. dubius* has seeds of the same size (0.22–0.25 line long), but with fewer (5–7) ribs, and larger, strongly lineolate areæ. The panicle of this plant is 3–5 inches long, the flowers slender, and with the capsule nearly 2 lines long.

36. J. MILITARIS, Bigelow, Flor. Bost. ed. 2 (1824), p. 139; Gray Man. ed. 2, p. 482, was "discovered by *B. D. Greene* at Tewksbury," and has since been traced from Maine, *Blake*, to Massachusetts, and southward to the Pocono Mountains in Pennsylvania, *T. Green*, New Jersey, *Asa Gray, C. F. Parker*, Maryland, *A. Commons*, and, if there is no error in the label, as far as Alabama, *Drummond*.—The stout stems, 2–4 feet high, spring from a creeping rootstock, and bear on their lower half a single leaf, ½–3½ feet long, which usually overtops the inflorescence, and is mostly followed by a second very short one, rarely developed beyond the vaginal part. The decompound, rather crowded, and often somewhat contracted light brown panicle is 2–5, usually about 3, inches long; the heads are 5–12 flowered, only in a Maryland specimen I find them 15–25 flowered. Flowers (in the North in August) 1½ lines long; sepals lanceolate, outer ones subulate-pointed or even aristate, mostly very little shorter than the acute inner ones; stamens 6, two-thirds the length of the sepals; linear anthers a little longer than the filaments; stigmas exsert, as long as the ovate acuminate ovary and the distinct style together; capsule sharply triangular, ovate, acuminate, rostrate, equalling or slightly exceeding the sepals, one-celled; seeds obovate, obtuse, unusually thick, and abruptly apiculate, 0.25–0.30 line long, and three-fifths of their length in diameter, neatly reticulate, the areæ marked with few longitudinal lines; 8–10 ribs visible.

Dr. Robbins has discovered a very curious peculiarity of this plant, which abounds in the Blackstone river, near Uxbridge, Massachusetts, and its tributaries, and in the flumes of the manufactories, but only in rapid parts of these streams, and is there not found in sluggish streams or in stagnant water. It seems that about the period of maturing the seeds, at the end of August, the long horizontal rhizoma, which at its end is to bear the flowering stem of next season, begins to shoot forth, and from the axils of its scales produces a number of extremely short or rudimentary branchlets which are again branching and form short knobs on the rootstock. These branchlets bear a number of capillary leaves of the thickness of horsehair, and knotted like the ordinary leaves of this species, at this time, end of August, few in number, and only a few inches long. Towards the close of the season they increase in number and length, and seem to live through the winter wherever they are immersed deep enough to escape the frost. They attain their full development about May and June, when they are 2–3 feet long, and carpet the bottom of those streams, at the depth of 2–4 feet below the surface, with their dark green undulating masses, most beautiful to look at, but quite obnoxious to the proprietors of the mill-streams, the sluices of which they are apt to obstruct. These leaves decay about the period the plant begins to bloom. The beautiful specimens collected by Dr. Robbins for the Herbarium Normale (No. 53) exhibit them to perfection. The twist and bend of the stem of many of Dr. Robbins' flowering specimens is caused by the strong current in which they grew. The only thing approaching such submerged leaves, Mr. Parker has found in the Delaware above Philadelphia, where this plant grows "in shallow water, extending to the border of deep running water, the finest specimens growing at a depth of 3 or 4 feet." How does this species grow in stagnant ponds or swamps? It would be very desirable that collectors of *Junci* should pay more attention to the circumstances under which these plants occur, the process of their vegetation, the time of flowering and of maturity, and, of course, to the base of the stem and to the rootstock, which is too often a vain desideratum in herbarium specimens.

37. J. SUPINIFORMIS, n. sp.: foliis vernalibus e basi latiore subulatis capillaceis longissimis teretibus pallide virentibus natantibus evanescentibus; caule florifero erecto humili (digitali vel ultra) folia erecta teretia longiora gerente; panicula simplici; capitulis sub-5-floris; sepalis ovato-lanceolatis cuspidatis nervosis æqualibus seu externis paulo brevioribus inter se inæqualibus stamina 3 stigmataque paulo excedentibus; antheris oblongis filamento multo brevioribus; stylo per-brevi; capsula prismatica obtusa mucronata uniloculari calycem fere excedente; seminibus obovatis utrumque apiculatis.

Common in and around ponds near Mendocino City, California; May and June, *H. Bolander*, Cal. State Surv. 4767.—Mr. Bolander informs me that in spring these ponds are completely covered with the pale green capillary leaves of this species, 1–2 feet long. As the water recedes with the advancing dry season, the erect flowering stems begin to form, and a little later the vestiges of the decayed vernal leaves cover the remaining mud with grayish spiderweb-like filaments. The flowers are nearly 2 lines long, the (immature) capsule is prismatic with concave sides; the seeds, too imperfect to make out their sculpture, were 0.27–0.30 line long, large for the size of the plant.

This species is closely allied to *J. supinus* of Europe, whence the name, and appears to stand next to its var. *fluitans;* but that species has smaller flowers, with obtuse sepals, an obtuse capsule, and smaller seeds. These characters, however, do not seem to be quite constant, so that further examination of more complete specimens will be necessary.

38. J. Elliottii, Chapman Flor. South. St. 494: caulibus (1–2-pedalibus) cæspitosis erectis folia tenuia longe excedentibus; panicula composita vel decomposita subpatente; capitulis 3–9-floris globulosis; sepalis ovato-lanceolatis acutissimis æqualibus stamina 3 tertia parte superantibus capsulam late ovatam obtusam brevissime mucronulatam 1-locularem atrofuscam lucidam fere æquantibus; antheris linearibus filamento vix longioribus; ovario ovato obtuso stigmatibus subsessilibus subinclusis fere æquilongo; seminibus oblanceolatis fusiformibus utrinque attenuatis rufo-fuscis areis lævibus reticulatis.

From North Carolina, *Canby*, to South Carolina, *Ravenel*, *Beyrich* (distributed under the name *J. acuminatus*), Florida, *Chapman*, Hb. norm. 54, Alabama, *Sullivant*, and southern Mississippi, *E. Hilgard.*—Many slender stems spring from a short rhizoma, which bears numerous long fibrous rootlets (under water?); panicle usually 3–4 inches long, with a few principal branches; fruit-heads (from the broad, blunt capsules) obtuse, 2 or 2½ lines in diameter; flowers 1.0–1.2 lines long, greenish, turning brown; capsule usually very dark colored and shining, rarely paler; seeds easily distinguished by their dark color and slender form, mostly 0.23–0.27 line long and one-third as much in diameter; 5 or 6 ribs quite conspicuous. This is one of our earliest species, flowering in April and May. The slender growth, the small, obtuse, dark colored heads and dark seeds distinguish this plant at once, but whether Elliott's *J. acuminatus* is the same as this, as Chapman suggests, or whether it belongs to one of the forms of the next species, does not appear from his insufficient description.

39. J. acuminatus, Michx. 1, 192, non Gray, Man. nec auct. Amer. plur.: caulibus cæspitosis plerumque erectis; panicula effusa plus minus composita; capitulis pauci- vel multifloris pallidis sæpe demum stramineo-fuscatis; sepalis lanceolato-

subulatis acutissimis subæqualibus stamina 3 dimida seu tertia parte superantibus; antheris filamento plerumque brevioribus; stigmatibus subsessilibus ovario ovato obtuso seu rarius acutato sub-brevioribus inclusis; capsula prismatica mucronata seu acutata uniloculari sepala æquante seu excedente; seminibus minutis obovatis seu oblanceolatis utrumque acutis areis lineolatis reticulatis.

Var. *α. legitimus:* caulibus (1–2-pedalibus) erectis gracilioribus; panicula simplici composita vel decomposita patula; capitulis pluri-seu multi-(5–12–30–50)floris demum e fusco stramineis; floribus majoribus; sepalis æqualibus seu raro exterioribus paulo longioribus capsulam prismaticam obtusiusculam mucronatam fere æquantibus; antheris filamento multo brevioribus; ovario ovato acuto.—*J. acuminatus*, Michx. 1, 192; La Harpe, 136; Elliott, 1, 409? Kunth, 3, 335, non Auct. Am. plur.; *J. pallescens*, E. Mey. *Junc.* 31, non Lamarck; *J. paradoxus*, E. Mey. l. c. 30; La Harpe, 141; Kunth, 3, 341; non Auct. Am.; *J. fraternus*, Kunth, 3, 340; *J. debilis*, Gray l. c. ex parte; *J. Pondii*, Wood Bot. (1861) 724.

Var. *β. debilis:* caulibus (spithameis sesquipedalibus) debilibus erectis seu decumbentibus radicantibusve; capitulis pauci-(3–6)floris; floribus minoribus pallidis; capsula acuta breviter mucronata exserta.—*J. debilis*, Gray Man. ed. 2, 481.

Var. *γ. diffusissimus:* caulibus (bipedalibus ultra) erectis paniculæ ultradecompositæ ramis numerosissimis filiformibus elongatis; capitulis pauci-(3–7)floris pallidis; sepalis angustioribus stamina fere duplo superantibus; ovario acutato; capsula lineari-lanceolata acuta calyci fere duplo longiore.—*J. diffusissimus*, Buckley, Pl. Tex. l. c. p. 9.

Var. *δ. robustus:* caulibus elatis (2–4-pedalibus) erectis foliisque elongatis robustis; panicula ultradecomposita patula; capitulis pauci-(5–8)floris stramineo-fuscis; floribus minoribus; antheris filamenta æquantibus; capsula ovata obtusa mucronata fusca sepala acutissima paulo excedente.

All over the States, from Massachusetts southward to the Rio Grande, and westward to Missouri; var. *α* is the most common form found in the whole territory indicated; var. *β* I have only seen from New Jersey, *C. E. Smith;* Pennsylvania, *Schweinitz*, *Moser*, *Porter;* Ohio, *Lea;* Kentucky, *Short* (the original of Gray's *J. debilis*); Mississippi, *E. Hilgard*, and South Carolina, *Ravenel*, but it is probably more extensively distributed; var. *γ*, northwestern Texas, *Lincecum*, *Buckley;* var. *δ*, in the Mississippi Valley from Illinois, *Geyer*, *Mead*, *Vasey*, to Missouri! and to Louisiana, *J. Hale.*—All the forms of this species flower early in the season, according to latitude, from April to June, and shed their numerous seeds from May to July.

Through the kind liberality of Profs. Roeper of Rostock and Decaisne of Paris I have now had the opportunity of examining and comparing fragments of Lamarck's original *J. pallescens* and Michaux's *J. acuminatus.* The former's name refers, as Prof. Roeper informs me, to two poor (*more suo*) specimens collected by Commerson near Buenos-Ayres; the heads are apparently 5-flowered; the flowers, not yet open, are similar to those of our plant, but are 6-androus and pedicelled. Lamarck gives North as well as South America as the habitat of his plant, but adds that his specimens are those above noticed; his reference to North America is evidently based on quotations from Pluk. Alm. t. 92, f. 9, and Moris. Hist. 3, sect. 8, t. 9. f. 5, which both represent rather something like *J. tenuis.* Meyer was undoubtedly misled by these references to North American localities to substitute Lamarck's to Michaux's name. La Harpe, p. 136, suggests, probably with more justice, that Commerson's plant is an immature *J. Dombeyanus.* Michaux's specimen, collected in South Carolina, is a rather small-flowered form of var. *legitimus*, such as often occur south-eastward (comp. Hb. norm. 58), with only 5 flowers in a head (Michaux says 3 flowers), the (unripe) capsule being about as long as the sepals. The other synonyms of the older authors have not given any less trouble, principally because both Meyer and Kunth have described their *J. paradoxus* and *J. fraternus* with outer sepals exceeding the inner ones (a very rare case in any form of *J. acuminatus*); and in the former the capsule was said to be longer, in the latter shorter, than the sepals; neither mentions the seeds. Having been able to examine a fragment of Kunth's plant, which had been sent from Boston by Boott, and is preserved in the Royal Herbarium at Berlin, I can most positively assert that it is a scanty-flowered form of what I have called var. *legitimus*, with the outer sepals very slightly exceeding the inner ones, and with a not fully ripe capsule about the length of the inner sepals. Meyer's *J. paradoxus* is more difficult to identify, because the original specimen does not exist in his herbarium; he had examined it, as a memorandum indicates, in Hb. Lehmann, to whom it was given by Willdenow under the name of *J. polycephalus*, and preserved only a drawing of it and a rough sketch of some details. There are, however, in the sheet superscribed by Meyer "*J. paradoxus*," ten dried specimens from different parts of the United States and Mexico, perhaps rather uncritically thrown together; flowers of only one of them have been sent to me, and they belong to the ordinary form of var. *legitimus.* The figure of the original type represents a plant with a decompound panicle about 4 inches high and as wide, with numerous few-flowered heads, and leafy excrescences from some of them; the other sketch shows an acute capsule exceeding the lanceolate-subulate sepals of *equal* length, and the inside of a valve with a parietal placenta on the lower half. Meyer, therefore, had seen the ripe fruit, and could not have failed to see some seeds, unless all had fallen out; but as they did not differ from the common form of *Juncus* seeds, he did not mention their shape, which he would certainly have done, and would have placed the plant in his second section, *Marsippospermum*, had they been at all appendiculate, as they are in the plant with us heretofore taken for *J. paradoxus*. Besides this, the latter, which is enumerated here as *J. Canadensis*, var. *longecaudatus*, never has the inner sepals shorter, but almost always longer, than the outer ones, and has rarely, if ever, as far as I am informed, those leafy degenerations of the flower-heads so common in var. *legitimus*. La Harpe, who describes "*J. paradoxus*" from Pennsylvanian specimens, speaks of the sepals as being nearly equal to the capsule, and of the seeds as *ovoid*. Why both, Meyer as well as La Harpe, should have separated their *J. pallescens* or *acuminatus* from this *J. paradoxus* is not very clear; they have evidently seen very few or single specimens only, and seem to have laid too much stress on the slight difference in the length of the sepals.

The extreme forms of this variable plant might readily be taken for distinct species were the intermediate ones wanting. All the forms produce from a short rootstock few or many erect or somewhat ascending, rather weak (except in var. δ) terete or slightly compressed stems, rarely (except in var. γ and δ) over two feet, and sometimes less than one foot high. The bracts are broad, membranaceous, and (the outer ones at least) awned; heads and flowers are of different sizes, but the sepals always regularly lance-subulate and very acute or almost awned but not rigid, and, with rare exceptions, equal in length; only in some few specimens of var. *legitimus* I have seen the outer a little longer than the inner ones. Capsules as long as, or longer than, the sepals, pale green to straw-colored or light brownish, with parietal placentæ on the lower half of the valves. Seeds obovate or oblanceolate, acute or apiculate at both ends, 0.20–0.25 line long, the length being equal to about 2½ diameters, of a yellowish or light brown color and apparently semi-transparent, neatly reticuted, and 6 or 7 ribs visible on one side.

Var. *a. legitimus* is the most variable of all the forms of this species, but is always readily recognized by the larger flowers, 1.5–2.0 lines long, and the ovate-prismatic obtusish mucronate capsule of the length of the sepals. Stems scarcely ever over 2 feet high; panicle, as well as heads, extremely variable, the former apparently more compound and the latter fewer-flowered north and eastward, while some Illinois (*E. Hall*, Hb. n. 55) and Texas specimens ("Hog bed prairies" on the Guadaloupe, *Wright*, Guadaloupe to Matamoras, *Berlandier* 1571 and 2556 in part) have few (3–8) large globose 20–50-flowered heads. Capsule rarely exceeding the calyx, and then approaching var. β. Seeds variable within the limits of the species, slender, or sometimes thick. Hb. n. 56 is a taller and 57 a slenderer form with fewer flowered heads, from Michigan, *Bigelow;* 58 and 59 are what Meyer named *J. paradoxus*, the former a smaller-flowered form from S. Carolina, *Ravenel*, the latter a larger-flowered one from Delaware, *Commons*.

Var. β. *debilis* is distinguished by the mostly very weak stem, $\frac{1}{2}$–$1\frac{1}{2}$ feet high, sometimes reclining, and even decumbent and rooting; panicle loose-flowered, 3–6 inches long; flowers 1.2–1.5 lines long; capsule very pale, more or less protruding beyond the calyx; seeds the smallest in the species. A rather small but rigid form comes from South Carolina, Hb. n. 60, *Ravenel*, and a similar autumnal one, in which the heads by renewed vegetation of their axis degenerate into spikes, has been sent by the same botanist, ib. 61.

Var. γ. *diffusissimus*, stouter, 2–$2\frac{1}{2}$ feet high, with a panicle 8 or 9 inches long and fully as wide; fruit-heads 5 lines in diameter; flowers $1\frac{1}{2}$ lines, or, with the straw-colored radiating capsules, fully $2\frac{1}{2}$ lines long; seeds as in last.

Var. δ. *robustus* is a very different looking plant, which in the hot Nelumbium swamps of the Mississippi bottoms grows even 4 feet high, with a stem 3 lines in diameter and leaves in proportion, which, however, do not reach beyond the base of the inflorescence; panicle 6–10 inches long and a little less across, with fruit-heads only 2 lines in diameter; flowers smaller than in the other forms, 1.1–1.2 lines long, and capsules more obtuse than in the others, with a short mucro; seeds among the larger ones.—The specimens distributed in Hb. n. 62 are, owing to the very dry season, not so well developed as the plant is often seen, nor did the fruit mature at all in that or the following year. It is an interesting fact observed by me for many years, that, if not in the whole Mississippi Valley, at least in this neighborhood, our ponds and lakes become lower every year, their rich vegetation is becoming extinct, and many have dried up altogether. Our beautiful Nelumbium, which twenty and ten years ago was an ornament to many sheets of water on hill as well as lowland in this vicinity, hiding them under their broad velvety leaves, and from the end of June to the middle of August dotting them with their splendid cream-white flowers, is fast disappearing in consequence of the retrocession of those waters, and with it its companions the Sagittariæ, the Spargania, the Junci, the Scirpi, the Zizania, and many of their minor attendants. But what botany and beauty loses, cultivation gains, and, above all, the health of the neighborhood.

40. J. BRACHYCARPUS, n. sp.: caulibus e rhizomate crasso horizontali paucis erectis (1–2½-pedalibus) rigidis teretibus; panicula e capitulis globosis multi-(30–50–100)-floris paucis seu pluribus simplice seu composita conferta; sepalis lanceolato-subulatis, interioribus quam exteriora multo brevioribus stamina 3 capsulamque triangulato ovatam acuminato-rostratam unilocularem æquantibus seu paulo superantibus; antheris lineari-oblongis filamento multo brevioribus; stigmatibus subsessilibus ovarium ovatum acuminatum fere æquantibus inclusis; seminibus parvis oblanceolatis obovatisve utrumque acutatis areis læviusculis reticulatis.—*J. cryptocarpus*, Bebb in litt.

In the Mississippi Valley from central Ohio, *Sullivant*, Michigan, *Folwell*, *Bigelow*, Hb. n. 74, and Illinois, *Bebb*, *Hall*, Hb. n. 63, to Missouri ! Kentucky, *Short*, Mississippi, *Hilgard*, Louisiana, *Hale*, and Texas, *Berlandier* 309, 313, 1569, 1573, and 2556 in part, *Lindheimer;* also, if the locality is correctly reported, near Charleston, S. C., *Beyrich* (distributed as *J. echinatus*). —Flowers in May and June, in Texas in April. —On one side this species is allied to the large-headed forms of *J. acuminatus*, and on the other much more closely to *J. scirpoides*, with both of which it has been confounded; it has the rhizoma and the inflorescence of the latter, but its very short inner sepals and short capsule at once distinguish it from either.—Stems from 8–10 inches (seen mostly in Texas specimens) to 2–2½ feet high, rather rigid; heads 4–5 lines in diameter, single or 2–3 together, or more commonly 5–8, or even 10, in a short (1–2 inches long) contracted panicle; flowers 1.8–2.0, and capsule 1.2, lines long, so that, as Mr. Bebb remarks, at maturity the arid sepals, protruding over the almost hidden capsule, give the plant an appearance of sterility. Filaments twice or three times as long as the anthers; seeds 0.20–0.22 line long, in shape like those of the last species, but the areæ are scarcely lineolate, the ribs, however, are crenulate and sometimes short, transverse lines extend from them into the area. Among Lindheimer's Texan specimens are some, the heads of which are degenerated into leafy excrescences.

41. J. SCIRPOIDES, Lamarck, Enc. 3, 267 (E. Meyer in Linn. 3, 370): caulibus (1–4-pedalibus) e rhizomate horizontali crasso albido rigidis strictis (seu raro decumbentibus) foliosis; capitulis globosis multifloris paucis seu pluribus; sepalis subulatis sæpius aristato-acutissimis demum rigidis spinescentibus; staminibus 3; capsula triangulato-pyramidata subulata uniloculari; seminibus oblanceolatis obovatisve utrumque acute apiculatis areis sublævibus reticulatis.—*J. polycephalus*, Michx. Fl. 1, 192; Pursh, Fl. 1, 237; Mey. Junc. 33.

Var. *a. macrostemon:* caulibus (1–2-pedalibus) foliisque teretibus rigidis strictis; capitulis paucioribus minoribus in paniculam strictam dispositis; staminibus sepala fere æquantibus, antheris lineari-oblongis filamento pluries (quater seu ultra) brevioribus; capsula calyci æquilonga seu rarius exserta; seminibus minoribus.—*J. scirpoides*, Chap. 494 in part.

A. *macrostylus:* sepalis æqualibus seu sæpius exterioribus brevioribus; stylo elongato, capsula plerumque lageniformi.—*J. macrostemon*, Gay, in La Harpe, 140.

B. *brachystylus:* sepalis æqualibus seu plerumque exterioribus, longioribus, stylo perbrevi.—*J. echinatus*, Muhl. Gram. 207? *J. scirpoides*, Lamarck in Herb.! Gray, Man. ed. 2, 481.

Var. *β. echinatus:* caulibus ($1\frac{1}{2}$–3-pedalibus) foliisque teretibus rigidis strictis; capitulis paucioribus majoribus in paniculam simplicem dispositis; sepalis exterioribus plerumque longioribus stamina dimidia seu tertia parte superantibus; antheris filamento (duplo triplove) brevioribus; stylis abbreviatis; capsula sepalis æquilonga seu rarius exserta; seminibus minoribus.—*J. echinatus*, Ell. Sk. 1, 410; *J. megacephalus*, Curtis, in Bost. Jour. N. H. 1, 132; *J. polycephalus, a.* La Harpe, 140; *J. scirpoides*, Chap. l. c. in part.

Var. *γ. polycephalus:* caulibus (2–4-pedalibus) compressis erectis seu flaccidis hinc decumbentibus; foliis a latere compressis gladiatis; panicula effusa decomposita et ultra; capitulis majoribus; stylis abbreviatis; capsula exserta.—*J. polycephalus*, Ell. 1, 409; Chapm. 494; *J. polycephalus, a.* Michx. l. c.; Pursh, l. c.; Mey. Junc. 33; *J. polycephalus, γ.* La Harpe, 140.

A. *minor:* caulibus capitulisque paulo minoribus; sepalis æqualibus trinerviis; antheris filamentum fere æquantibus; seminibus majoribus fusiformibus.

B. *major:* caulibus capitulisque majoribus sepalis uninerviis exterioribus interiora tenuia superantibus; antheris filamento brevioribus; seminibus obovatis abrupte apiculatis.

A southern species, which extends northeastward as far as Pennsylvania and New Jersey. Var. *a.* A. I have only seen from South Carolina, Hb. n. 67 (the form with lobed heads), to Florida, Alabama and Texas; *a.* B. is distributed over the whole range of the species, from New Jersey and Pennsylvania, Hb. n. 65, to South Carolina, Hb. n. 66, Arkansas and Texas. Var. *β.* has been found from Maryland to Florida, Hb. n. 68 and Texas; Var. *γ.* A. from North Carolina to Florida, Hb. n. 69, and var. *γ.* B. from the same States westward to Louisiana, Arkansas and Texas. There must be some error in La Harpe's statement that La Pylaie found *J. macrostemon* in Newfoundland; perhaps he took the large-headed form of *J. nodosus* for it.—It flowers, according to latitude, from June to August.

I comprise under the name of *J. scirpoides* a number of forms, several of which have often been taken for distinct species. Michaux, who no doubt had seen a great deal of it in the south-eastern States, had united all under his *J. polycephalus*, in which he was followed by Pursh as well as by Meyer; but the earlier name of Lamarck must take precedence, though it seems to refer only to a single form, a specimen of which, brought by Frazer from South Carolina, is still preserved in his herbarium, now in the hands of Prof. J. Roeper of Rostock. This proves to be var. *macrostemon* (the form with longer exterior sepals), as has already been stated by Meyer (Linn. 3, 370). The older authors appear to have confounded it with *J. nodosus*, which latter Michaux does not seem to have known or distinguished, and which, on the other hand, is taken by Hooker in Flor. Bor. Am. for *J. polycephalus*.

All the forms of this species have compact, globose, mostly greenish heads, turning straw-color or light brown at maturity, on rigid or stout stems, rising, at least in var. *α* and *β*, from thick white horizontal rhizomas; those of var. *γ* I have never seen in herbarium specimens; sheaths of the leaves, especially in *α* and *β*, loose and open; stamens 3, very rarely, in var. *α*, 4 or 5 in number; seeds, though differing much in form and size (from 0.2 to over 0.3 line long, and from an elongate fusiform to a thick ovate shape), with 5 or 6, very rarely 7, ribs on one side, and smooth or delicately marked areæ; these marks consist of one or a few perpendicular lines, sometimes crossed by a couple of horizontal ones.—Our southern botanists will have to find out whether one or the other of these forms may not justly claim to be considered as a distinct species.

Var. *α* is readily recognized by its wiry stem 1–2 feet high, its strictly erect panicle of a few (5–9, rarely single) small heads, 3½–4 lines in diameter, and composed of 15–30–40 flowers,* the stamens of which are as long as the sepals, the small anthers often protruding from between their tips; flowers 1¼–1½ lines long; seeds 0.22–0.28 line long, their length being equal to 2–2½ diameters. The form with long protruding styles has in flower a very curious aspect; in fruit it is often of a deeper brown than any other variety, and its capsules are not regularly subulate, as we find them in all other forms of this species, but oblong and rostrate, almost bottle-shaped. Another peculiarity of it is, that its heads are often lobed, as already remarked by Dr. Chapman, i. e. composed of a number (3–5–7) of smaller heads, the axillary productions of the lowest bracts of the primary head. Sometimes the panicles become larger, 6 inches or more in length, and composed of numerous heads; in some southern, especially Texan, speci-

* Muhlenberg describes his *J. echinatus* with 9-flowered heads, and Lamarck his *J. scirpoides* with heads bearing 12–18 flowers.

mens I find the inflorescence more spreading, and with somewhat larger heads, so that thus the transition to the following varieties seems to be given.

Var. β is 1–3 feet high, and stouter, and bears its larger heads in an almost umbel-shaped, more compact panicle; heads 5–6 lines in diameter, consisting of 50–90 flowers, each of which is $1\frac{3}{4}$–2 lines long; seeds 0.22–0.25 line long, slender, their lengths being equal to 3 diameters. The inflorescence is sometimes looser and more compound, making a transition to the next.

Var. γ is a very different looking plant, with a compressed, tall, often inclined and even decumbent stem, which is said to become 4 feet long; leaves laterally compressed, already described by Elliott as *gladiate*, 3–6 lines wide; panicle spreading, 8–12 or 15 inches long and about as wide, with distant, sometimes one-sided (usually called *sessile*) heads, i. e. heads from the base of which a long axillary peduncle springs, which bears a second head that often behaves in the same manner. So far both forms of this variety agree, but in the flowers and in the seeds they appear very different, and may eventually have to be separated, though our best southern botanists do not distinguish them, and seem to agree in the view that it is the rich marshy soil of their ricefields, and similar localities, which produces these "overgrown" forms.—The fruit-heads of the smaller form have a diameter of 5–6 lines, and are composed of 30 or 40 to 70 or 80 flowers; flowers, i. e. calyx, 2–$2\frac{1}{2}$ lines long, sepals about equal in length, and exterior and interior ones not more different in structure than is usually the case; anthers longer than in any other variety of our species, and equal to the filament; seeds the longest and most slender of all the forms, 0.30–0.33 line long, the length equal to 3 or $3\frac{1}{2}$ diameters.—The subvariety *major* has fruit-heads of 5–7 lines in diameter, the long pointed capsules radiating conspicuously in all directions; 20–50 or 60 flowers, $2\frac{1}{4}$–$2\frac{1}{2}$ lines long, in each head; sepals very unequal in length, as well as in texture, the exterior ones triangular dagger-shaped, and at maturity indurated; the interior ones much shorter, and more or less membranaceous; seeds ovate or almost globose-ovate, obtuse, very abruptly or sometimes scarcely apiculate, 0.20–0.23 line long, the length being equal to $1\frac{1}{2}$ or less than 2 diameters.

42. J. Bolanderi, n. sp.: caulibus (bipedalibus ultra) gracilibus rectis compressis; foliorum teretiusculorum striatorum vaginis longe biauriculatis; capitulis multi-(30–50)-floris singulis seu paucis in glomerulum congestis seu breviter pedunculatis; florum (fuscorum) sessilium sepalis lineari-lanceolatis subulatis æquilongis stamina 3 quarta parte superantibus capsulam clavato-turbinatam obtusam mucronatam

unilocularem æquantibus; filamentis anthera oblongo-lineari apiculata bis terve longioribus; seminibus obovatis apiculato-acutatis areis lineolatis reticulatis.

Swamps near Mendocino City, California, discovered in October, 1865, by *H. N. Bolander*, and named for him, one of the acutest and most zealous explorers of Californian Botany. Rhizoma not seen; flattened stems very slender, terete leaves strongly knotted; mature heads 4–5 lines in diameter, brown, shining, single, or 2, or, usually, 3–5 together, either sessile and crowded together into a large cluster, or, some of them, peduncled; flowers 2 lines long, with very narrow and sharp pointed sepals, and very slender stamens; shape of capsule quite peculiar; seeds 0.25 line long, with about 8 ribs visible. The flattened stems and the brown heads assimilate this species to the Californian *Ensifolii*, but the rounded and strongly knotted leaves and the sessile flowers seem to separate it from them and place it with *J. scirpoides* and its allies.

43. J. NODOSUS, Lin. Sp. Pl., ed. 2, 1, 466, excl. syn.; Rostk. Mon. 38, t. 2, f. 2, excl. syn. Torr. Fl. N. Y. 2, 325, excl. var. 2; Gray, Man. ed. 2, 482: caulibus teretibus erectis e basi stolones tuberiferos emittentibus; paniculæ plerumque subsimplicis capitulis pluri vel multifloris; sepalis lanceolato-linearibus subulatis stamina 6 fere duplo superantibus capsulam pyramidato-rostratam unilocularem æquantibus seu plerumque ea brevioribus; seminibus ovatis abrupte apiculatis lineolato-reticulatis.—*J. Rostkovii*, Mey. Junc. 26; La Harpe, Mon. 133; Kunth, l. c. 332; *J. polycephalus*, Hook. Fl. Bor. Am. 2, 190.

Var. *α. genuinus*, caule humiliore (spithameo ultrapedali, rarissime elatiori) foliisque tenuibus; spatha erecta paniculam subsimplicem coarctatam (raro capitulum singulum) superante; capitulis minoribus pluri-(8–20)floris; floribus minoribus fuscatis; sepalis lanceolatis æqualibus seu exterioribus paulo brevioribus; antheris oblongis seu oblongo linearibus plerumque apiculatis filamento brevioribus; ovario ovato stylo brevissimo coronato; capsula ovato-lanceolata rostrata plus minus exserta.

Var. *β. Texanus:* caule elatiore (pedali bipedali) foliisque tenuibus; spatha patente paniculam plerumque compositam decompositamve fere æquante; capitulis majoribus multi-(15–40)floris; floribus majoribus demum stramineis; sepalis lanceolato-subulatis exterioribus brevioribus; antheris linearibus obtusis filamento (hinc duplo) longioribus; ovario lanceolato in stylum longiorem sensim abeunte; capsula pyramidato-lanceolata subulata exserta.

Var. *γ. megacephalus*, Torr. l. c.: caule elatiore (pedali tripedali) foliisque robustis; spatha erecta seu paulo deflexa foliove summo paniculam subsimplicem coarctatam sæpius superante; capitulis magnis densissime multi-(30–80)floris; floribus majoribus virescentibus demum stramineis; sepalis lanceolato-subulatis exterioribus longioribus; antheris linearibus filamento paulo brevioribus; ovario lanceolato in stylum brevem sensim abeunte; capsula pyramidato-subulata vix exserta.—*J. megacephalus*, Wood, Bot. 724, non Curtis.

This species takes a much wider geographical range than the last, including the whole of North America north of Mexico, with the exclusion of the south-eastern States; but the different forms occupy different geographical regions. Var. *a.* is found throughout British North America from Canada and the Hudson Bay regions to the Rocky Mountains and the North-west coast, and extends southward to Pennsylvania, *Porter*, Hb. n. 70, Ohio, *Lapham*, Michigan, *Bigelow*, Hb. n. 71, and Wisconsin, *Lapham*, *Hale;* I have seen no specimens from further south, though the older authors credit it to Virginia and Carolina, quoting, among others, Bosc as their authority. Var. β has been solely found in Western Texas, *Lindheimer*, 545, *Wright*, *Buckley*. Var. γ meets *a* on Lake Ontario, where also *J. alpinus* and *articulatus* join, and extends from thence westward to Michigan, *Bigelow*, Hb. n. 74, and southwestward to Illinois, Missouri, the northern Red River, *Hubbard*, the Saskatchawan, *Bourgeau*, the Yellowstone, *Hayden*, Colorado, *Parry*, Hb. n. 75 (a dwarfed form), New Mexico, *Fendler*, 849 *Wright*, 696 & 1926, Texas, *Lindheimer*, 546, and others; and to Arizona, *Coues & Palmer*, and California, *Coulter*, 809. It flowers from July to August.

Our plant is very closely allied to the last one, and is often confounded with it; but the number of stamens and the markings of the seeds will readily distinguish any of the forms which may be mistaken for one another, e. g. *J. scirpoides*, β *echinatus*, and *J. nodosus*, γ *megacephalus;* besides, the slender stolons which terminate in a chain of small bulbs, probably the only part that sustains the life of the plant during winter, are quite characteristic of all the forms of this species. Another peculiarity of var. β and γ is the direction of the leaves, especially the upper ones, which are patulous, making a very distinct angle with their sheathing base, while in var. *a* the leaves are erect, forming an almost straight continuation of the sheath. Var. *a* and more rarely var. γ exhibit sometimes that degeneration of the heads into bunches of sheaths or leaves which has been spoken of in another place. The seeds are 0.22–0.27 line long, the length being nearly equal to 2, rarely to 2½ diameters; commonly 8 ribs are visible on one side.

The northern form, var. *a*, is the genuine *J. nodosus* of Linnæus, who described it from specimens sent by Kalm (most probably from Canada), as Prof. Gray ascertained in the Linnæan herbarium itself; he informs me that "Linnæus' reference to Gronov. Virg. 15 [leg. 152] is a mistake, in copying from Gronovius of *Gramen junceum elatius pericarpiis ovatis Americanum*, Pluk. alm. That this is not the type of *J. nodosus* is clear, because it does not, like all other Gronovian plants, appear in the first edition of Spec. Plant. Linnæus' annotations prove that he was considering some plant in his herbarium, and not a mere quotation." The figure of Rostkovius is a very good representation of the ordinary appearance of this variety.—It is by far the slenderest form, usually from 8–12 or 15 inches high, with 2–5 or 8 brown heads in a rather compact and simple or slightly compound panicle; in the Rocky Mountains a dwarf form occurs, with a filiform stem 3–5 inches high, bearing a single few-flowered head (*J. polycephalus*, γ, Hook. l. c.); a similar variety was collected on the mountains of Vermont by *H. Mann*, Hb. n. 72; *Judge Clinton* and *Dr. Bigelow*, Hb. n. 73, send from the shores of the northern lakes a taller form, 2–3 feet high, with a more compound lighter colored panicle; and this makes a transition to one which Dr. Vasey has sent from the northern border of Illinois, a stout, large (nearly 2 feet high) green-headed plant, with a decompound panicle of at least 30 greenish heads, each composed of 25–35 flowers. This latter is an interesting form, as it connects all three varieties.—The heads of the genuine *J. nodosus* are 3½–4 lines in diameter, and show a deeper brown color than any of the other varieties; the flowers are 1½–2 lines long, and the capsule, which is usually rostrate from an oblong body and not regularly subulate, in most instances considerably exceeds the sepals. The seeds are, as in all other forms of this species, ovate or obovate, abruptly apiculate, and prettily reticulated with very distinct cross-lineolation, 0.22–0.27 line long, their diameter being equal to about one-half their length, or, in some forms with slender seeds, much less.

Var. β is usually a taller plant, 12–20 inches high, but quite slender; the compound or decompound rather lax panicle is 2–4 inches long, and the echinate fruit-heads have a diameter of 5 or 6 lines. Flowers 2½ lines long; obtuse anthers often twice as long as the filaments; seeds usually a little smaller than in the last, 0.22–0.24 line long.

Var. γ is a stouter plant, 1–2½ feet high, with the largest heads of any *Juncus* known to me, in fruit 6–8 lines in diameter, in a rather compact panicle; seeds like those of the last. The Texan variety and Dr. Vasey's specimens, mentioned above, unite this with the genuine *J. nodosus*, from which I cannot separate it, though looking so very distinct.

44. J. Canadensis, J. Gay in La Harpe, Mon. 134; Kunth, l. c. 333; caulibus cæspitosis teretibus lævibus; paniculæ capitulis pauci-multifloris; sepalis lineari-lanceolatis plerumque

acutis, exterioribus brevioribus stamina 3 vix seu paulo superantibus; antheris oblongo-linearibus filamento brevioribus; ovario in stylum brevem attenuato, stigmatibus vix seu breviter exsertis; capsula triangulato-prismatica uniloculari plerumque exserta; seminibus oblongis seu oblongo-linearibus multi-costatis plus minus caudatis.

* Formæ capitulis minoribus paucifloris.

Var. *α. coarctatus:* caulibus humilioribus ($\frac{1}{2}$–$1\frac{1}{2}$-pedalibus) erectis; paniculæ minoris coarctatæ ramis erectis; florum minorum sepalis acutis seu raro obtusiusculis; antheris oblongis filamento duplo brevioribus; capsula castanea acutata longius exserta; seminibus oblongis lineolato-multicostatis, appendicibus diametrum fere æquantibus.—*J. Canadensis, β.* Gay, l. c.; *J. acuminatus*, Torr. N. Y. 2, 327; Gray, l. c. 481; Chap. Fl. 464, et Auct. Am. plur. non Michx.

Var. *β. brachycephalus:* caulibus elatioribus ($1\frac{1}{2}$–$2\frac{1}{2}$-pedalibus) gracilibus erectis seu descendentibus; paniculæ majoris effusæ ramis patulis; florum minorum sepalis plerumque obtusis; antheris linearibus filamento brevioribus; capsula e stramineo fuscata obtusiuscula mucronata breviter exserta seminibus ut in var. *α*.

* * Formæ capitulis majoribus plurifloris.

Var. *γ. subcaudatus:* caulibus (1–$2\frac{1}{2}$-pedalibus) gracilibus erectis seu decumbentibus; paniculæ effusæ ramis patulis sæpe horizontalibus; capitulis pluri-(8-20)floris; florum majorum sepalis acutissimis; antheris oblongo-linearibus filamento multo brevioribus; capsulis demum stramineis plerumque acutatis exsertis rarius mucronatis subexsertis; seminibus oblongis reticulato-multicostatis in appendices perbreves attenuatis.

Var. *δ. longecaudatus:* caulibus ($1\frac{1}{2}$–3-pedalibus) erectis robustis rigidis; paniculæ abbreviatæ seu patulæ capitulis pluri-multi-(5–8–20–50–90)floris; florum majorum sepalis acutis seu rarissime obtusiusculis; antheris oblongis sæpe mucronatis filamento plerumque duplo brevioribus; capsulis prismaticis obtusis mucronatis seu rarius acutatis sæpe fuscatis sepala excedentibus seu rarissime æquantibus; seminibus oblongis seu oblongo-linearibus lineolato-multicostatis, appendicibus diametro longioribus.—*J. Canadensis, α.* Gay, l. c.; *J. polycephalus, β. paradoxus*, Torr., N. Y. 2, 327: *J. paradoxus*, Gray, l. c.; Chapm. l. c. et Auct. Am. plur., non Meyer.*

This species inhabits the eastern parts of North America and extends westward in the region of the Great Lakes to the Upper Mississippi and down to central Illinois, and again in the Gulf States to Louisiana, leaving out the

* This arrangement of the varieties differs somewhat from that previously adopted by me on p. 436, and in some herbaria labelled by me. No confusion will arise from this if the reader will only substitute "*brachycephalus*" for *brevicaudatus patulus*.

central States of the Mississippi Valley, to which it seems to be a stranger. It flowers in July and August, when *J. acuminatus*, with which it might be confounded, has already shed its seeds.—Var. *a* is decidedly the most northern form of this species, which extends from the north-eastern States to Canada and the Lake Superior region, Hb. n. 76 & 77, and southward to Pennsylvania, where Prof. Porter finds it in the neighborhood of Lancaster; Dr. Chapman gives Georgia as the southern limit of "*J. acuminatus*," but I have seen no specimens from those southern parts. —Var. *β* has been observed from Pennsylvania, *Porter*, to western New York, *Gray*, *Sartwell*, *Vasey*, *Clinton*, Central Ohio, *Sullivant*, Central Illinois, *Hall*, *Brendel*, Michigan, *Bigelow*, Hb. n. 79, and Wisconsin, *Lapham*.—Var. *γ* is a form of the Atlantic States, found from Connecticut, *Eaton*, to New Jersey and Pennsylvania, *Durand*, *Smith*, Hb. n. 81, *Leidy*, *Porter*, Hb. n. 80, Delaware, *Commons*, Hb. n. 82, District of Columbia, *Bebb*, South Carolina, *Nuttall*, and Georgia, *Beyrich* (distributed by him under the name of *J. acuminatus*).—Var. *δ* is the most common of all the forms, extending over the whole region, with the exception, perhaps, of its north-eastern extremity. I have not seen any specimens from Canada, or from the States north of Massachusetts. The Herb. norm. contains different forms of this variety from Michigan 84, Pennsylvania 83, Maryland 88, and South Carolina 85, 86 and 87.

The different forms of this intricate species are as wide apart in habit, as well as in artificial characters, as they possibly can be, but are connected by insensible transitions, so that even the different varieties cannot always be kept clearly distinct. Its synonymy is in some confusion. It is quite impossible that specimens of so wide-spread and so easily accessible a species should not have been obtained by collectors long since, and we do indeed find such among Michaux's (La Harpe, l. c.) and among Schweinitz's plants, and no doubt in many other old herbaria; but, somehow or other, its striking diagnostic characters were overlooked, and it was thrown together with other species, such as the similar looking *J. acuminatus*, especially its var. *legitimus*, under the name of *J. polycephalus* or *J. verticillatus* (lege *subverticillatus*).—This and the following two species are well distinguished from all the other articulate ones by their tailed seeds and by the proportions of their usually strongly nerved sepals, the inner of which always exceed the outer ones. From its two allies it is distinguished principally by the shape and proportion of its capsule, and the smaller and differently shaped seeds.

Varr. *a* and *β* are distinguished from the others by their small, usually 3–4-flowered, heads, smaller flowers, which are 1¼–1½ and only in Lake Superior specimens of *a* 1¾ lines long, and the form of the smaller seeds. These seeds are 0.25–0.33 line long, 2½ diameters being equal to the length; appendages about equal to the diameter, so that the whole seed has a length of 0.40–0.60 line; 7–9 ribs visible, connected by delicate cross-lines.

Var. *a* is readily known by its low stature, rarely over a foot high, erect, dark colored panicle (1–4 inches long and ¾–1½ inches wide) and elongated capsules, and therefore longer fruit-heads; the sepals are usually acute, but in some forms from Pennsylvania and from New Hampshire I have found them obtuse. American botanists have usually taken this form for *J. acuminatus*, Michx.; but Michaux's plant is very different and, moreover, comes from South Carolina, while the present variety is, I believe, not found south of Pennsylvania. Prof. Porter gets in the mountains of that State a low form with more patulous lighter colored panicles, and more obtuse sepals, Hb. n. 78, which seems to form a transition to the next variety.

Var. β stands in habit and stature nearest to var. γ, but its small, short heads, obtuse sepals and short capsules distinguish it at once from that and from var. *a*; our botanists have sometimes confounded it with *J. debilis* or with *J. articulatus*, from both of which however the characters enumerated readily distinguish it. Stem 1½–2½ feet high; panicle 4–9 inches long and proportionately wide. Mr. C. E. Smith gets a form at Tinnicum, near Philadelphia, which unites this with var. γ, having the seeds of this, but the greater number of flowers (10–12), the larger heads, and the pointed sepals, of the other.

Var. γ is a rather rare plant and does not seem to have attracted the attention of botanists, though it had been collected especially about Philadelphia and in New Jersey, until Mr. Bebb of Washington and Mr. Smith of Philadelphia studied it with a great deal of attention; the shortness of the appendages had induced some to place it away from its close alliances and with or near *J. acuminatus*, but I cannot entertain any doubt but that it is so closely allied to var. δ that it can barely be kept apart from it, the length of the appendages being quite variable even in seeds from the same capsule. The whole plant, however, is more delicate, lighter green, the stem weak, and more usually decumbent, the panicle very loose, commonly with long and often horizontally-spreading slender branches; heads pale, 8–15–20-flowered; flowers as large as in the next, 1½–2 lines long; sepals always subulate and very acute, and often only 1-nerved; capsule more commonly acute or acutate, as long or mostly longer than the sepals; seeds 0.25–0.36 line long, thicker than in the next variety, the length being equal to 2–2½ diameters; seed with appendages 0.33–0.50 or very rarely 0.60 line long; appendages less than the diameter of the seed, often only half as long; 7–8 ribs visible, usually very distinct, with cross-striation and an approach to reticulation.—A slender form is distributed in Hb. n. 80 and 81, a more rigid one is n. 82, but both run together.

Var. δ is the most polymorphous of all the forms of this species; it is stouter, taller and more rigid than the other varieties, and thus approaches more nearly to the following species. The panicle 3–6, or sometimes as much as 9 or 10, inches long, and 2–5–7 inches wide, with somewhat spreading but rarely horizontal rays, is either much branched and bears smaller (5–8–20-flowered) but more numerous heads, or it is more simple, with larger (30–40 and in some Delaware specimens even 80 or 90-flowered) and fewer heads; it is usually loose, but sometimes quite compact; specimens from South Carolina, Hb. norm. 85, have large green heads in a decompound panicle. Flowers 1½–2 lines long, greenish, at last with the capsules light brown; sepals generally 1–3 or sometimes 5-nerved, very acute, or rarely somewhat obtusish, usually quite unequal, or, as an exception, nearly equal in length; capsule prismatic, and usually obtusish and mucronate, as long as or mostly longer than the sepals, sometimes acutate and elongate. Seeds slender, and either large with shorter appendages, or smaller and thinner and with longer tails; the former are 0.30–0.46 line long, length equal to 2½ diameters, with the appendages 0.60–1.00 line long; the more slender seeds are of the same total length, but the body of the seed is a little shorter (0.25–0.35 line long) and its length is equal to nearly 3 diameters; 8–10 or 15 ribs or striæ are visible on one side of the seed.—A curious form with branched heads, the single branches being elongated into spikes, was found by A. Commons near Salisbury, Maryland (see p. 427). Mr. Ravenel has collected this species in South Carolina with often more than 3 stamens; Hb. n. 87.—This variety is the plant which by most American botanists has been taken for Meyer's *J. paradoxus;* but I have shown above (p. 462) that Meyer's plant, *sepalis* "*exterioribus longioribus*," must be what I have designated as *J. acuminatus*, var. *legitimus*, and cannot have been meant for our plant, the exterior sepals of which are *shorter*. Meyer's name was not given in reference to the curious seeds, but to the frequent foliaceous excrescences of his plant, which seem to be quite rare, if not unknown, in the present species.

45. J. CAUDATUS, Chapm. Fl. S. St. 495: caulibus (2–3-pedalibus) cæspitosis teretibus foliisque rigidis lævibus; paniculæ compositæ seu decompositæ ramis suberectis; capitulis pauci-(2–5)floris; sepalis lanceolatis 3–5 nerviis, exterioribus brevibus acutis stamina 3–6 æquantibus, interioribus subulatis

longioribus; ovario lineari-lanceolato in stylum perbrevem sensim abeunte, stigmatibus exsertis; capsula obtuse triangulata pyramidata acutata atro-rubente lucida semitriloculari longe exserta; seminibus lineari-oblongis multo-lineatis longe caudatis.—*J. erythrocarpus*, Chapm. olim in sched.

South-eastern and southern States, from South Carolina, *Curtis*, *Ravenel*, Hb. n. 89, to Florida, *Chapman*, Hb. n. 90, Alabama, *Bigelow*, and Louisiana, *Hale;* fl. Sept. & fr. Oct.—Similar to the next but with much smaller flowers, long protruding pyramidal capsule, slender stamens inconstant in number and larger seeds. Rigid cespitose stems "from a thick and creeping rhizoma" (Chapman); panicles in most of the specimens before me 2–6 inches in length and quite contracted, the principal branch of the panicle being often strictly erect and quite elongated,—in others more open; fruit-heads 2–4 lines in diameter, with 2–4 or 5 flowers; flowers $1\frac{3}{4}$ lines long, with very unequal strongly nerved sepals; capsule much longer, sometimes twice as long as flowers, regularly pyramidal from an oval base, deep red brown or almost black. The number of stamens is quite variable, but more frequently 3 than 6; in 40 flowers of eight different specimens, from all the localities mentioned above, I have found only 4 with 6, 9 with 5, 11 with 4, and 16 with 3 stamens, and in no instance did all the flowers of one plant exhibit the same number of stamens. Seeds, without the appendages, 0.45–0.50 line long, their length being equal to $2\frac{1}{2}$ or $2\frac{3}{4}$ diameters; appendages straw-colored or white, upper one mostly as long or longer than the seed, lower one stouter and shorter, as is usually the case in the appendages of *Juncus* seeds; whole seeds with the tails $1–1\frac{1}{4}$ lines long; striæ of seed very numerous and close.—This may possibly be the same as *J. trigonocarpus*, Steud. Glum. 2, p. 308, of which I have not been able to obtain a specimen or a satisfactory description.

46. J. ASPER, n. sp.: caulibus (bipedalibus et ultra) cæspitosis teretibus cum foliis papilloso-asperatis; paniculæ compositæ seu decompositæ ramis erecto-patulis; capitulis pauci-(2–6)floris; sepalis late lanceolato-subulatis rigidis multinerviis lævibus, interioribus longioribus stamina 6 duplo superantibus; antheris late linearibus filamentum late subulatum fere æquantibus; ovario lanceolato in stylum eo breviorem abeunte, stigmatibus exsertis; capsula ovato-oblonga sursum triangulari rostrata rufo- vel virescenti-fusca lucida semitriloculari sepala vix excedente; seminibus majusculis ovato-oblongis costato-lineolatis longe caudatis.

Thus far only in New Jersey, where it was found many years ago, at Quakerbridge, *Pickering* in Hb. Ac. Philad., *Durand;* re-discovered within the last few years "in a sphagnous swamp at Griffith's, $6\frac{1}{2}$ miles south-east of Philadelphia, where it grows with several forms of *J. Canadensis*," *C. E. Smith*, Hb. n. 91; also at Quakerbridge, *C. F. Parker;* flowering in August and in fruit in September.—An interesting and well characterized species closely allied with the last ones, with which it has in common the longer inner sepals and the tailed seeds, distinguished from them by its rough stem and leaves, its large flowers with 6 large stamens, and its large dark seeds with (usually) purplish tails.—Roughness is a rare character in the genus *Juncus*, which I find noticed only in the South American *J. rudis*, Kunth, and the Portuguese *J. rugosus*, Steud.; in these the flowers are smooth just as in our species, while in *J. falcatus* the stem and leaves are smooth and only the flowers rough (see p. 452). All parts of this plant are very rigid, the stems $1\frac{3}{4}$–$2\frac{1}{2}$ feet high, the panicle 2 or 3–6 or 7 inches long, less in expansion; fruit-heads 4–6 lines in diameter, usually with 3–5, sometimes only with 2 flowers; flowers $2\frac{1}{2}$ lines long or more; capsule equaling or scarcely exceeding the rigid and sharp pointed green or darkish tipped sepals; outer sepals indistinctly 5-nerved, inner ones (at least in the dry state) strongly 7-nerved; capsule tough and hard, reddish or greenish brown, at base completely, upwards partially, 3-celled; seeds 0.5–0.6 line long, their diameter being nearly equal to half their length, the lower appendage thick and usually short, the upper one not quite as long as the seed itself; whole seed, with the tail, about $1\frac{1}{4}$ lines long; side of seed with 12 or 14 ribs, and usually distinctly cross-lineolate.

47. J. Mertensianus, Bong. Veg. Sitcha in Mem. Ac. St. Petersb., ser. 6, vol. 2 (1833), 167, ex Kunth, l. c. 361: caulibus e rhizomate crasso repente cæspitosis humilioribus (spithameis pedalibus) compressis debilibus; vaginis foliorum averse compressorum auriculatis; floribus pluribus (15–25) fusco-atris pedicellatis in capitulum laxius singulum seu rarius bina ternave aggregatis spatha brevioribus; sepalis ovato-lanceolatis, exterioribus acuminato-subulatis, interioribus plerumque paulo brevioribus obtusis mucronatis seu rarius exteriora æquantibus acutis, stamina (3–) 6 superantibus capsulam late obovatam obtusam mucronatam æquantibus seu superantibus; antheris oblongis seu oblongo-linearibus sæpissime mucronatis filamentum æquantibus seu eo brevioribus; stylo quam ovarium obtusum plerumque breviore; seminibus oblanceolato-obovatis fusiformibus utrumque breviter caudatis reticulato-costatis, arcis lineolatis.—*J. ensifolius*, Hook [Fl. Bor. Am. 2, 191; Gray in Pl. Hall & Harb. l. c.

Var. β. *paniculatus:* caule elatiore (ultra bipedali); vaginis vix auriculatis; capitulis (6–9) minoribus (10–15-floris) in paniculam compositam dispositis.

From the islands of the North-west coast, Sitcha, *Mer-*

tens, Unalaschka, *Chamisso*, to the Cascade Mountains, *Lyall*, and Rocky Mountains, *Drummond*, Big Horn Mountains, *Hayden*, Medicine Bow Mountains, *H. Engelmann*, and southward to Colorado, *Hall & Harbour*, 565, Huerfano Valley, *C. C. Parry*, and to the Californian Sierras, *H. Bolander*, at the Mono Pass, Hb. n. 92; var. β in the northern Rocky Mountains, *Bourgeau*.

With some hesitation I refer the Rocky Mountain plant, of which I have numerous and well preserved specimens before me, to *J. Mertensianus* of the North-west coast, the authentic specimens of which, at my disposal, are rather incomplete; but they are distinct enough to prove Meyer wrong in referring the Sitcha plant to his *J. falcatus* (Ledeb. Fl. Ross. 4, 228). Bongard, to be sure, describes the leaves as flat, but they are not adverse like those of *J. falcatus*, but averse like those of *J. xiphioides*, and, besides, are slightly but distinctly knotted.

Stems 7–14 inches high, compressed, but not ancipitous except in var. β, "weak and flaccid" (Hall), grooved below, smooth upwards; leaves, as in all its allies, of very different width, usually ½–1 or rarely 1½, but in β 1½–2½ lines wide; heads 4½–6 lines in diameter; flowers very distinctly pedicelled, 1¾ to (commonly) 2 lines long; inner sepals, as in this whole section, quite variable, obtuse to acute and even acuminate, usually shorter, but in some flowers of the Sitcha specimens even longer than the outer ones. Stamens ⅔ or ¾ the length of the sepals, usually 6, but sometimes 3 (3, Bongard; 4–5, Kunth) in Sitcha and Cascade Mountain specimens, 6 in all those from the Rocky Mountains or California, which I have examined; anthers as long as, or, usually, shorter than the filament, often apiculate. Ovary as well as capsule broadly obovate and obtuse. The seeds make a near approach to those of the last section, their appendages being sometimes quite conspicuous; in Hall's Colorado specimens I find them usually very short, while in a specimen of Dr. Hayden's they are almost equal to the diameter of the seed; the seed itself is 0.23–0.30 line long, the length being equal to 2–2½ diameters; with the appendages they are 0.30–0.35, and in the abovementioned specimen of Dr. Hayden even 0.50 line long; 7–9 and in some Rocky Mountain specimens (*Drummond*, *Hall*) 9–12 ribs are visible on the side; the surface is regularly reticulated with more or less distinct cross-lineolation.

Var. β, with its tall stem, long and broad leaves, and a panicle of 3 inches in length, looks quite distinct from the ordinary form, but I cannot find any more essential differences.

This species with the four following ones, the Mexican *J. brevifolius*, Liebm., and the Asiatic *J. Leschenaultii*, Gay, form a very natural group, united by characters as well as geographical range. Their compressed or ancipitous stems usually come from a creeping rhizoma, and bear laterally compressed, or averse, equitant leaves, which in the larger forms resemble greatly those of *Sisyrinchium* and other iridaceous plants, and which are very imperfectly septate or articulate; their sheath sometimes terminates with two auriculæ or stipular appendages, or frequently, and in the same species, imperceptibly runs out into the edge of the leaf. The flowers, always pedicelled, are brown, mostly deep chestnut, rarely greenish or paler, and are arranged in few or many-flowered heads; in many species we find forms with single or few large heads in clusters, and others with numerous small heads disposed in compound panicles. The sepals are mostly broad, the outer ones acute or acuminate, the inner ones often shorter and obtuse, rarely longer, often variable even in flowers of the same head. The number of stamens also varies in the same species. The style is distinct, either short, or sometimes very long. The mucronate capsule is about as long or rarely longer than the calyx, nearly one-celled. Seeds reticulate, with smoothish or lineolate areæ. They inhabit the western slope of North America and extend to the Asiatic side of the Pacific.

48. J. XIPHIOIDES, E. Meyer, Syn. Junc. 50 et Rel. Haenk. 1, 143; Kunth, l. c. 331: caulibus (1–4-pedalibus) e rhizomate crasso repente erectis ancipitibus; capitulis pauci- vel multifloris paucis plurimisve; floribus pedicellatis; sepalis lanceolatis subulato-acuminatis æqualibus seu interioribus obtusioribus brevioribus stamina 6 seu raro (in var. ε) 3 fere duplo superantibus capsulam prismaticam acutam mucronatam hinc rostratam plerumque æquantibus; antheris oblongo-linearibus filamentum fere æquantibus; ovario ovato in stylum breviorem attenuato, stigmatibus subexsertis; seminibus ovato-oblanceolatis utrumque apiculatis lineolato-reticulatis.

Var. *a. littoralis:* caulibus robustis elatis (2–4-pedalibus); foliis latis iridaceis, vaginis sæpius inappendiculatis; paniculæ sæpe supradecompositæ capitulis pauci- vel pluri-(3–20)floris e stramineo fuscis; sepalis subæquilongis capsula acuta seu rostrata vix brevioribus; antheris sæpe apiculatis filamento paulo longioribus; seminibus oblanceolatis.—*J. xiphioides*, Mey. l. c.

Var. *β. auratus:* caulibus gracilibus elatis (3-pedalibus ultra); vaginis in folia latiora sensim excurrentibus; paniculæ supradecompositæ capitulis pauci-(5–10)floris stramineis nitentibus; sepalis æquilongis capsula rostrata brevioribus; seminibus ut supra.

Var. *γ. montanus:* caulibus humilioribus (spithameis sesquipedalibus); foliis angustioribus basi plerumque auriculatis; capitulis pauci-(3–10)floris pallidioribus pluribus paniculatis seu paucis (raro singulis) pluri-(12–20) vel multi-(20–50) floris fuscis; floribus paulo minoribus; sepalis interioribus brevioribus plerumque acutis, exterioribus capsulam longe mucronatam æquantibus; seminibus ut supra.—*J. xiphioides*, Torr. Bot. Mex. Bound. 222; Gray, Pl. Hall & Harb. l. c.

Var. *δ. macranthus:* caulibus mediis (sesqui-bipedalibus); vaginis in folia angustiora sensim excurrentibus; capitulis paucis multi-(18–40)floris; floribus majoribus fuscis; sepalis fere æquilongis, interioribus sæpe obtusiusculis capsulam acutam æquantibus; seminibus majoribus obovatis abrupte apiculatis.—*J. polycephalus*, *a.* ex parte, Hook. Fl. B. Am. l. c.

Var. *ε. triandrus:* caulibus humilibus seu mediis (spithameis bipedalibus); vaginis in folia angustiora sensim excurrentibus; capitulis singulis paucisve multi-(15–30)floris seu pluribus pauci-(5–8)floris paniculatis; floribus majoribus atrofuscis 3-andris; sepalis æquilongis seu interioribus obtusioribus subbrevioribus capsulam mucronatam æquantibus seu ea brevioribus; seminibus fere ut in var. *a.*—*J. ensifolius*, Wickstr. in Act. Holm. 1823, II. 1; Kunth, l. c. 337.

On the Pacific slope of the continent from southern California to Unalaschka, extending eastward into the plains east of the Rocky Mountains. Var. *a* seems peculiar to the fertile lands of the California coast region: Monterey, *Haenke*, San Francisco, *Bolander*, *Kellogg*, Hb. n. 93, Fort Tejon, *Xantus*. Var. *β* has been found on Monte Diablo, near San Francisco, *Brewer*, Calif. St. Surv. 338. Var. *γ*, the large-headed form in the Rocky Mountains, from Oregon, *Spalding*, *Lyall*, to Colorado, *Hall & Harb.* 564, and N. Mexico, *Fendler*, 858, *Wright*, 1925, and into the plains, Saskatchawan, *Drummond*, and Ft. Riley, *H. Engelmann;* the small-headed form is of more southern origin—Arizona, *Coues & Palmer*, 70, N. Mexico, *Wright*, 1923 in part, and west Texas, *Lincecum*. Var. *δ* only in Unalaschka, *Eschscholtz*, on the "North-west coast," *Douglas*, and in the Cascade Mountains, *Lyall*. Var. *ε* from Unalaschka, *Eschsholtz*, *Chamisso*, *Mertens*, to the Cascade Mountains, *Lyall*, and the Californian Mountains, *Bolander*, Hb. n. 94; the panicled form, San Francisco, *Bolander*.

This species, the type of the group of *Ensifolii*, is as variable as any of its eastern congeners, and its extreme forms are as widely apart in size of stems and leaves, and of flowerheads, in their inflorescence and even in the number of stamens, and transitions between the different varieties are not wanting; but in flower and fruit they are remarkably uniform. —The flowers are 1½ lines long, rarely a little smaller, and only in var. *δ* and *ε* larger; the sepals are narrow, the outer ones always long-pointed, but the inner ones quite variable and often shorter; stamens scarcely more than half as long as sepals; seeds 0.23–0.26 line long and attenuate at least at the lower end, except in var. *δ*; their length is usually equal to

2½ diameters; about 8 ribs are visible on the side; the net-work of the surface and the cross-lines of the areæ are very delicate but quite distinct.

Var. *α* is often 4 feet high, with a stem 3 lines wide, and leaves 3 or 4 or sometimes even 6 lines broad; panicle 4–8 inches long; heads in some forms, and also in the original Haenkean specimen, few-flowered, in others many-flowered; seeds usually slender and almost fusiform. Var. *β*, similar to the last, with leaves 2–3 lines wide, is distinguished by its showy, glistening, golden-straw-colored panicles, about 4 inches in length; sepals almost nerveless; capsules larger than in the other forms and longer than the sepals, thus approaching the following species. Var. *γ*, the mountain and eastern form of the species, is smaller, with fewer heads, either few-flowered and in a small panicle (about 1½ or 2 inches long), or many-flowered, 3–4 lines in diameter and 1–5 or 8 in number; leaves usually ½ to 1½ lines wide. Var. *δ* may be considered a large flowered north-western form of the latter; flowers 1¾ lines or more in length; seeds 0.25–0.26 line long, thicker than in the other forms and with short and abrupt points. Var. *ε*, with its very flat and somewhat curved, sword-shaped leaves, and, usually, few large dark-colored heads of triandrous flowers, looks quite peculiar, but flower, fruit and seed are the same as in the other forms. I find plants of the same habit and with the same kind of leaves and heads among the different forms of *J. Mertensianus* and of *J. phæocephalus*, but the fruit and flowers will always distinguish them. The seeds in this variety are intermediate between those of the last and those of the other forms.—Meyer (Linn. 3, 373) describes *J. ensifolius* with an obovate obtuse capsule; I do not find it so, but suppose he had a specimen of *J. Mertensianus* in view, for which this shape of the capsule is quite characteristic.

49. J. OXYMERIS, n. sp.: caulibus (2–3-pedalibus) e rhizomate repente erectis seu ascendentibus compressis; foliis a latere compressis plus minus distincte nodosis; panicula supradecomposita patula seu stricta; capitulis pauci-(5–10)floris pallidis; floribus pedicellatis; sepalis lineari-lanceolatis acuminato-aristatis, interioribus sæpe paulo longioribus stamina 6 quarta parte superantibus capsula lanceolata rostrata uniloculari plerumque brevioribus; antheris longo-linearibus filamento duplo longioribus; stigmatibus ovarium lanceolatum apice attenuatum cum stylo ei æquilongo æquantibus exsertis; seminibus ovato-oblanceolatis apiculatis areis lævibus reticulatis.—*J. acutiflorus, floribus solito longioribus*, Benth. Pl. Hartw. 341.

Sacramento Valley, Cal., *Hartweg*, 2017, San Francisco and Mariposa, Cal., *Bolander*, Hb. n. 95.

This species is intermediate between *J. xiphioides*, var. *auratus*, the paniculate form of *J. phæocephalus* and *J. dubius;* from the two first it is distinguished by the sharp pointed sepals and their proportion, and the almost subulate capsule, which is similar to that of *J. nodosus*, from the first also by the long anthers, from the last by the flat leaves, and from both these by the sculpture of the seed. Sheaths of the leaves with or without auricular appendages, leaves 1–2½ lines wide; panicle 4–6 inches long; flowers 1¾–2 lines long, greenish straw-colored or sometimes reddish towards the tip; seeds 0.22–0.24 line long, with the ribs (7–9 visible on the side) slightly crenulate but the areæ smooth.

50. J. PHÆOCEPHALUS, n. sp.: caulibus erectis compressis apice capitulum singulum paucave multiflora seu rarissime plura minora paniculata gerentibus; foliis compressis basi auriculatis seu inappendiculatis; floribus majoribus fusco-atris pedicellatis; sepalis lanceolato-ovatis æquilongis omnibus acuminatis acutis vel cuspidatis seu interioribus obtusatis stamina 6 paulo superantibus capsulam obtusam seu acutam mucronatam subuniloculärem æquantibus seu ea paulo brevioribus; antheris late linearibus filamento bis terve longioribus; ovario lanceolato in stylum æquilongum attenuato, stigmatibus elongatis exsertis; seminibus ovatis utrumque apiculatis areis sublævibus reticulatis.—*J. Rostkovii?* Meyer in Rel. Haenk. 1, 142.

Var. *a. glomeratus:* rhizomate longe repente, caule spithameo sesquipedali; vaginis sine auriculis in folia latiora sensim excurrentibus; capitulis multi-(15–25)floris paucis glomeratis.

Var. *β. paniculatus:* caule bi-tripedali; vaginis foliisque ut in *a*; capitulis minoribus pauci-(8–12)floris composite paniculatis.

Var. *γ. gracilis:* cæspitosus caule digitali spithameo; vaginis auriculatis; foliis angustis seu angustissimis; capitulis multi-(15–20)floris sæpius singulis.

California, from the sea-coast into the Sierras; var. *a* near the coast, from Monterey, *Haenke*, *Brewer*, to San Francisco, *Bolander*, *Kellogg*, Hb. n. 96, and to Mendocino, *Bolander;* var. *β* also in the lowlands, Napa Valley, *Bigelow*, San Francisco, *Bolander*, *Kellogg*, Hb. n. 97, and in the mountains, *Bolander;* var. *γ* in the higher mountains, about the "Big Tree Grove," *Hillebrand*, *Bolander*, and especially in the upper Tuolumne Valley, *Brewer*, Cal. St. Surv. 2339, 1709 & 1760, *Bolander*, 5062, Hb. n. 98, and Mono Pass, *the same*, 6013. — All the forms of this variable species are readily recognized by their deep brown heads, large flowers, broad sepals, large conspicuous anthers, long style, and by the markings of their seeds, whatever the height of the stem, width of the leaves or nature of the inflorescence may be.—Flowers 2–2½ lines long; sepals broad and either obtuse, or, usually, acute or acuminate and even with subulate tips, the inner ones as long as the outer ones, but often more obtusish; anthers about 1 line (in a large-flowered specimen of var. γ even 1½ lines) long, always much longer than the filament; capsule long mucronate, scarcely exceeding the sepals, incompletely 3-celled, by the projection of the placentæ; seeds 0.31–0.33 line long, their length being equal to 2 diameters; 8 or 9 ribs visible; reticulation close but distinct; areæ smooth or marked with one or two delicate perpendicular lines, and thus similar to the seeds of *J. scirpoides*, which, however, have fewer ribs.—E. Meyer (l. c.) describes the plant very correctly, but suspecting that the flattened appearance of stem and leaves might be owing to undue pressure in drying, places it with doubt with *J. Rostkovii*, from which it is widely different.

Var. α has leaves 1–2 lines wide, as long or longer than the stem; heads large, about 5 lines in diameter, usually 2 or 3 in a cluster, or sometimes as many as 6 or 8 in a short panicle.—Leaves of var. β 2 lines wide, shorter than the tall stem; panicle loose-flowered, somewhat erect, sometimes 6 inches in length. Some of the mountain forms collected by Mr. Bolander (Yosemite Valley, Cal. St. Surv. 6036, and especially "alpine meadows," 6006, which is only a foot high) have smaller flowers 1½–1¾ lines long, and seem to approach closely to *J. oxymeris.*—Under Hb. n. 97 two forms have been inadvertently mixed, one the real var. *paniculatus*, and the other a tall (2–3 feet high) several-headed form of var. *glomeratus.*—Var. γ is a small mountain form, which with its dark heads, large flowers, and long protruding stigmas, resembles so nearly the smaller forms of *J. falcatus*, that a close examination only will distinguish them; leaves ¼–½ line wide; heads 4–5 lines in diameter, single or two together.

51. J. CHLOROCEPHALUS, n. sp.: caulibus (pedalibus sesquipedalibus) e rhizomate brevi repente cæspitosis erectis et foliis compressis; capitulis multi-(15–25)floris singulis seu paucis glomeratis spatham membranaceam subæquantibus; floribus magnis conspicue pedicellatis pallidis; sepalis oblongis obtusis seu exterioribus et rarissime interioribus mucronatis æqualibus seu interioribus paulo longioribus stamina vix excedentibus; antheris longe-linearibus filamento multo longioribus; stylo ovario ovato pluries longiore exserto; stigmata æquante vel iis longiore; capsula ovata obtusa mucronata uniloculari sepalis breviore; seminibus ovatis utrumque apiculatis reticulatis.

In the higher mountains of California, *Hillebrand*, Cal. St. Surv. 2338; dry places on peaks near Mount Dana, 10,000 ft. high, *Brewer*, Cal. St. Surv. 1804; along the rapid current of streamlets in Yosemite Valley, 4,000 feet high, *Bolander*, Cal. St. Surv. 6033, Hb. n. 99; mountains near Carson City, Nevada, *C. L. Anderson*.— Allied to the last, but readily distinguished by its pale flower heads, which look more like those of some cyperaceous plant, its broad and obtuse sepals, small ovary, very long style, shorter stigmata, and very short obtuse capsule.—The specimens before me are from 10 to 17 inches high, pale green, with the auriculate sheaths often rose purple; leaves ½–1 line wide, like the stem compressed, but not ancipitous, shorter than the stem; 1–3 heads, 6–7 lines in diameter; flowers 2½ lines long, pale or whitish-green, shining; sepals very obtuse, often mucronate or cuspidate, with broad membranaceous margins; stamens scarcely shorter, and sometimes even a little longer, than sepals; anthers twice to four times as long as filament, much exceeding the ovary; style often twice as long as the ovary; capsule, in the only fruiting specimen which I could examine, much shorter than the sepals; seeds (immature) very similar to those of the last species, 0.32 line long and more than half as wide, 7–8 ribs visible on the side, reticulation distinct, but, as yet at least, no transverse lineolation visible.

During the two years which have passed since the first part of this paper, pp. 424–458, was published, the attention of many botanical friends has been directed to our *Junci*, and their exertions have enabled me to add several new species to the foregoing list, complete the history of others, and make several additions and corrections. In the foregoing pages I have already acknowledged the liberality of Professors Roeper and Decaisne, who have enabled me to study the *Junci* of Lamarck and of Michaux; I have now also seen fragments of those collected by Haenke on our western coast from the Herbarium of Prague sent by Professors Kosteletzky and Von Leonhardi, and those obtained on the north-west coast by the Russian explorers, communicated by Director Regel of St. Petersburg. Thus, I believe, I have had an opportunity of examining all the original specimens of the older authors; the single *J. Pylæi*, La Harpe, from the "little island of Saint-Pierre-de-Miquelon, near Newfoundland," remains unknown to me.

The request for assistance in forming an *Herbarium Juncorum Boreali-Americanorum Normale* (p. 424) has been generously responded to by twenty-three botanists, who have sent sets of 99 plants, to be distributed by me among the great standard herbaria of this country and of Europe and among the contributing botanists themselves. They are quoted in these pages as *Herb. norm.* or *Hb. n.* The largest number of species were sent by Messrs. Bolander and Kellogg of California, Ravenel of South Carolina, and Bigelow of Michigan, and after them by Messrs. Porter and Smith of Pennsylvania and Chapman of Florida. My own and the whole botanical fraternity's acknowledgments are due to all of them.

The 99 numbers comprise 38 different species—among them 10 described here for the first time and 12 very rare or critical ones—and 20 important varieties; the balance consist of minor varieties, different forms of the same species or variety, and in a few instances the same plant from different localities. The specimens are not all of equal value or beauty, in some few instances they are inferior, or the different specimens of the same number are sometimes not sufficiently homogeneous for a collection that claims to be a standard one; but on the whole they will be found satisfactory, and many of them very perfect and better and more complete than they can be found in most herbaria. If my friends or the friends of botany in this country will undertake the labor of collecting and sending me specimens of the *Junci* not at all or only incompletely represented in the Herbarium Normale, I will cheerfully promise to do my best to arrange and distribute them in the same manner as in the present collection. I would, in this case, urge the importance of getting not only those species that are wanting in the Herb. Norm., but especially the intermediate and doubtful forms, that connect the different forms of such polymorphous species as *J. scirpoides* or *J. Canadensis* and similar ones.

ADDITIONS AND CORRECTIONS.

Pag. 425. Among the vegetative organs, the *rootstock* (not root-stalk, as misprinted) has been barely mentioned, while it is a most important organ and exhibits many differences in the different species of perennial *Junci*. Very few of our species are annuals, and these all belong to the section *graminifolii: J. bufonius*, *triformis*, *Kelloggii*, and, I believe, *repens*. The others bring forth buds from the axils of the lowest scaly leaves (*Niederblaetter*) at or soon after the period of flowering, and especially at the time the fruit ripens, in the form of short leaf-buds or stolons or horizontal rhizomas, which preserve the existence of the plant through winter while the old stock is decaying, and in the following season produce the new flowering stalks and die themselves in the succeeding summer or fall when their successors are forming, so that the living part of the plant never gets more than a year old; but in most species the rhizoma, often bearing the vestiges of the decayed flowering stems, continues to exist much longer, attached to the living plant, but destitute of vitality. The buds are very short and ascending in the cespitose species, *J. acuminatus*, etc.; in the creeping ones they form shorter or longer stolons, fibrous (*J. falcatus*, *J. phæocephalus*) or fleshy (*J. scirpoides*), and often bearing a bunch of leaves at their end; in *J. nodosus* the stolons form thin fibres, which bear little bulbs, and often a series of them, the source of the stems of next season (see Herb. norm. 74, where in many specimens the old withered stolons with the vestiges of the decayed stems of last season and the new ones can be seen). The species of the first section (*Junci genuini*) have stout horizontal rhizomas, and none stouter than the maritime species (*J. acutus* and *Rœmerianus*), which bear upright stems at almost every node, and not at the end like most *articulati;* where the internodes are short, they become cespitose, where they are long the plants are called creeping; difference in soil and moisture, however, seem considerably to influence the length of the internodes in the same species.

Pag. 427. For "*J. pallescens*," wherever that name is used for one of our species, read *J. acuminatus;* for "var. *fraternus*," var. *legitimus;* for "*J. Buckleyi*," *J. leptocaulis;* and for "*J. saginoides*," *J. triformis*, var. *uniflorus*.

Pag. 428. The "subgenus *Junceltus*" here and p. 436 must be cancelled.

In *J. pelocarpus* and *J. acuminatus* the viviparous buds are the result of retrograde metamorphosis; in other cases they may be produced by insects, and are then much larger degenerations.

Pag. 430. It is evident, that the sculpture of the seeds is the result of the structure of both the epidermis and the next inferior layer of cells, which both together probably constitute the *testa;* in some species it is more one, in others more the other stratum, which gives character to the appearance of the seed. My investigation of these points is not sufficiently advanced to furnish definite results; but I may state, that, what I have, in common with other authors, designated as the *testa*, properly seems to be the epidermis only, consisting of a single layer of cells, always larger than those of the layer under it, and never transverse. In most species the epidermis is thin, transparent, and closely adhering to the body of the seed; in others (*J. Rœmerianus*, *Balticus*, *arcticus*, etc.) it is thicker, swells up when moistened and may then be detached; in others again, those with tailed seeds, it is quite thick and loosely adhering to the body of the seeds, so as almost entirely to obscure their proper sculpture. In the first two classes the cells of the epidermis are about as wide as they are long, and only in part correspond with the sculpture of the seed; they seem, however, to cause the markings designated by me as "levissime irregulariter reticulata" (p. 432,

I. 1). In the third class these cells are narrow and much elongated, sometimes as long as the seed itself, and their thick walls form the ribs of these seeds.

Dr. F. Buchenau, the acute observer of the *Junci*, has published the results of his observations on the seeds of the German species in Botanische Zeitung 25, p. 201 (June 25, 1867). He generally coincides with my views; but a new term for the crossbars of the reticulated seeds, *transtilla*, seems to him necessary, and for my *semina lineolata* he substitutes the words *transverse reticulata*, which is correct in itself and was used by me p. 431 and p. 432, II. 1. but does not seem to me to express the predominant character of these seeds as well as the former term. He also minutely describes the color of the seeds, a character which I have occasionally mentioned, but which seems to be in most species too slight, and even varying, to give it much importance.

Pag. 432. *J. brachycarpus*, *oxymeris* and *falcatus* ought to be classed under I. 2. For "*J. rudis*" read *J. microcephalus*. *J. dubius* comes under I. 3. *J. acutus* belongs rather between I. 1 and I. 2, and *J. Kelloggii* near *J. marginatus*, III. 1. *J. longistylis* together with *J. obtusatus* may be properly classed under I. 2. The apparent necessity of these numerous changes is a proof of the difficulty of properly classing the seeds; only completely ripe and well developed seeds ought to be used for these investigations.

Pag. 433. It ought to have been stated that in the systematic arrangement all the species not expressly marked as belonging to 3-androus sections, are 6-androus.

Add: 5. b. *J. Lesueurii* for subsp. *Pacificus*.

Pag. 434. 10. *J. Smithii* comes under 1. *Aphylli*.

Pag. 435. 27. *J. repens* was inadvertently classed with the 6-androus species. The *Glomeruliflori* would be better arranged thus:

* Triandri. (No. 26 b. & c. sæpius uniflori; No. 30, 3-6-andrus.)

J. Kelloggii, n. sp. California.
J. triformis, n. sp. California.
J. repens, Michx.
J. marginatus, Rostk.
J. leptocaulis, Torr. & Gr.

** Hexandri.

J. falcatus, Mey.
J. obtusatus, n. sp. California.
J. longistylis, Torr.

The other changes, necessary on this and the following page, the reader will please make for himself, following the text from p. 459 onward.

Pag. 438. *J. acutus*. The specimens said to come from New Jersey are from Z. Collins' herbarium, and are, as Mr.

Durand informs me, undoubtedly of European origin; the only certain locality in North America is the Californian one.

Pag. 439. *J. Rœmerianus.* The New Jersey locality rests on the doubtful authority of Pursh; I have seen no specimens collected farther north than Wilmington, N. Carolina, whence Mr. Canby has sent it, Hb. norm. 1.

Pag. 441. *J. Balticus* has been distributed in Hb. norm. 4 from Pennsylvania, *Porter;* 3, Michigan, *Bigelow;* 2, Wisconsin, *Lapham*, and 5, Californian Mountains, *Bolander.* It also occurs on the Pacific coast at least as far south as the Dalles of the Columbia, *Lyall; J. Haenkei*, Mey. Junc. p. 10, is a depauperate northern form.

Pag. 442. In place of "subsp. *J. Pacificus*," put:

5. b. J. Lesueurii, Bolander, in Proc. Acad. Cal. 2, 179 (1863): rhizomate repente; caulibus (2-3-pedalibus) crassioribus mollibus sæpe fistulosis; paniculæ ramis secundis; floribus (bruneo-striatis) majoribus; sepalis lanceolatis exterioribus acutissimis interiora obtusa paulo superantibus, omnibus supra capsulam ovatam vix obtuse angulatam acutam breviorem vel æquilongam conniventibus; antheris 6 late linearibus filamento brevissimo quadruplo quintuplo longioribus; seminibus magnis ovatis obtusis breviter vel vix apiculatis tenuissime irregulariter reticulatis vel læviusculis.—*J. Balticus*, Benth. Pl. Hartw. 341; *J. Balticus*, subsp. *Pacificus*, p. 442; *J. compressus*, E. Mey. Pl. Cham. in Linn. 3, 368, and *J. pictus*, Philippi, ib. 33 (1864), p. 268 (planta Chilensis).

In saltmarshes and in saline sandy soil near the coast of San Francisco bay, *Bolander*, *Kellogg*, Hb. n. 6.—Fl. July and August.—The plant certainly stands close to *J. Balticus*, but may always be recognized by the characters given above, and the habit is quite different. The stems of the larger specimens are much thicker, often 2½–3 lines in diameter, and softer; inflorescence as in all its allies very changeable, sometimes loose but more commonly compact and with strikingly 1-sided branches; flowers larger than in *J. Balticus*, 2½–3 lines long, and capsule from an oval base pointed; seeds 0.30–0-37 and in Chamisso's Chilian specimen even 0.40 line long, smoothish or usually somewhat reticulate, the network corresponding with the cells of the epidermis, which when removed leaves the seed, very similar to that of *J. Balticus*, marked with a distinct but delicate transverse reticulation; something of this is also seen on the inside of the detached epidermis, perhaps from adhering parts of the second layer of cells. *J. Balticus* has usually smaller flowers, 1¾–2 lines long, only in north Pacific specimens have I seen them nearly as large as in *J. Lesueurii;* its capsule is more prismatic and abruptly mucronate, the seeds of the same size, but, evidently owing to the greater transparency of the epidermis, which otherwise exhibits the same structure, always marked with regular transverse reticulation.

Pag. 443. *J. effusus.* Several forms are distributed in Herb. norm.; the common one from Michigan, 7, and South Carolina, 8, and an unusually slender one, 9, from the Californian mountains, where the common one also grows. The western botanists find in the saltmarshes near San Francisco a brown flowered variety, which may be distinguished as var. *bruneus;* inflorescence somewhat looser and fastigiate, Herb. n. 10, or more compact, ib. 11; other differences, if they exist, have escaped me.

J. patens was distributed by Dr. Kellogg in Herb. norm. in two forms; 12 is a tall plant with loose panicles of green flowers, 13 a low (8–15 inches high) rigid form with a more compact darker colored inflorescence.

Pag. 444. J. Smithii: rhizomate longe repente; caulibus ($1\frac{1}{2}$–2-pedalibus) gracilibus teretibus farctis siccis striulatis basi vaginis fusco-rufis breviter aristatis instructis; paniculæ laxæ vix compositæ paucifloræ spatha longissima; sepalis æquilongis, exterioribus lanceolatis acutatis, interioribus obtusis stamina 6 fere duplo superantibus; antheris oblongis filamentum æquantibus; ovario ovato in stylum brevem attenuato cum stigmatibus eo æquilongis fere incluso; cetera vide p. 444.

Found abundantly by Messrs. Smith, Porter and Leidy on Broadmountain, Pennsylvania (Herb. norm. 15), where it had been discovered by the former the year before; also in Rausch's Gap, Lebanon county.—The very complete specimens sent by these gentlemen enable me to complete the history of this, thus far, very rare plant, which proves to be intermediate between *J. Balticus* and *J. filiformis*, with the rootstock of the former and the inflorescence of the latter, and with almost the seeds of *J. arcticus.* Seeds 0.32–0.38 line long, with short and broad appendages and a distinct rhaphe, distinctly but somewhat irregularly reticulate and partly also lineolate; epidermis easily removed after soaking.

J. setaceus; a larger and a smaller form from South Carolina have been distributed in Herb. norm. 14 by Mr. Ravenel; internodes of the creeping rhizom short, stems cespitose.

Pag. 445. *J. arcticus* is more closely allied with *J. Balticus* and *Smithii* than with *J. Drummondii;* more specimens obtained from the coasts of the north Pacific show that the var. *Sitchensis* is not rare there, and extends to Kamschatka; its characters hold their own well.

J. Drummondii, Californian Alps, *Bolander*, Hb. norm. 16.

Pag. 446. *J. Parryi;* a form with the interior sepals obtuse and much shorter than the exterior ones, which are as long as the capsule, was found by Mr. Bolander on alpine meadows, California.

Pag. 448. *J. stygius* also on the north shore of Lake Superior, *O. B. Wheeler;* it seems rare everywhere, so that I have not yet been able to obtain it in sufficient quantity for the Herb. norm.

J. Vaseyi; while I was deploring the destruction of Dr. Vasey's original locality, Rev. Mr. Holzer and Dr. Bigelow discovered this species in abundance in damp open woods on both sides of the river near Detroit, growing together with *J. Greenii.* Dr. Bigelow's fine specimens are distributed in Herb. norm. 17. Many of them are 2½ feet high.

Pag. 449. *J. Greenii;* Dr. Bigelow's Detroit specimens, Hb. n. 19, are 2–2½ feet high, taller and stouter than those found on the coast, Massachusetts, *H. Mann*, Hb. n. 18, Maine, *E. Tuckerman.*—Both species hold their own perfectly well, and can always be readily distinguished by the characters given above; *J. Vaseyi* is also a much more slender plant and flowers earlier, maturing its fruit, near Detroit, in the beginning of July, when the other is just in flower.

Pag. 450. *J. tenuis;* a form with long spathes, most specimens tall, is Hb. n. 20 from Pennsylvania, *Porter;* another, even taller, with the flowers often one-sided, is 21, from Illinois, *Hall;* 22 is the var. *congestus*, from California, *Kellogg*, unfortunately in too few specimens; 23 is var. *secundus*, from Pennsylyania, *Porter.*

J. dichotomus has been found as far north as Delaware and New Jersey, *Leidy*, *Commons*, *Parker*, Hb. n. 24, and others. Mr. Ravenel sends from South Carolina a taller form, Hb. n. 25, and a smaller, few-flowered one, 26.

Pag. 451. *J. Gerardi*, Massachusetts, *Mann*, Hb. n. 27.

J. bufonius, Hb. n. 28, is an erect form from the coast region of California, *Bolander.*—Prof. E. Hilgard found on the sandy beach of Ship Island in the Mississippi Sound the var. *fasciculiflorus* with perfectly smooth seeds; specimens of the same sent by Lindheimer from Galveston show extremely slight marks.

26. b. J. TRIFORMIS, n. sp.: caule annuo brevissimo folioso ramuloso; pedunculis capillaribus scapiformibus numerosis (½–4 pollicaribus) folia brevia filiformia supra canaliculata apicem versus plana longe excedentibus; floribus paucis capitellatis vel singulis; sepalis lanceolato-subulatis æquilongis capsulam ovatam obtusam mucronatam 2–3 locularem fere æquantibus; seminibus ovatis obtusis breviter apiculatis tenuiter pauci-costatis et transverse lineolatis.

Var. α. *stylosus:* planta major (2–4-pollicaris); capitulis 3–5-floris; sepalis stamina et capsulam longius mucronatam paulo excedentibus; antheris longe-linearibus filamento plus quam duplo longioribus; stylo ovario ovato pluries longiore exserto, stigmatibus elongatis.

Var. β. *brachystylus:* planta minor (1–2-pollicaris); floribus binis ternis rarius singulis; sepalis stamina fere duplo superantibus; antheris oblongis filamento bis brevioribus; stylo brevissimo cum stigmatibus brevibus incluso; capsula calycem æquante vel vix excedente obtusa brevissime mucronulata.

Var. γ. *uniflorus:* planta minima ($\frac{1}{2}$–1-pollicaris); floribus bracteis 2 suffultis singulis plerumque 2-meribus (sepalis 4, staminibus stigmatibus carpellisque binis).—*J. saginoides*, p. 436.

California, from the coast to the mountains; var. *a.* Yosemite Valley, alt. 4,000 feet, *Bolander*, Hb. n. 30; fl. July; var. β. Ukiah, Mendocino county, *the same*, Hb. n. 31, fl. May, also "Fort Bragg, near the coast" (1–3-flowered); var. γ. Sierra Nevada, among mosses, *Hillebrand;* upper Tuolumne River, *Bolander*, and in the lowlands, Anderson Valley, *the same*, Hb. n. 32; fl. April and May.

A curious and suggestive little plant, which must considerably undermine our confidence in certain characters, considered of specific value, already shaken by the variations of other species from the same wonderful country; it proves that the singleness or plurality of flowers on the peduncle, the number of their parts, and, if my view is correct, even the proportion of stamens and styles, are not sufficient to establish specific distinction. The first points are established beyond a doubt by some of Mr. Bolander's specimens from the mountain region, intermediate between β and γ with one or two flowers, and often with a dimerous and trimerous one in the same inflorescence. Var. *a* may be considered a distinct species by those that hold its differential characters to be of paramount importance, but the similarity of the whole appearance of the plants and of most of their parts, and, above all, the absolute identity of the well-marked seeds, convince me that it must be united with the others, and that eventually intermediate forms will dispel all doubts.

Only the small dimerous form was known to me when the first part of this paper went to press, and was then considered as the type of a distinct subgenus, *Juncellus*, allied through its single-flowered stems to *Rostkovia*, and distinguished by its dimerism from any other known *Juncus* (see pp. 426, 428 & 436). Mr. Bolander, however, has since discovered other forms of this plant which bear trimerous flowers, thus assimilating it to the ordinary form of *Junci* and more particularly to the European *J. capitatus*, and destroying the subgenus *Juncellus*. I am now convinced that it must be placed with its European ally near *J. marginatus*, in the section *Graminei*, the dimerous variety constituting an anomaly not otherwise observed in this genus, but again found among the allied *Restiaceæ* and *Eriocauloneæ*, where dimerism and trimerism occur in the same genus—whether in the same species, is unknown to me.

In all the forms of this little plant the leaves are 2–12 lines long and $\frac{1}{4}$ line wide, filiform, but fleshy, on their lower part strongly carinate below and grooved above, flattened towards the tip; axillary stems, or properly peduncles, with one or two leaves at their base, naked upwards and much longer than the leaves, bearing at the apex 1–5 or 6 flowers in the axils of membranaceous bracts, half as long as the sepals or smaller; flowers 1–1$\frac{3}{4}$ lines long; sepals green with red, outer ones sharp pointed, inner ones rather broader; seeds 0.23–0.28 line long, their length being equal to 1$\frac{1}{2}$ or 1$\frac{3}{4}$ diameters; 4 or 5 faint ribs visible and between them a well marked cross-lineolation. The central peduncle is really terminal and bears the earliest flowers, the lowest axillary one is the next in the progress of development, and then follow the others in ascending order, so that the one next to the terminal one bears the latest flowers; in the smaller specimens the leaves of the main stem and, consequently, the peduncles are alternating, or in $\frac{1}{2}$ order.

Var. a is the largest one with a remarkably long style, about 3 times as long as the ovary, and much exceeding the sepals and the very long anthers; its seeds, however, are among the smallest of the species;—var. β is intermediate in size between both others; when the heads bear 2 flowers, these are arranged exactly like those of *J. pelocarpus*, with 2 lower bracts, bearing the flowers in their axils, and a third sterile one at the inner base of the upper flower; sometimes this upper flower is dimerous;—var. γ is the smallest one only $\frac{1}{2}$–1 inch high; its single flowers have 2 bracts at their base, just as those of any other single flowered *Juncus*, and alternating with the exterior sepals, the stamens, carpels and stigmas; the inner sepals and the valves of the capsule are opposed to them.

26. c. *J. Kelloggii*, n. sp.: caule annuo folioso brevissimo ramosissimo; foliis e basi vaginali latiore filiformibus supra canaliculatis; ramulis abbreviatis infra foliosis capitula laxa pauci- (3–5)flora terminalia et subinde ex axillis inferioribus pedunculos longiores bifloros gerentibus; sepalis lanceolato-subulatis æqualibus medio herbaceis stamina 3 tertia parte superantibus capsulam ovatam obtusam mucronatam tenui-membranaceam 3-locularem fere æquantibus; antheris oblongo-linearibus filamento brevioribus; seminibus ovatis vix apiculatis pauci-costatis lineolatis.

Sandy soil in San Francisco, in flower and fruit in April, *Dr. Albert Kellogg*, for whom as the pioneer of modern Californian botany, which he investigated and elucidated, at first unaided and struggling with numerous impediments, this plant has been named.—Nearly allied to the last but differing in many striking points, this little species represents a glomerule of a few lines in diameter, pushing out in all directions a number of thread-like leaves; these are 6–10 lines long, and $\frac{1}{4}$–$\frac{1}{2}$ line wide; the short terminal heads are quite loose, the flowers on such distinct peduncles that one would be inclined to consider them as single, if the pair of bracts were not wanting which always surround the base of single flowers in this genus; the lowest axils of a branch often produce longer peduncles, elevated above the glomerate mass, but shorter than the leaves, and bearing small heads, usually of two flowers only. Flowers pale green and whitish, and, especially the capsule, of very delicate structure, 1$\frac{3}{4}$–2 lines long; seeds 0.25 line long, 1$\frac{1}{2}$ diameters equal to the length, similar to the seeds of the last species, but with much more prominent dark ribs, 4 of which are visible on the side.

Pag. 452. *J. repens*, Hb. n. 29, South Carolina, *Ravenel.*

J. falcatus; add: capsula sepala subæquante; seminibus lanceolato-ovatis epidermide plus minus producta subcaudatis irregulariter costato-reticulatis, areis elongatis lævibus.—Sandy soil near San Francisco, *Kellogg*, *Bolander*, Hb. n. 40.—Ripe seeds 0.35–0.40 line long, length equal to 2 or 2$\frac{1}{2}$ diameters; tips slightly or rarely considerably elongated, or the upper one wanting; surface palish and shining, with a thick rather loose epidermis, the cells of which correspond with the reticulation of the seed.—A form from the mouth of the Columbia, *Douglas*, communicated by Dr. Hooker, has an obtuse capsule and thick ovoid seeds.—The differences between this and what I have named *J. Tasmanicus*, p. 453, note, seem to be almost too slight to be of specific value.

Mr. Bolander sends from sphagnous swamps near Mendocino, California, a form which may be distinguished as var. *paniculatus;* analogous to the paniculate forms of *J. phæocephalus* and others; the heads of the simple or somewhat compound panicle are about 5-flowered; Hb. n. 41, not yet in bloom in May; no stipular appendages at the base of the leaves. Maturer specimens would be desirable.

Pag. 453. 28. b. J. OBTUSATUS, n. sp.: rhizomate repente stoloniformi; caulibus (spithameis) erectis lævibus plerumque 1-foliatis folia linearia plana tenuia fere æquantibus; capitulis pauci- seu pluri-floris paucis in paniculam simplicem dispositis; floribus minoribus virescentibus extus leviter scabrellis pedicellatis; sepalis ovatis æqualibus, exterioribus sæpe cuspidatis, interioribus obtusissimis capsula ovata obtusa brevissime mucronulata 3-loculari multo brevioribus; staminibus 6 dimidia sepala superantibus ovarium obtusum cum stylo breviore æquantibus; stigmatibus elongatis exsertis; seminibus ovatis obtusis seu vix apiculatis reticulatis.

Near the Big Tree Grove, Mariposa, California, growing in large tufts, 2–3 feet in diameter, on the sandy banks of streamlets, alt. 6,500 feet, *H. Bolander*, fl. in July.—In many respects intermediate between the foregoing and the following species, this plant is distinguished from both by its small obtuse flowers, green with light brown margins ($1\frac{1}{2}$, or in fruit nearly 2, lines long), the elongated obtuse capsule, and above all by the distinctly reticulated almost obtuse seeds, which in both others are more or less pointed or even tailed and differently marked; the seeds, I could examine, not quite mature, are 0.25 line long and half as much in diameter, and exhibit 8 ribs on one side; their areæ are apparently smooth.

J. longistylis also on the Red River of the North, *Hubbard* in Hb. Lapham; Huerfano Valley of the Rocky Mountains, *Parry;* on the banks of Mono lake in the Californian mountains, *Bolander*, Hb. n. 43.—Stem with several short leaves, always considerably exceeding the linear foliage; seeds apiculate or short tail-pointed, with a distinct white raphe, strongly ribbed, when not perfectly mature, like those of *J. marginatus;* fully ripe seeds with very slight cross-bars and a faint transverse lineolation.

Var.? *latifolius:* caule erecto (pedali) nudo seu basi unifoliato, folia brevia lineari-lanceolata longe excedente; panicula simplici spatha membranacea rare foliacea longiori; capitulis pauci- (3–5-)floris; antheris longe linearibus filamento triplo quadruplo longioribus; seminibus obovatis costato-subreticulatis.

Californian Sierras on alpine meadows or along rivulets in the Yosemite Valley, alt. 4,000 feet, Hb. n. 46; on the upper Tuolumne, alt. 10,000 feet, and frequent on the eastern slope of the mountains, *H. Bolander.*—Easily recognized by its broad (2–3 lines wide) and short (2–4 rarely 5 inches long) light green leaves, few-flowered heads and long anthers. but probably not specifically distinct; seeds 0.25–0.30 line long, reticulate with faint cross-bars, areæ slightly lineolate or almost smooth; 7 or 8 ribs visible.

Pag. 454. *J. leptocaulis;* the Arkansas specimens have been collected by Dr. Leavenworth; for the Texan localities credit is also due to that ardent old gentleman, Dr. Gideon Lincecum, who, in his 79th year, still continues an active botanist, and is now seeking a new field in Mexico.—Mr. Buckley protests against the change of his and the restoration of an older manuscript name, and threatens to lay the matter before the public for arbitration, in which I wish to assist him, referring only to the remarks on page 454.

J. marginatus; var. *paucicapitatus* ought to follow var. *vulgaris;* both are distinguished from the other variety by a more slender growth, meagre panicle, and mostly smooth edges of the leaves; in Herb. norm. only gracile forms are represented, 33 Pennsylvania, *Porter;* 34 West Canada, *Bigelow*; 35 South Carolina, *Ravenel*; var. *biflorus* is a stouter plant with broader leaves, rough on the edges and a larger panicle; Hb. n. 38 Delaware, *Commons*; 39 S. Carolina, *Ravenel*. Intermediate forms do not seem to be rare and are found in Hb. n. 36 and 37. Characters taken from the relative length of the inner and outer sepals, or from the differences in the shape of the capsule, seem to be entirely inconstant. No species bears more abundant seed than this, but in the collections it is rarely found fully mature.

Pag. 455. *J. pelocarpus*; as far west as the banks of the St. Peters river, in Minnesota, *C. C. Parry*.—It seems that the plant attains its normal development, and bears fruit only in a northern climate, and grows then only 4–7 or 8 inches high, Massachusetts, *Tuckerman* in Hb. n. 45, while the proliferous forms usually become 1 or 2 feet high, New Jersey, *Smith & Leidy* in Hb. n. 46; the interesting southern var. *crassicaudex*, Florida, *Chapman*, Hb. n. 47, is often 2 feet or more in height and bears a very large decompound panicle, 5–9 and even 11 inches long.

A specimen of Michaux's *J. fluitans*, from his own herbarium in Paris, bears me fully out in my supposition that it is a depauperate water or mud form of this species; its short, rooting stems, about 4 inches long, bear single terminal 2-flowered heads; the flower I could examine was not fully open yet, and leaves me in doubt whether it is 3- or 6-androus. The description of La Harpe is not quite correct in so far as he attributes to the head 2 external bracts; while they have 3 as the 2-flowered heads of the regular form have, one under each flower, and a third one above the upper flower. Michaux found his plant, as Prof. O. Brunet of Quebec informs me, on the Chicoutimi, about 100 miles north of Quebec.

Pag. 458. *J. articulatus*, as far west as the shores of Lake Erie, *G. W. Clinton*; in Herb. norm. 48 from Western New York, *Sartwell*, and 49 from Massachusetts, *Tuckerman*.—A form with obtuse 5-flowered green heads in a spreading and often almost level-topped panicle, obtuse, mucronate sepals and obtuse short mucronate capsule, which I designate as var. *obtusatus*, has been found by Messrs. *Diffenbaugh* and *Burke* on the river banks near Philadelphia; Hb. n. 50.

INDEX.

The names of the species are in Roman type, those of the synonyms in Italics.

Account of the passage through the Great Cañon of the Colorado of the West, from above the mouth of Green River to the head of steamboat navigation at Callville, in the months of August and September, 1867, *by* JAMES WHITE, *now living at Callville. Reported Jan.* 6, 1868, *to* J. D. PERRY, *Esq., Pres't of the Union Pacific Railway, Eastern Division, by* C. C. PARRY, *Ass't Geologist, U. P. R. Surv.*

Sir—The Railroad survey now in progress under your direction has afforded many opportunities for acquiring valuable additions to our geographical knowledge of the unexplored regions of the far West from original sources not accessible to ordinary map compilers. Mining prospecters within the last twenty years, more adventurous even than the noted trappers of the Rocky Mountains, have scarcely left a mountain slope unvisited, or a water-course unexamined, over the wide expanse extending from the Mississippi River to the Pacific Ocean. Could the varied and adventurous experience of these mountain men be brought into an accessible form, we should know nearly as much of these western wilds, as we now do of the settled portions of our country.

Among the geographical problems remaining for the longest time unsolved, was the actual character of the stupendous chasms, or cañons, through which the Colorado of the west cleaves its way from its snowy source to its exit into the California Gulf. Within the last ten years public attention has been frequently directed to this subject, and various Government expeditions have imparted reliable information in reference to the upper and lower course of this remarkable river. Lieut. Ives, in 1857–8, made a satisfactory exploration of the navigable portion of the Colorado, extending from its mouth to the Great Cañon, and since then a regular line of light draft boats have been successfully traversing these inland waters. Still the *Great Cañon* remained a myth; its actual length, the character of the stream, the nature of its banks, and the depth of its vertical walls, were subjects for speculation, and afforded a fine field for exaggerated description, in which natural bridges, cavernous tunnels, and fearful cataracts formed a prominent feature. Now, at last, we have a perfectly authentic account from an individual who actually traversed its formidable depths, and who, fortunately for science, still lives to detail his trustworthy observations of this most remarkable voyage. Happening to fall in with this man during my recent stay of a few days at Hardyville, on the Colorado, I drew from him the following connected statement in answer to direct questions noted down at the time.

NARRATIVE.

James White, now living at Callville, on the Colorado River, formerly a resident of Kenosha, Wisconsin, was induced to join a small party for the San Juan region, west of the Rocky Mountains, in search of placer gold diggings. The original party was composed of four men, under the command of a Capt. Baker.

The party left Fort Dodge on the 13th of last April, and after crossing the plains, completed their outfit for the San Juan country in Colorado City, leaving that place on the 20th of May. Proceeding by way of South Park and the Upper Arkansas, they crossed the Rocky Mountains, passing round the head waters of the Rio Grande, till they reached the *Animas* branch of the San Juan River. Here their prospecting for gold commenced, and being only partially successful, they continued still farther to the west, passing the *Dolores* and reaching the *Mancas*, which latter stream was followed down to the main valley of the San Juan. Crossing the San Juan at this point, they continued down the valley in a westerly direction for about 200 miles, when the river entered a cañon. Here they again crossed to the north bank, and leaving the river passed across a mountain ridge aiming to reach the Colorado River. In a distance of 50 miles over a very rugged country, they reached this latter stream, or rather its main eastern tributary, Grand River. At the point where they first struck the river it was inaccessible on account of its steep rocky banks; they accordingly followed up the stream in search of a place where water could be procured. At an estimated distance of 12 miles they came upon a side cañon down which they succeeded in descending with their animals, and procuring a supply of water. They camped at the bottom of this ravine on the night of the 23d of August, and on the morning of the 24th, started to ascend the right bank to the table land. In making this ascent they were attacked by Indians, and Capt. Baker, being in advance, was killed at the first fire. The two remaining men, James White and Henry Strole, after ascertaining the fate of their comrade, fought their way back into the cañon, and getting beyond the reach of the Indians, hastily unpacked their animals, securing their arms and a small supply of provisions, and proceeded on foot down to the banks of Grand River. Here they constructed a raft of dry cottonwood, composed of three sticks, 10 feet in length and 8 inches in diameter, securely tied together by lariat ropes, and having stored away their arms and provisions, they embarked at midnight on their adventurous voyage.

The following morning, being on the 25th of August, they made a landing, repaired their raft by some additional pieces of dry cedar, and continued on their course. The river here was about two hundred yards wide, flowing regularly at a rate of $2\frac{1}{2}$ to 3 miles per hour. According to their estimate they reached the mouth of Green River, and entered the main Colorado 30 miles from the point of starting. Below the junction the stream narrows, and is confined between perpendicular rocky walls, gradually increasing in elevation. At an estimated distance of 40 miles from Green River they passed the mouth of the San Juan, both streams being here hemmed in by perpendicular walls. From this point the cañon was continued, with only occasional breaks formed by small side cañons equally inaccessible with the main chasm. Still they experienced no difficulty in continuing their voyage, and were elated with the prospect of soon reaching the settlements on the Colorado, below the Great Cañon.

On the 28th, being the fourth day of their journey, they encountered the first severe rapids, in passing one of which, Henry Strole was washed off, and sank in a whirlpool below. The small stock of provision was also lost, and when White emerged from the foaming rapids, he found himself alone, without food, and with gloomy prospects before him for completing his adventurous journey. His course now led through the sullen depths of the Great Cañon, which was a succession of fearful rapids, blocked up with masses of rock, over which his frail raft thumped and whirled, so that he had to adopt the precaution of tying himself fast to the rocking timbers. In passing one of these rapids, his raft parted, and he was forced to hold on to the fragments by main strength, until he effected a landing below in a shallow eddy, where he succeeded, standing waist deep in water, in making necessary repairs, and started again. One can hardly imagine the gloomy feelings of this lone traveller, with no human voice to cheer his solitude, hungry, yet hopeful and resolute, closed in on every side by the beetling cliffs that shut out sunlight for the greater part of the long summer day, drenched to the skin, sweeping down the resistless current, shooting over foaming rapids, and whirling below in tumultuous whirlpools, ignorant of what fearful cataracts might yet be on his unswerving track, down which he must plunge to almost certain destruction; still, day after day, buoyed up with the hope of finally emerging from his prison walls, and feasting his eyes on an open country, with shaded groves, green fields, and human habitations.

The mouth of the Colorado Chiquito was passed on the fourth day, in the evening, the general appearance of which was particularly noted, as he was here entangled in an eddy for two hours, until rescued, as he says, "by the direct inter-position of Providence." The general course of the river was noted as very crooked, with numerous sharp turns, the river on every side being shut in by precipitous walls of "white sand rock." These walls present a smooth, perpendicular and, occasionally, over-hanging surface, extending upward to a variable height, and showing a distinct line of high-water mark thirty to forty feet above the then water-level.

His estimate of the average height of the Cañon was 3,000 feet, the upper edge of which flared out about half way from the bottom, thus presenting a rugged crest. The last two days in the Cañon, dark-colored igneous rocks took the place of the "white sandstone," which finally showed distinct breaks on either side, till he reached a more open country, containing small patches of bottom land, and inhabited by bands of Indians. Here he succeeded in procuring a scanty supply of Mezquite bread, barely sufficient to sustain life till he reached Callville, on the 8th of September, just fourteen days from the time of starting, during seven of which he had no food of any description.

When finally rescued, this man presented a pitiable object, emaciated and haggard from abstinence, his bare feet literally flayed from constant exposure to drenching water, aggravated by occasional scorchings of a vertical sun; his mental faculties, though still sound, liable to wander, and verging close on the brink of insanity. Being, however, of a naturally strong constitution, he soon recovered his usual health, and is now a stout, hearty, thick-set man. His narrative throughout bears all the evidences of entire reliability, and is sustained by collateral evidence, so that there is not the least reason to doubt that he actually accomplished the jonrney in the manner and in the time mentioned by him.

CONCLUSIONS.

The following may be summed up as some of the new facts to be derived from this remarkable voyage, as additions to our present geographical knowledge of the Hydrography of the Colorado River:

1st. The actual location of the mouth of the San Juan, 40 miles below Green River junction, and its entrance by a cañon continuous with that of the Colorado.

2d. From the mouth of the San Juan to the Colorado Chiquito, three days' travel in the swiftest portion of the current, allowing a rate of four miles per hour, for fifteen hours, or sixty miles per day, would give an estimated distance of 180 miles, including the most inaccessible portion of the Great Cañon.

3d. From Colorado Chiquito to Callville, ten days' travel was expended. As this portion of the route was more open, and probably comprised long stretches of still water, it would not be safe to allow a distance of more than thirty miles per day, or three hundred miles for this interval. Thus, the whole distance travelled would amount to five hundred and fifty miles, or something over five hundred miles from Grand River junction to head of steamboat navigation at Callville.

4th. The absence of any distinct cataract, or perpendicular falls, would seem to warrant the conclusion that in time of high water, by proper appliances in the way of boats, good, resolute oarsmen, and provisions secured in water-proof bags, the same passage might be safely made, and the actual course of the river with its peculiar geological features properly determined.

5th. The construction of bridges by a single span would be rendered difficult of execution on account of the usual flaring shape of the upper summits; possibly, however, points might be found where the high mesas come near together.

6th. The estimated average elevation of the Cañon at 3,000 feet, is less than that given on the authority of Ives and Newberry, but may be nearer the actual truth, as the result of more continuous observation.

7th. The width of the river at its narrowest points was estimated at 100 feet, and the line of high-water-mark thirty to forty feet above the average stage in August.

8th. The long continued uniformity of the geological formation, termed "white sandstone" (probably Cretaceous), is remarkable, but under this term may have been comprised some of the lower stratified formations. The contrast, on reaching the dark igneous rocks, was so marked that it could not fail to be noticed.

9th. Any prospect for useful navigation up or down this cañon during the season of high water, or transportation of lumber from the upper pine regions of Green or Grand Rivers, could not be regarded as feasible, considering the long distance and the inaccessible character of the river margin for the greater part of its course.

10th. No other satisfactory method of exploration, except along the course of the river, could be adopted to determine its actual course, and peculiar natural features, and James White, as the pioneer of this enterprise, will probably retain the honor of being the only man who has traversed, through its whole course, the Great Cañon of the Colorado, and lived to recount his observations on this perilous voyage.

Age of the Porphyry Hills of South-east Missouri.

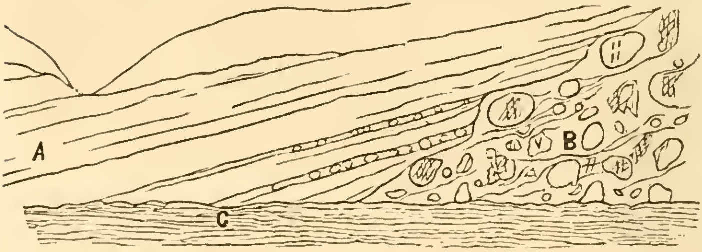
By Edwin Harrison, B.S.

The Magnesian Limestones, interstratified with several beds of sandstone, constitute the sedimentary rocks of Washington and adjoining counties, and, as has been fully developed by the State Geological Survey, belong to the Silurian system. Here and there porphyry hills protrude, some of which deserve, as they have received, the title of mountains, such as Hughes' Mountain, in Washington county, and Buford Mountain, in St. François.

The relation of these porphyry hills and ranges to the sedimentary rocks in contact with them, as regards their relative age, seems never to have been established. Were these hills existing as such before the deposition of the sedimentary rocks which rest against their sides, or were they upheaved, forcing their way through those rocks? As the solution of this question is of some interest as applicable to the geology of a number of counties in this State, I have undertaken it, and, I believe, successfully.

Two localities in this (Washington) county reveal the porphyry and magnesian limestone in contact. One of the localities is a point some six hundred yards south-west of Irondale, in the east bank of Mill Creek. The section, as seen in the bank, is represented by the accompanying sketch.

Between the solid mass of porphyry and the beds of limestone is a conglomeration of waterworn pebbles and boulders, all porphyry, cemented together by a calcareous matrix showing some signs of stratification. Interstratified with the limestone are thin layers containing waterworn porphyry pebbles. The conclusion cannot, therefore, be avoided that the stratified beds took their position in contact with the porphyry at the time of their formation as we now find them, and that, therefore, our porphyry hills existed as such before our Silurian beds were deposited.



A.—Beds of Magnesian Limestone.
B.—Pebbles and boulders of porphyry bound together by a calcareous cement with signs of stratification, all waterworn.
C.—Thin layers in the limestone, consisting chiefly of porphyry pebbles, waterworn.

METEOROLOGICAL TABLE FOR 1866—ST. LOUIS, MO.—By Dr. G. Engelmann.

MONTHS.	BAROMETER. (Reduced to Freezing Point.)				THERMOMETER. (Fahrenheit.)				Evaporation.*	Force of Vapor.	Relative Humidity.	Quantity of Rain and melted Snow in inches.	Prevailing Winds.	Proportion of Cloudiness.	No. of Thunderstorms.
	Mean of the observations made daily at 7, 2, and 9 o'clock.	Highest.	Lowest.	Range.	Mean of the observations made daily at 7, 2, and 9 o'clock.	Highest.	Lowest.	Range.							
Jan.	**29.690**	**30.510**	28.974	**1.536**	**31.8**	55.0	-1.5	56.5	**2.4**	0.134	75,9	4.16	N.W. and S.E.	5.5	2
Feb.	29.736	30.236	29.108	1.128	32.6	69.0	**-9.0**	**78.0**	3.2	**0.124**	67.9	2.24	W. then S.E.	4.9	1
Mar.	29.645	30.078	28.895	1.183	41.8	81 5	13.5	68.0	4.4	0.169	65.8	2.80	N.W.	5.7	1
April.	29.467	29.913	29.152	0.761	59.8	91.0	33.0	58.0	7.9	0.278	**56.1**	1.56	S.E.	4.3	3
May.	**29.441**	**29 670**	**28.842**	0.828	64.2	87.5	41.0	46.5	**8.5**	0.331	56.2	2.24	S.E., N.W., S.W., N.E.	4.6	2
June.	29.465	29.827	29.091	0.736	74.3	94.0	50.0	44.0	8.0	0.524	64.2	5.59	S.E.	3.7	**13**
July.	29.517	29.704	**29.360**	**0.344**	**81.7**	98.0	**62.0**	**36.0**	7.9	**0.726**	68.3	3.67	S.E.	4.2	8
Aug.	29.511	29.739	29.128	0.611	74.5	**100.5**	48.5	52.0	8.2	0.538	64.5	5.16	N.E.	**3.1**	4
Sept.	29.526	29.804	29.206	0.598	63.3	87.5	39.5	48.0	4.1	0.451	**78.2**	**10.53**	N.W. next S.E.	5.7	4
Oct.	29.612	29 985	29.040	0.945	57.7	79.5	30.5	49.0	5.5	0.319	68.6	2.01	S.E.	3.6	1
Nov.	29.553	30.039	29.135	0.904	45.6	73.0	25.0	48.0	4.2	0.207	68.3	**1.37**	S.E.	4.4	0
Dec.	29.570	29.985	28 989	0.996	33 5	**53.5**	8.0	45.5	2.5	0.143	74.9	1.87	S.E. and N.W.	**6.3**	0
	29.561	30 510	28.842	1.668	55.1	100.5	-9.0	109.5	5.6	0.329	67.4	43 20	S.E. next N.W.	4.6	39

* Mean difference of dry and wet bulb Thermometers.

METEOROLOGICAL TABLE FOR **1867**—ST. LOUIS, MO.—By Dr. G. Engelmann.

MONTHS.	BAROMETER. (Reduced to Freezing Point.) Mean of the observations made daily at 7, 2, and 9 o'clock.	BAROMETER. Highest.	BAROMETER. Lowest.	BAROMETER. Range.	THERMOMETER. (Fahrenheit.) Mean of the observations made daily at 7, 2, and 9 o'clock.	THERMOMETER. Highest.	THERMOMETER. Lowest.	THERMOMETER. Range.	Evaporation.*	Force of Vapor.	Relative Humidity.	Quantity of Rain and melted Snow in inches.	Prevailing Winds.	Proportion of Cloudiness.	No. of Thunderstorms.
Jan.	29.555	30.118	**29.792**	**1.326**	**25.6**	**58.5**	**0.0**	58.5	**1.9**	**0.106**	**77.4**	2.28	S.E., W. and N.W.	5.6	0
Feb.	29.528	39.109	28.956	1.153	39.4	69.0	1.5	67.5	3.6	0.165	68.3	4.81	S.E.	5.5	1
Mar.	29.610	30.080	29.041	1.039	33.4	68.0	0 5	67.5	2.3	0.147	77.2	2.37	N.W.	**7.7**	0
April.	29.470	29.800	29.025	0.775	55.6	85.0	31.5	53.5	7.8	0.230	**53.2**	0.53	S.E. and N.W.	5.4	3
May.	**29.423**	29.674	29.070	0.604	60.5	80.5	35.0	45.5	7.7	0.299	57.9	**8.26**	S.E. and N.W.	5.1	7
June.	29.470	29 772	29.139	0.633	78.1	94.5	58.0	36.5	8.5	0.610	64.5	5.64	S.E.	2.9	**13**
July.	29.495	**29.739**	29.255	0.484	79.3	95.0	**61.5**	**33.5**	8.7	**0.630**	64.4	3.71	S.E.	3.6	2
Aug.	29.511	29.743	29.305	**0.438**	**79.4**	**97.5**	58.0	39.5	**10.4**	0 569	58.6	2.29	S.E. next N.W.	2.9	2
Sept.	29.580	29.805	**29.307**	0.498	71.8	92.5	45.0	47.5	8.0	9.488	64.6	**0.17**	S.E. and S.	**2.6**	1
Oct.	**29.614**	29.994	29.237	0.757	58.1	91.5	32.5	59.0	6 6	0.295	62.9	1.31	S.E. and S.	3.3	3
Nov.	29.574	30.040	28.975	1.065	48.2	76.0	7.5	**68.5**	5.9	0.196	59.5	2.74	S.	4.2	1
Dec.	29.562	**30.134**	28.959	1.175	35.6	71.0	12.5	58.5	2.7	0.154	74.2	3.65	S.E. then N.W.	6.5	2
	29.533	30.134	28.792	1.342	55.4	97.5	0.0	97.5	6.2	0.324	65.2	37·76	S.E. next N.W.	4.6	35

* Mean difference of dry and wet bulb Thermometers.

Mr. Meek's Notes on my Preliminary Report of the Geology of Kansas, as edited by Dr. Hayden.

By Prof. G. C. Swallow.

These "carefully prepared Notes," which appeared in the July number, 1867, of Sillman's American Journal, seem to demand some notice on my part.* But before proceeding to the matters in debate, it may be proper to state that this labor is rendered very disagreeable by the peculiar *animus* of these Notes and sundry other papers and criticisms of the same authors. Profs. Marcou, Agassiz, Heer and Geinitz, and Drs. Shumard and Norwood, and Maj. Hawn and myself, all may be wrong in our views of the geology of our North-western States and Territories; still it would be much more agreeable, if those who feel in duty bound to correct our errors would, in doing it, exhibit a little more of the *suaviter* and the amenities so common to, and inseparable from, scholarly men of science. Very few men of sound learning and solid attainments assume supercilious manners, even toward those far below themselves in attainments, and much less toward their peers and superiors. Some of the men, whose papers on our Western Geology have been treated with so much want of consideration, have attained such eminence in science, that even ill-natured critics are usually constrained to admire and honor them. With what feelings, then, must every true lover of science receive their productions?

There was probably no design to make these criticisms so obnoxious and distasteful, as all of us know how much more pleasure we take in reading papers which cultivate the most kindly relations and sympathies and emulations among scientific men. It is, however, to be hoped we shall grow wiser as we increase in age and experience.

But to pass by the manner, tone and bearing of our critics towards their co-laborers in this western field, the paper in question seems to be designed to accomplish several objects:

1. To publish again the extensive labors of Dr. Hayden, assisted by Mr. Meek, in the Territories of the North-west, together with the labors of Messrs. Meek and Hayden in Kansas.

2. To call attention to two supposed errors in my Preliminary Report on the Geology of Kansas.

3. To set forth anew and more in detail the claims of

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* To prevent any misunderstanding respecting my delay in noticing these Notes, it may be proper to state that some geological investigations have detained me in the Territories of the North-west during the last eight months.

Messrs. Meek and Hayden to the discovery of the Permian Rocks of the West.

4. To announce still again the views of Messrs. Meek and Hayden on the Permian System of the West, and to show that they are right, and that all who differ from them are necessarily wrong.

5. To set forth that old array of fossils so often displayed and somewhat rearranged, interspersed with numerous remarks which show the authors possessed of rare intuitive knowledge of the unpublished views of others.

1st.—But so far as I understand the labors of Dr. Hayden in the Territories of "Kansas, Nebraska, Dakota, Idaho, Montana and Colorado," and the assistance rendered by Mr. Meek, it appears proper to remark that we all do owe Messrs. Hayden and Meek, for their explorations and numerous papers on this vast territory, no small debt of gratitude, and that that debt would have been greatly increased, had they stated the facts collected with a little more precision, and had not mixed them up with so many hasty general deductions and conclusions, (which they have felt bound to defend, or lose reputation for accuracy); and had they spent more time in perfecting their own work, and less in correcting what they supposed the errors of others.

There are many rocks in numerous localities in this vast territory, and it will take no small amount of labor to collect all the facts necessary for those positive general deductions of science from which none may presume to differ.

2d.—In regard to the errors in my Preliminary Report, Dr. Hayden complains, in the first place, that I did not give Messrs. Meek and Hayden the credit due them for the discovery of Permian Rocks in Kansas.

I omitted to declare Mr. Meek the discoverer of the Permian System for sundry reasons.

1st. There was no occasion for mentioning the matter.

2d. In 1858, I read a paper before the American Association, setting forth the history of that discovery, which was accepted by all parties interested as a final settlement of the dispute between Mr. Meek and Maj. Hawn.

Dr. Hayden, in a revised edition of an Official Report* on Nebraska, gives a full history of the Permian discovery, save the part which I performed. He mentioned Maj. Hawn's discovery and the announcements made by Messrs. Meek and Hayden, and Drs. Shumard and Norwood and Mr. Worthen, but my name is carefully omitted. He also speaks of what was done at the American Association, and the Permian fossils there exhibited, and still no intimation that I had any

* Acad. Nat. Sci. Phil., vol. 10, p. 144.

part in the matter, either in the papers read or the fossils exhibited. But of this I never complained, nor had I deemed it of sufficient importance to mention, although it would be as charitable to suppose one could give a history of the geological discoveries at the Black Hills and inadvertently omit the name of Dr. Hayden, as to suppose there was no design in omitting my name from this history of the Permian discoveries in the West.

And yet Dr. Hayden says: "At the same time, Meek and Hayden manifest no desire to ignore the connection of Mr. Hawn and Prof. Swallow with the Permian discovery. They have the right to expect their own agency in the matter to be acknowledged, especially in an official report." (Am. Jour., July, 1867, p. 39.)

But he had ignored my agency in it, when, to do it, he was compelled to mar the truth of history, and that, too, in an "Official Report." On the contrary, when I wrote the history of the discovery, I gave Messrs. Meek and Hayden all they or their friends claimed, and when I have occasion to refer to the matter, or when I write up the history for my detailed report, it shall be my pleasure to do them and all others full justice.

Hence all complaints in this regard seem to come with exceedingly bad grace from Dr. Hayden.

I gave no history of the discovery whatever, and yet Dr. Hayden complains that I did not mention his name and Mr. Meek's. And yet, he nine years before, gave a full history of the matter, and designedly left out one of the principal actors; and yet no one but himself and Mr. Meek has thought the matter of sufficient importance to refer to it.

3d. As to the discovery of Permian Rocks in the West, the question whether these rocks do really exist, was one of primary importance to the scientific world; but it matters little whether Mr. Meek, or somebody else, made and published that discovery first. And yet, to this unimportant part of the subject Dr. Hayden devoted two full pages of the American Journal of July last, and Messrs. Meek and Hayden, either jointly or singly, have consumed, on this subject, large portions of several papers in various scientific publications* during the last ten years.

At first, the object seemed to be to prove that Mr. Meek was entitled to the sole honor of discovery, but afterward, to show that Messrs. Meek and Hayden were joint wearers of this honor and that of the first announcement also.

After I had made the discovery and sent a notice of the

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*See Trans. Albany Institute, vol. 4; Trans. Acad. Nat. Sci. Phil., 1858, p. 144; Trans. Acad. Nat. Sci. Phil., 1858, p. 9; American Journal, July, 1867, p. 38.

fact to the American Journal and the St. Louis Academy of Science, on the 16th of February, 1858, I learned that Mr. Meek was exceedingly troubled that he had lost that small honor. By the solicitation of his friends, I made a statement in the American Association, at Baltimore, in May, 1858, giving Mr. Meek all the credit he then claimed. This statement was acquiesced in by all the interested parties as a final settlement of the whole matter; and as such, it was published in the proceedings of the Association* and the American Journal.

So far as I remember, I have referred to the matter but once since, and then merely to repeat one of the items in the statement made at Baltimore, and that without addition, subtraction or comment, although Messrs. Meek and Hayden had, both jointly and singly, made sundry statements, both unjust and distasteful from one who had received from me a credit for discovery, which many believed belonged to myself, and which Dr. Hayden has well nigh proved does not belong to Mr. Meek. The Baltimore statement was made to put a final quietus upon the unprofitable discussion. But they will not let it rest; they keep its miserable ghost in an everlasting perambulation to the infinite disgust of the scientific world.

As some of our most distinguished geologists doubted the existence of Permian Rocks in the West, and as Messrs. Meek and Hayden, even after they claimed the discovery, were so very doubtful that they used no stronger expressions than that their fossils *indicated* the existence of Permian Rocks,† there seemed to be a necessity for publishing the section of Maj. Hawn and a description of the fossils which proved the rocks Permian. This was done in one or two journals, and a paper was read before the American Association at Baltimore, where the fossils were exhibited, and a full discussion was had of the whole subject.

Since then I have published nothing upon the geology of Messrs. Meek and Hayden's peculiar provinces, (save that small Preliminary Report on the Geological Survey of Kansas, which has so sadly displeased them,) though I have lived in this region 17 years, and spent a large part of that time in examining its geology and noting the facts collected.

But Messrs. Meek and Hayden have so unfairly discussed the matter of discovery that it becomes necessary to set the matter right. It is not proposed to change the settlement

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* Proc. Am. Ass., 1858, p. 220; Amer. Jour., Sept., 1858, p. 187.

† In the record of their discovery, made in the Smithsonian Institute, they say "*forms indicating Permian*," while the Potsdam and Carboniferous are mentioned in positive terms, showing decided doubts about the Permian. So, also, in the title of the Paper in the Trans. Albany Ins., vol. IV., in which Messrs. Meek and Hayden made their first announcement.

made in 1858, except so far as it has been done by the parties above named. It is not proposed to follow them through all their devious course on this subject, but to bring out some of the salient points.

It seems Mr. Meek had long entertained the hope* that Permian Rocks would be discovered somewhere in the West. He also had in his possession Permian fossils† from three or four localities some six months or more previous to the discovery and announcement of these fossils in Kansas. He also had vague suspicions that these fossils might be "*Carboniferous*," "*Triassic* or *Permian*," and wrote many times to Maj. Hawn and Dr. Hayden, urging them to find and send him more fossils, that he might determine what they really were. He also urged Maj. Hawn to get the fossils out of my hands before I had examined them.

And yet, with all these materials, and all this anxiety to get more fossils, and all this fear lest I should examine and determine the character of the fossils, he did not come to any definite conclusion that they were Permian until the announcement was made, and even then he was doubtful.‡

But it is said Messrs. Meek and Hayden made a record in the Smithsonian Institute.§ This way of announcing a discovery is unique, and ought to have been made in the Patent Office. This record consists of fossils spread on a table, and a statement to Prof. Baird, that the first fossils are "*Potsdam*," the next are "*Carboniferous*," the next, "*forms indicating* Permian." This certainly shows that Meek and Hayden had discovered some Potsdam and Carboniferous fossils, and that certain forms will *probably* prove to be Permian. It is no declaration that they are Permian, but an indication that they may prove to be such. This is a safe record to make.

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* Perhaps he got it while an assistant in the Missouri Survey, where the matter was often discussed. The prophetic declaration that it would be found in Missouri, points in this direction. See Proc. Acad. Nat. Sci. Phil., 1858, p. 144.

† Amer. Jour., July, 1867, p. 39, note; Trans. Albany Institute, 1858, pages 1, 2, 4 and 15 of M. & H.'s paper; Proc. Acad. Nat. Sci. Phil., 1858, pp. 42 and 47.

‡ His convictions are expressed in his letters to Maj. Hawn. In one, he says: "Your fossils from the Smoky Hill are of a suspicious character, that is, they lead me to think the beds may be, after all, *Triassic* or *Permian*, although they may belong to the *Coal Measures*."

On the 21st December, 1857, he wrote, "I do not pretend to say that they are Permian, but that some of them look suspicious. They may belong to the *Coal Measures*." (See Trans. Acad. Sci. St. Louis, vol. 1, No. 2, Feb. 22, 1858, Maj. Hawn's note.)

These letters prove conclusively that Mr. Meek had made no discovery of Permian fossils. He thought they belonged to one of three formations, and that was all he could say.

§ Proc. Acad. Nat. Sci. Phil., 1858, p. 44, E. and F. of section.

If they prove to be Permian, it shows the prophetic power of those making it; and if it proves not to be so, it will soon be forgotten.

That this was the interpretation they themselves put upon it, is proved by their paper on these same fossils from the Black Hills, published March 2d, 1858. In this section of the Black Hills, they put the Potsdam and Carboniferous rocks, but no Permian. They not only leave these rocks out of the Permian, but actually place them in the Carboniferous, and below the middle of that system.* And this is the interpretation they themselves put upon this record six weeks after it is made. They declare these fossils Carboniferous rather than Permian. But four months later, they revise this section† and change these rocks (E. and F. of section) to the Permian, with a statement showing they were in doubt when this record was made, or afterwards.

These two letters to Maj. Hawn, above quoted, and this record in the Smithsonian Institute, are the strongest proofs yet adduced that Mr. Meek, or Dr. Hayden, had discovered the Permian before I announced the fact, and these most positively prove that they were not fully satisfied whether these fossils were "Permian or Carboniferous or Jurassic." They rather thought they were Permian, at times, but seemed unwilling to risk an announcement.

On the 2d of March, 1858,‡ they read a paper before the Albany Institute, with this caption: "DESCRIPTION OF NEW ORGANIC REMAINS FROM NORTH-EASTERN KANSAS, INDICATING THE EXISTENCE OF PERMIAN ROCKS."

This is called an announcement of a discovery; but it is simply a declaration that it may become a discovery, and it is probable the authors now so consider it, since they insist on calling rocks in Kansas Carboniferous, which contain nearly or quite all of the species described in this paper. In their opinion, therefore, these fossils still merely *indicate* Permian Rocks, and do not prove them to be such. And this is proved to be the interpretation they wished to be put upon it by their letter to Prof. Leidy, read, by their request, before the Academy of Natural Science, at Philadelphia, on the very day this paper was read before the Albany Institute.

The officers of the Academy so understood it as proved by the record then made. A "letter * * * *indicating* the *probable* existence of Permian¶ Rocks." This is very

* See Amer. Jour., July, 1867, p. 38.

† Proc. Acad. Nat. Sci. Phil., 1868, p. 144.

‡ Eight days after my announcement was made in the St. Louis Academy of Science. (See Trans. Feb. 22, 1858.)

¶ Proc. Acad. Nat. Sci. Phila., 1858, March 2.

doubtful, a mere probability of a probability that these rocks will prove to be Permian, and the letter itself is quite as non-committal.

And it was not until after Dr. Shumard and Maj. Hawn and myself had published several papers proving these rocks Permian, and not until after the meeting of the American Association at Baltimore, that Dr. Hayden in his paper* of June 22d, ventured to refer to this publication as designed "to announce a conclusion." If it was a *conclusion*, it certainly decided nothing, and expressed no positive opinion respecting the age of the rocks.

At the Baltimore meeting, Mr. Meek wanted some credit for the discovery, although he still doubted whether there really is any Permian System.

But when Messrs. Meek and Hayden found the identity of the Kansas Rocks with the Permian of Europe fully established, at the Baltimore meeting, and that neither they themselves nor others could distinguish the Kansas fossils from the characteristic Permian fossils from Europe there presented for comparison, and when they had seen Mr. Worthen's fine collection of (Permian) fossils from Illinois,† Dr. Hayden makes haste to write a history of all the discoveries and publications made on the subject, save what I had done in the premises, and to announce, "We have, therefore, reliable evidence of the existence of these rocks in Kansas, Nebraska, New Mexico and Illinois,"‡ and this (read June 22d, 1858) is the first declaration, so far as I can discover, of any settled opinion on the subject, by either Mr. Meek or Dr. Hayden.

In this same paper, they revise§ their Geology of the Black Hills, by taking the Permian Rocks, F. and E., from the middle of the Carboniferous System, and erecting them into the dignity of a Permian system ||

But Prof. Rogers states in the British Association, that he

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* Proc. Acad. Nat. Sci. Phil., 1858, p. 144, note.

† But Meek and Worthen now pronounce these "*fine Permian fossils*" Carboniferous. (See Illinois Reports.)

‡ Proc. Acad. Nat. Sci., 1858, p. 144.

§ Dr. Hayden says, this revision enables him "to add some geological *formations not previously known to exist* in the West." He added Devonian (?) and Permian only. The Permian, therefore, was not previously known to exist in the West. This was said June 22d, 1858. What then, did Messrs. Meek and Hayden mean by that record in the Smithsonian Institute, made five months before?

|| This would look like a belief in the Permian, had they not added a note to the effect that "they do not wish to be understood as giving any opinion on the question whether there really is any such thing as "the so-called Permian."

has seen no satisfactory evidence that these Kansas Rocks are Permian.

Drs. Shumard, Norwood, and Swallow, and Maj. Hawn, satisfied to let the question rest on the evidence already adduced, say nothing more.

Affairs look dubious again, and Messrs. Meek and Hayden hasten to Kansas and examine a "large part of it," and make a large collection of fossils. After several months, they gave us the results,* which is, in substance, that there is really no evidence in Kansas, either on palæontological or lithological ground, of a Permian System,† although some of the rocks are "equivalents of the so-called Permian of Europe."

Thus, this matter is wisely settled. They pertinaciously held on to the discovery, and at the same time, fearing they have discovered nothing, they say, no evidence has been found that there really is anything to be discovered.

But, in the course of events, Prof. Newberry, in summing up for the use of the Government what was known of Kansas Geology, declares the evidence conclusive that the Rocks in question are the "representatives of the Permian Rocks of Europe."‡ And this, too, on the facts adduced by Messrs. Meek and Hayden. He probably did not know of any other evidence, as he did not refer to any.

And Count D'Archiac§ positively declares in his History of Geology, that our western geologists have clearly proved the existence of the Permian System in several localities in the West. Then follows my Preliminary Report, which shows a very distinct Permian System.

This is a little too much of a good thing, which they had well-nigh abandoned; and Dr. Hayden, fully armed with copious notes from Mr. Meek, publishes the remarkable paper which made this article necessary.

In this paper, they claim the Permian, not only by right

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* Proc. Acad. Nat. Sci. Phil., 1859, p. 20.

† "The passage from the Carboniferous to the strata containing Permian types, however, is so gradual here, that it seems to us that no one undertaking to classify these rocks without any knowledge of the classification adopted in the Old World, would have separated them into distinct *systems*, either upon lithological or palæontological grounds, especially as they are not, so far as our knowledge extends, separated by any discordance of stratification, or other physical break."

‡ See Colorado Explor., Ex-Lieut. Ives, p. 110.

§ "Les découvertes si importantes de MM. Swallow, Hayden, et G. Shumard au Nouveau-Mexique, de MM. Swallow et Hawn dans Kansas, de M. Norwood dans l'Illinois, etc., justifient pleinement, au contraire, l'existence de la faune permienne, et par conséquent de cette formation dans cette partie du nouveau continent, sans cependant autoriser, quant à presént, une division en deux groupes qui correspondraient d'une manière absolue, l'un au *zechstein*, l'autre au *rothe-todte liegende*."

of discovery, but also by right of certain private letters and that *Smithsonian Record.* But all these letters and the record only prove that they considered the Permian fossils *suspicious*; they might prove to be "*Jurassic* or *Coal Measures*," or *Permian:* they "*probably* would." *

If Dr. Hayden has proved any right of discovery, it is, that it belongs to Messrs. Meek and Hayden jointly, and not to Mr. Meek, as has been claimed for almost ten years.

These curious results, deduced from the numerous letters and papers of Messrs. Meek and Hayden, are mentioned not so much for their importance, as for their wonderful lack of consistency and the light they throw upon a matter made so prominent by Messrs. Meek and Hayden, the guardians of Western Geology.

4th. Messrs. Meek and Hayden do not like my section of the Kansas Rocks. Let us exactly understand in what we agree and in what we differ.

My section contains every stratum in Kansas, from the Cretaceous to the Lower Carboniferous, as they are developed on the south side of the Kansas River.

In this, I presume we agree. We only disagree as to the division of this section into geological systems.

Dr. Owen and other geologists classified that portion of the rocks forming the lower 2,000 feet of the section, as *Lower Carboniferous.* But in 1853, it became my duty to examine and describe them, and show them to be Coal Measures. Mr. Meek says the proof was conclusive, and Dr. Hayden calls them Coal Measures. On this 2,000 feet, then, we agree.

Immediately under the Cretaceous Rocks there are 388 feet of gypsums, shales and marls, which I call Triassic (?); which means simply, I do not know what they are, but that such evidence as I have *indicates* Triassic. Messrs. Meek and Hayden said, in 1857, they "may be Jurassic or Triassic, or both,† but incline to the opinion that they are Jurassic; but in 1867, they are inclined to think they are Triassic.‡ We therefore, agree on this part too, as well as two parties can agree where one does not agree with itself.

The next 141 feet are called *Permian* in my section. Messrs. Meek and Hayden say they are the equivalents of "the so-called Permian Rocks of Europe." On this division then, we agree. The remaining rocks between the Permian

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* If they have no better proof of claims, it seems to me, they had better fall back on the Baltimore Record, which none but themselves have shown any disposition to disturb or ignore.

† See Amer. Jour., Jan., 1859, p. 34; Proc. Acad. Nat. Sci., 1859, p. 21.

‡ Amer. Jour., July, 1867, p. 40.

and the Coal Measures, some 563 feet, are called Lower Permian in my section. Messrs. Meek and Hayden call them "Permo-Carboniferous." I think them related to both the Permian and Coal-Measures, but more to the Permian. They think them related to both the Permian and Coal Measures, but more to the Coal Measures. Our only difference, then, is as to the degree of relationship which these rocks bear to the Permian and Coal Measures.*

My principal reason for calling these rocks Permian is, that they contain many more Permian than Carboniferous fossils, while Messrs. Meek and Hayden† declare the preponderance is in favor of Carboniferous fossils.‡

5th. Dr. Hayden, by Mr. Meek's notes, spends great learning in a criticism on my list of Lower Permian fossils, published ten years since. He well knew that all my materials for the papers published in 1858 were collected by Maj. Hawn, under such circumstances as would preclude absolute accuracy.§ Still, it is a fact that all the materials collected since by Messrs. Meek and Hayden and Maj. Hawn and myself have not materially changed the principal divisions of the section then published by Maj. Hawn in our joint paper, on the Permian. The progress of a single season compelled Messrs. Meek and Hayden to make more changes in their Nebraska section than the progress of the last ten years has made in Maj. Hawn's. It was a matter of surprise to me to find the rocks so accurately represented in the main features of his section.

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* This is the extent of my sinning.* Rather small to call for such an article as Dr. Hayden's.

† Messrs. Meek and Hayden claim deference to their opinions, because they examined these beds so carefully for several weeks on and near the junction. But aided by Maj. Hawn, I spent two seasons on and near the junction of these rocks, and have lived seventeen years on the rocks forming a part of this section.

‡ This is a simple difference of opinion. And to test the matter, since Dr. Hayden is so very positive in his assertions, I make two propositions, and pledge myself to make them good. I will find two Permian species in these rocks to every Carboniferous one Messrs. Meek and Hayden will find, and I will produce more Carboniferous fossils from a single foot of rocks, just below my line of division, than Messrs. Meek and Hayden can from all the 700 feet of rocks above it, and I will set my labor against both of theirs, and only occupy the same time they do jointly.

§ Proc. Acad. Sci. St. Louis, vol. 1, p. 175, note.

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* I cannot close this part of the subject without making my acknowledgments to Dr. Hayden for writing a letter to a prominent official in Kansas, detailing this, my error, and hence my unfitness to discharge the duties of State Geologist. It was understood that this letter was designed for publication. The merits of this act of labor with the civil authorities of Kansas is made still more manifest in view of the fact that the decision of this matter either way would make no difference in the economical Geology of Kansas. The rocks would have the same properties and value whether Dr. Hayden's views or mine are correct. There was, then, no necessity for this letter, and it must have been a pure labor of love.

But Dr. Hayden thinks my catalogue of fossils does not sustain my Lower Permian. But the logic of the conclusion is not apparent, even admitting all his corrections, additions, subtractions and all the other statements he makes about it to be true; whereas, many of them, though stated as matters of fact, are strangely different from what appears to be the real state of the case.

My catalogue gives fifty-seven species (Dr. Hayden says it gives seventy) of Lower Permian fossils, and only sixteen of these had been found in the Carboniferous Rocks, and nearly all of the other forty-one were Permian, or allied to Permian species. This is a good showing for the Permian side. And the late investigations by Messrs. Meek and Hayden and Maj. Hawn and myself make it no worse, but rather the better.

But let us examine this matter a little more in detail. Dr. Hayden says that all the sixteen Lower Permian and Carboniferous fossils given in my catalogue, save two, are found in the Lower Permian; but Maj. Hawn and myself were unable to find, and Messrs. Meek and Hayden did not find (or mention) nine of them in the Lower Permian, viz.: *Productus æquicostatus*, and *Rogersii*, *Spirifer pectenifera*, and *cameratus*, *Chonetes*, *Flemingii*, *Orthisena umbraculum*, *Athyrus subtilita*, *Naticopsis Pricei*, nor *Macrocheilus spiratus*.

Subtracting these nine, then, we have seven Coal Measure fossils left in the Lower Permian.

But Dr. Hayden says he knows that eight others are found there, which must be added, viz.: *Spirifer lineatus*, *Chonetes mucronata*, *Euomphalus rugosus*, *Productus Calhounianus*; *Philipsia Cliftonensis*, *Nautilus occidentalis*, *Aviculo-pecten occidentalis*, and *Fusulina cylindrica*. But it is almost certain that *Spirifer lineatus* does not range up into the Lower Permian. We never found it there, and Messrs. Meek & Hayden say, "it appears not to range very high in the Upper Coal Measures of Kansas." There is, however, a small spirifer in these rocks somewhat like the *lineatus*, but we never found it in the Carboniferous Rocks below. The *Productus Calhounianus* is not found below the upper beds of the Coal Measures, though Messrs. Meek and Hayden have often quoted me as saying it ranges down into the Lower Carboniferous rocks. In this, also, they must be mistaken; for I have never given it a habitat below the Upper Coal Measures. When it was first noticed and described with Maj. Hawn's collection of Coal Measure fossils, I was satisfied it belonged to the Permian Rocks, and said, "as far as observed, it is confined to the Upper Coal Measures* (?) and

* The variety *Kansasensis*, I then supposed, was found in the Encrinital Limestone. This opinion was based upon an imperfect specimen, and

the Lower Permian," and there has been no reason to change the habitat since.

Messrs. Meek & Hayden, it is true, say it ranges down low in the Coal Measures, but they, at the same time, say it is almost or quite impossible to distinguish it from the *semi-reticulatus*. If they cannot distinguish it from the *semi-reticulatus* they certainly should not add it to a list which already contains that fossil, (I will add it, as it possibly ranges into a few of the upper beds of the Coal Measures), nor is it obvious how *they*, who do not know the fossil, can declare that it ranges so low in the Coal Measures.

If, then, we add the 7 others suggested by Dr. Hayden, we shall have 14 instead of 16 fossils (as given in 1858) common to the Lower Permian and the Coal Measures, still an improved showing for the Permian, after all Dr. Hayden's corrections. But there are 8 or 10 Permian fossils to be added, and the catalogue for the Lower Permian, when revised to meet the present state of our knowledge, will stand about 15 Carboniferous to 50 Permian fossils, which, being over three to one, will make it necessary to continue the rocks containing them in the Permian System,* even were there no other evidence; unless, indeed, Messrs. Meek & Hayden succeed in proving that there is no Permian.

But Messrs. Meek and Hayden object to the genus *Bellerophon* as not known in the Permian of Europe, and "not known above the Coal Measures" anywhere.† But Messrs. Meek and Hayden found it in the Permian, as they themselves say, of both Kansas and Nebraska,‡ and Maj. Hawn found it in the same rocks in Kansas which proves it a Permian genus.

Dr. Hayden also thinks fossils of the genera *Monotis*, *Bakevellia*, *Schizodus*, *Pleurophorus*, *Synocladia*, and *Thamniscus*, because three of the six range down into the older rocks, are no proof of the Permian system; and yet Messrs. Meek and Hayden considered the genera *Monotis*, *Pleurophorus*, *Bakevellia* and *Myalina* sufficient evidence to announce§ a Permian discovery upon, though all of them

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subsequent investigations have disclosed no additional proof. But this fossil is very distinct from the *Calhounianus*, and its distinctive marks are permanent, and I have never found them together.

* According to the best authorities there is a still larger number of undoubted Carboniferous fossils in the English Permian. There is a list of 20 in the American Journal, vol. 35, p. 133. King's Monograph mentions a number.

† Am. Jour. 1867, p. 331 *et al.*

‡ Acad. Nat. Sci. Phil. 1858, p. 44, and 1859, p. 30.

§ Am. Jour., 1867, p. 331 *et al.*

range down into the Carboniferous rocks, as they have informed us.

Dr. Hayden says: "The occurrence of a few types that would generally be regarded as Permian along with numerous well known Coal Measure species far below the Permian," etc., etc. If this curious hypothesis is designed to represent the facts in our Lower Permian, the Dr. may be a little too fast. He should remember that, according to the present state of our knowledge on this subject, these rocks contain more than three fossils of Permian types to one of Carboniferous, nor should he say they are "far below the Permian," for that is just what he is trying to prove, the question at issue—what logicians call "*begging the question*."

The Dr. also says the Permian types in Kansas do in several cases appear in something like "*colonies*" far down in the Coal Measures,* in beds similar to Permian Rocks. This is worthy of note. I have often thought it strange that so many of our Permian fossils should be found scattered off "far down" in the older rocks, as found by Messrs. Meek and Hayden, but it is still stranger that whole "*colonies*" should travel so far from home and carry their accustomed Permian beds with them. These facts might be looked upon as "indicating the existence of Permian Rocks," and that they are not, after all, so "far down in the Coal Measures" as Messrs. Meek and Hayden† have sometimes put them.

It must also be added, in order to have the full force of the Palæontological argument, that scarcely any of the 15 fossils admitted to be common to these Lower Permian rocks and the Coal Measures range below the very highest beds of

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* If this be so, why may not *colonies* and, much more, a few species, of Carboniferous fossils be found in the Permian? Messrs. Meek and Hayden seem to labor under the erroneous impression that in seeking a division between the Permian and Carboniferous, they must begin at the lowest beds and work up, and place all the rocks in the Carboniferous until the last Carboniferous fossil disappears. But if they begin in the upper beds of the Permian and work down, following the same rule, they would be compelled to place more than a thousand feet of the Upper Coal Measures in the Permian; as they say, they themselves found Permian fossils that low down in the series. And, besides, if they apply the same rule to the other systems, they will blot out several, if not all, above the Silurian. Even the venerable Devonian system will disappear with the others.

† There may be no harm in remembering in this connection, that two of *these colonies*, E. and F. of Messrs. Meek and Hayden's Nebraska Section, never did wander "far down" in the Coal Measures as represented by Messrs. Meek and Hayden, (see Acad. Nat. Sci. Phil., 1858, p. 144,) but like sensible fossils staid at home, as shown by these same authors a few months later. (See Acad Nat. Sci., 1858, p. 144.) It may be expected that when Messrs. Meek and Hayden correct the rest of their own work on the Permian and Coal Measures all of the other "*colonies*" will be found at home in the Permian Rocks, snug and close where the Creator put them.

the Coal Measures. And it is almost certain that the larger part of them are not absolutely identical with the species to which they are referred in the Coal Measures. Even Messrs. Meek and Hayden say they are "rather intermediate* in their affinities."

The true *Productus Calhounianus* is certainly permanently different from the species (*P. semi-reticulatus*) to which it is referred by Mr. Meek. And the same may be said of the *Pecten Cleavelandicus*, *Productus Norwoodii*, and others. And it will need no argument of mine to show that permanent varieties are of great value in determining formations. In fact some contend that they should be reckoned as species.† Even Mr. Meek is compelled to take this side of the question in his famous review of Prof. Geinitz, and it is the only view to make fossils the most useful.

But if these arguments of Messrs. Meek and Hayden prove the rocks in question not Permian, they will equally prove there are no Permian Rocks in Kansas; for all of their arguments will apply with equal force, and some of them with still stronger force, to the rocks which we all agree are Permian, or equivalents of the Permian of *Europe.*

By following their line of argument and assuming these Lower Permian Rocks to be Coal Measures, as they do, and that all the fossils in them are Carboniferous, and that only those fossils confined to the Permian Rocks are *Permian fossils*, we shall find that the rocks admitted to be Permian by all, contain more Carboniferous than Permian fossils; that is, a larger proportion of the fossils in the Permian range down into the Lower Permian, than from the Lower Permian down into the Coal Measures.

And if *Monotis* and other Permian *genera* do not prove these rocks to be Permian, they cannot prove any other rocks Permian.

If *Monotis Halli*, and *speluncaria*, *Schizodus Rossicus* and other Permian species do not prove these rocks Permian, they certainly do not prove those above them to be Permian.

And besides, the objectionable *genera Bellerophon, Orthisena*, etc., are in these rocks, which all admit to be Permian.

We also have such a change in the lithological characters of the rocks at our line of separation that the rocks above and below it can be distinguished at a distance of ten or fifteen miles; but where Messrs. Meek and Hayden make the line of separation they themselves say there is "no lithological change."

Now, this lithological argument is very important in con-

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* Am. Jour. No. 79, p. 35.

† Am. Jour., No. 131, 1867, p. 170.

nection with others, and the geologist who neglects it must expect to fall into errors, which will ever mar his work. And besides, the line between the Lower Permian and Coal Measures is marked by a striking non-conformability or a "*thinning out by erosion*," as they call it. But Messrs. Meek and Hayden say there is none, where they make the division.

If, then, my Lower Permian is not Permian, there is no Permian in Kansas, and Messrs. Meek and Hayden never discovered any, and they have made a great ado about nothing, for all the arguments, palæontological, lithological, and those from non-conformability, are stronger for the lower than for the upper line of separation.

But Dr. Hayden says there is no want of conformability; that the discordance observed is a "mere thinning out of strata, caused by local erosions." This remark is the more remarkable and important as coming from Dr. Hayden, who, with Mr. Meek, visited the localities at Manhattan and Mill Creek, which I mention as furnishing evidence of non-conformability. After making a "careful examination" of these localities in 1859, they say that "they are not, so far as their knowledge extends, separated by any discordance of stratification or physical break," and they further add, "This, however, would be impossible in Kansas.*

It would seem strange that the absence of eleven distinct strata, measuring over eighty feet in thickness, in one of these localities, which are found in the other, should not be even hinted at, when it was so positively asserted that there was "no discordance of stratification," and that this condition of strata could not produce any discordance; and quite as strange that the reason why no discordance of stratification was produced by such an erosion was not explained at that time. Had Dr. Hayden then given the lucid explanations contained in his late paper,† and shown us what is really meant by conformability, and how that kind of "*thinning out*" which is "*produced by erosion*" can not possibly produce any "discordance" or "non-conformability"‡ in the strata, I might have been spared the mortification of receiving such a lecture on the elements of Geology, and lost the pleasure of reading so fine a definition of conformability; § one which contains some ideas which Dana and Murchison had omitted.

Still, the facts stated respecting the Coal Measures and Permian Rocks in Kansas fulfill all the Doctor's conditions of

* Acad. Nat. Sci. Phil., 1859, p. 20.

† Amer. Jour., July, 1867, p. 33, et seq.

‡ Acad. Nat. Sci. Phil., Jan. 1859.

§ Amer. Jour., July, 1867, p. 33.

non-conformability, both those of other authors and those he has added.

Let us compare his conditions with the facts in the case.

There are "*two sets of strata resting one upon another*," and "*dipping at different angles*" "in consequence of the older beds being tilted,"* and it has already been shown that this "*want of conformity*" is "*accompanied by differences in the groups of fossils above and below the line of non-conformity.*" A "*considerable change of physical conditions as well as the lapse of long periods of time*," are shown by the palæontological and lithological changes already mentioned. Therefore, the Dr. must admit that there is a want of conformability, although he and Mr. Meek did not see it, when they made the "careful examination of those localities." And although they say there is no physical break here, it still appears to me there is such a break as the absence of eleven distinct strata 80 feet in thickness has made, and such an one as Mr. Sedgwick† describes in Great Britain, and which, he says, was the principal reason for separating their Permian from the Carboniferous rocks.

And still Messrs. Meek and Hayden positively affirm that "all the evidence sustains the opinions expressed by Messrs. Meek and Hayden, in 1859, that "there is in Kansas an unbroken series from the bottom of the Coal Measures to the top of the Permian"; and that no one without a knowledge of the classification of the Old World, would separate the Permian from the Coal Measures.

But Messrs. Meek and Hayden themselves testify‡ that there is not a single fossil common to the upper and lower portions of this unbroken series. Does that "evidence" sustain the opinion of Messrs. Meek and Hayden that the upper and lower beds belong to the same formation?

Messrs. Meek and Hayden also testify that the lithological character§ of the upper strata is strikingly different from those below, and are such as would incline them to suspect the rocks containing them to be Permian. And, in fact, every witness testifies to the remarkable difference in the lithological characters. Maj. Hawn and myself have stated that there is a line of non-conformability, and that the limestones below are blue, brown and ferruginous, while those above are white and buff and magnesian; that there are coal beds immedi-

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* Meek and Hayden prove this tilt to the West. Acad. Nat. Sci. Phil., January, 1859.

† Geo. Trans., 2d Series, vol. 4, p. 397.

‡ Proc. Acad. Nat. Sci. Phil., Jan. 1859, pp. 20 & 21.

§ Proc. Acad. Nat. Sci. Phil., Jan. 1859, pp. 20 & 21.

ately below and none above; bituminous shales below and none above; beds of carbonate of iron below and none above; cancellated shales above and few below; and what is stronger than all the rest, our evidence shows that three-fourths of all the fossils above this line are Permian, and nearly all below are Carboniferous; and yet they repeat it, that "*all the evidence sustains*" their opinion that all these strata belong to one formation; and they also say this opinion* was "accepted by most of the geologists in this country and Europe."

It may be that nearly all have adopted Messrs. Meek and Hayden's views on this and all other matters of Western Geology. If so, they must have been very active to keep up with all the changes of opinion expressed in the various papers of these distinguished authors, and they must have needed the consolation of Benton's maxim, "Wise men change, fools never." Again, if all have accepted their views, it seems a very singular and unfortunate circumstance that Messrs. Meek and Hayden have been compelled to write such voluminous and learned criticisms on nearly every one who has ventured to express opinions on the geology of their chosen field. One author, Prof. Newberry, I believe, escaped; for he not only adopted their views and facts without change, but also praised them for their valuable contributions to science.

If this be so, it shows how careful men of such great and wide-spread influence should be never to express an opinion which is not fully sustained by the facts.

But Profs. Marcou, Agassiz, Heer, Geinitz, and Drs. Shumard and Swallow, Maj. Hawn, and Count D'Archiac and others, have been so unfortunate as to differ from them, and the most of us have felt the disagreeable sensation of having that everlasting string of genera and species, (sometimes under one name and sometimes under another,) arranged and rearranged before us until they have been displayed in every possible view, form and arrangement, to prove that what we had said did not agree with Messrs. Meek and Hayden's views, and were, therefore, unworthy of credence.†

This state of things is unfortunate for science. Men of taste and refinement do not like to be in a *dispute* about scientific matters, and hence forbear to express facts and views which will be sure to bring men about their ears who do not regard the amenities of good breeding in their criticisms. But as my official duties have compelled me to

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* Amer. Jour. Sci., July, 1857, pp. 32 & 36.

† Am. Jour., July, 1867, p. 32. It is to be hoped they will not feel bound to correct all views not in accordance with theirs, as it will take too much time from more valuable labors, and science may live it all do not agree with them.

occupy a position so disagreeable, and as these men expect all geologists to accept their views and rely upon their facts, I would suggest to Messrs. Meek and Hayden to review all their papers on Western Geology and Palæontology, and so arrange the facts and theories therein expressed that we may know what their views *really* are at the *present time*, especially on those points about which they have so many times changed. Will they, as guardians of our Western Geology, tell us, once for all, whether there really is any Permian System in the West? Whether the genus *Bellerophon* is ever found in Permian Rocks? Whether the genera *Monotis* and *Bakevellia* are any proof of this system?

Do they now think, as in 1859,* that the Triassic of my section "may be Jurassic, or Triassic, or both, though * * * we rather incline to the opinion that they may prove to belong to the former?" Or do they still think, as in July, 1867,† that "they may be *Triassic*, *Permian*, or even *Jurassic*, * * * we are much inclined to believe they will be found to belong to the Trias"?

Will they tell us how it happens that they found *Bellerophons* in No. 10, the Permian‡ of the Kansas Section, and in E. the Permian§ of their Nebraska Section, when they believe this genus "to be either exclusively Carboniferous, or not found above the Coal Measures."‖

There are in the various papers of our authors scores of statements which appear to me equally inconsistent with scores of other statements in the same and other papers, and it is due to themselves and science that these invaluable papers be revised, and these blemishes be removed.

Our authors have made so many changes in the nomenclature of our fossils that Prof. Geinitz and myself have not always used the last name, and they, while reviewing our works, have much trouble in correcting us, and telling their readers what fossils we wish to designate. This makes them appear a little pedantic, and could be avoided if they would only tell us what names they intend finally to adopt.

To illustrate how difficult it is to keep up with their changes of nomenclature, the short history of one fossil will suffice. The *Encrinus moniliformis* of Marcou, Messrs. Meek and Worthen changed to the genus *Erisocrinus* in March, 1865, then to *Philocrinus* in May of the same year, and back to *Erisocrinus* in August following. They also change the

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* Proc. Acad. Nat. Sci. 1850, p. 21.

† Am. Jour., July, 1867, p. 40.

‡ Proc. Acad. Nat. Sci. Phil., 1859, p. 16.

§ Proc. Acad. Nat. Sci. Phil., 1858, p. 44.

‖ Am. Jour., Nov., 1867, p. 331.

specific name as often. In March, 1865, they call it *typus*, in May *pelvis*, and *Nebrascensis* in March of the same year.

Thus, this poor fossil was graced with six—three generic and three specific—names in the short space of five months. We hope, therefore, our critics will excuse us if we do not always get the very last, especially when it comes out after our article is written.

There are a few criticisms and little sophisms which may require a passing notice.

Dr. Hayden says: "In Prof. Swallow's former papers he gives the thickness of the Upper and Lower Permian at 820 feet, and in the Report under review the thickness of the same beds is given at 704 feet 1 inch." This discrepancy of 116 feet he is kind enough to account for, though not in the right way; but the "1 inch" troubles him. It may relieve the Dr. to learn that his 820 feet was taken from Maj. Hawn's section,* not mine, as he states; and that the "1 inch" was a natural result of the addition of the figures representing the thickness of all the strata, a simple sum in the addition of duodecimals, and not "an effort to be over exact."

Messrs. Meek and Hayden doubt the accuracy of my identification of fossils, when I place Carboniferous, Permian, Triassic, and Liassic species together in the same beds. But I never placed such fossils together in the same beds; and Messrs. Meek and Hayden made several mistakes, and ignored sundry facts by me stated before they could get them into that condition. They alone are responsible for the unnatural position they have placed these fossils in. But they have shown the Carboniferous and Permian species great wanderers. Why not give the Triassic and Jurassic the same privilege?

I am under many obligations to them for sanctioning my views of the Triassic (?) formation. But it is to be regretted that in summing up the Palæontological evidence they should, as they often do, misquote me and mistake the facts. They say I "at first referred to this horizon a trilobate leaf." But the fact is I simply said "it is the only fossil plant in the collection belonging to the beds above the Permian." The Cretaceous are above the Permian, and it may belong to the Cretaceous. I never found it in place. Maj. Hawn located it in No. 14 (?) of the Triassic, (?) expressing a mere probability of a probability that it belonged to the Triassic. And that is all we have said about it. And yet they say.

* It may assist Messrs. Meek and Hayden out of some of their troubles to be reminded that the materials and sections used in the papers of Maj. Hawn and myself, in 1858, were collected and made by Maj. Hawn (see Proc. Acad. Sci. St. Louis, vol. I, p. 175,) but what I used in my Report were collected by myself and Maj. Hawn.

positively that I referred this leaf to this horizon. They also mistake my statements respecting the *Myophoria orbicularis* and several other fossils. But this paper is already too long, or I would quote their remarks and make the corrections in a score of instances where they have misapprehended the facts. To play the critic well one needs sound learning and a clear head; he should read with care and understand what he reads; and he must judge fairly, and clearly state his conclusions.

Yearly Report of Atmospheric Electricity, Temperature, and Humidity, from Observations made at St. Louis, Mo.

By A. WISLIZENUS, M.D.

1.—*Monthly Mean of Positive Atmospheric Electricity in* 1861–1867, *based on daily observations at* 6, 9, 12, 3, 6, *and* 9 *o'clock, from morning till night.*

ATMOSPHERIC ELECTRICITY.

YEAR.	JAN.	FEB.	MAR.	APRIL	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	Mean of year.
1861..	16.5	12.1	9.8	8.8	7.8	4.0	3.7	3.4	3.0	7.1	10.0	14.3	8.4
1862..	12.1	16.0	9.4	10.6	7.5	3.0	2.2	2.3	3.0	7.7	12.6	13.9	8.4
1863..	16.9	15.9	13.6	8.8	4.7	2.0	2.8	4.4	4.8	12.5	12.1	11.5	9.2
1864..	15.8	11.3	11.0	8.5	5.1	4.0	2.3	0.9	1.8	5.4	6.6	9.0	6.8
1865..	12.2	9.5	5.9	3.3	2.4	3.4	2 6	5.9	1.2	5.3	10.1	6.4	5.7
1866..	5.9	8.1	5.7	2.1	3.3	2.1	2.4	5.1	3.2	7.0	10.2	7.0	5.2
1867..	9.2	8.2	6.5	3.3	2.9	2.8	2.7	5.2	3.5	3.0	4.2	4.2	4.6
Mean.	12.7	11.6	9.0	6.5	4 8	3.0	2.7	3.9	2.9	6.9	9.4	9.5	6.9

2.—*Monthly Mean of Temperature and Relative Humidity in* 1861-1867, *based upon daily observations contemporaneous with those of Atmospheric Electricity.*

TEMPERATURE.

YEAR.	JAN.	FEB.	MAR.	APRIL	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	Mean of year.
1861..	32.2	40.4	44.8	58.1	64.1	76.9	77.5	78.6	69.1	57.9	46.0	39.7	57.1
1862..	28.9	30.2	43.2	55.0	69.7	75.1	81.2	80.7	72.1	57.3	42.6	41.3	56.4
1863..	36.8	35.7	43.6	57.4	65.5	71.9	77.2	77.5	69.2	48.0	43.7	35.9	55.2
1864..	29.2	38.3	40.7	51.4	69.4	78.9	83.5	78.8	72.9	53.1	44.9	30.4	56.0
1865..	28.1	38.4	46.7	56.8	68.8	80.7	77.7	78.1	77.8	58.8	48.0	30.8	57.5
1866..	32.2	33.4	42.2	61.2	66.3	75.3	82.2	76.8	64.0	59.3	46.6	33.3	56.0
1867..	25.4	39.1	34.1	56.7	61.1	76.9	81.3	81.4	68.5	59.6	49.2	36.1	55.8
Mean.	30.4	36.5	42.2	56.7	66.4	76.5	80.1	78.8	70.5	56.3	45.9	35.4	56.3

RELATIVE HUMIDITY.

1861..	72.2	63.3	64.5	61.5	66.3	70.8	66.3	69.6	77.3	76.6	69.0	74.3	69.5
1862..	85.3	73.9	70.8	67.0	57.3	67.0	66.8	64.3	74.2	67.2	69.5	74.6	69.8
1863..	79.2	81.7	68.1	57.2	59.4	67.7	68.6	70.7	68.2	74.4	67.4	79.5	70.2
1864..	75.6	62.7	70.0	69.8	56.4	61.5	62.8	69.0	64.1	67.9	74.2	75.5	67.4
1865..	74.6	72.0	66.1	66.8	62.1	67.9	77.4	71.7	76.8	74.1	62.3	78.8	70.9
1866..	75.1	70.6	69.1	60.6	59.7	66.0	68.2	66.7	81.8	71.7	72.5	76.8	69.9
1867..	76.2	73.5	75.7	59.1	61.4	64.8	63.9	60.0	63.7	67.9	64.9	77.6	67.4
Mean.	76.9	71.1	69.2	63.1	60.4	66.5	69.0	68.7	72.3	71.4	68.5	76.7	69.3

3.—*Yearly Mean of Positive Electricity, of Temperature, and of Relative Humidity of the Atmosphere, at the hours of* 6, 9, 12, 3, 6, *and* 9, *from morning till night, based upon daily observations at those hours, in* 1861–1867.

ELECTRICITY.

YEAR.	6 A.M.	9 A.M.	12 M.	3 P.M.	6 P.M.	9 P.M.
1861..............	8.5	9.9	9.0	7.7	8.5	6.8
1862..............	8.9	10.0	9.1	7.3	8.1	6.8
1863..............	10.5	10.6	10.0	7.5	9.1	7.4
1864..............	7.9	8.8	7.4	5.4	5.9	5.5
1865..............	6.4	7.1	6.0	5.3	5.4	3.8
1866..............	5.5	6.2	5.2	4.5	5.2	4.4
1867..............	5.2	5.6	4.9	4.2	4.3	3.8
Mean..............	7.6	8.3	7.4	6.0	6.6	5.5

TEMPERATURE.

1861..............	48.9	54.9	61.6	63.6	59.3	54.3
1862..............	48.9	55.0	60.9	62.3	58.0	53.6
1863..............	47.5	53.6	59.7	61.0	57.2	52.2
1864..............	48.0	54.1	60.5	62.2	58.1	53.0
1865..............	50.4	55.8	61.8	63.3	59.3	54.7
1866..............	48.4	54.6	60.3	61 9	57.9	53.4
1867..............	48.4	54.2	60.0	61.4	57.4	53.3
Mean..............	48.6	54.6	60.7	62.2	58.2	53.5

RELATIVE HUMIDITY.

1861..............	86.4	71.3	60.3	57.2	65.1	77.3
1862..............	85.3	70.6	60.0	57.5	67.6	78.0
1863..............	86.8	71.4	60.2	58.0	66.7	77.9
1864..............	83.9	69.3	57.7	55.0	64.0	74.8
1865..............	84.7	71.7	61.3	59.0	68.3	78.9
1866..............	84.9	70.1	60.6	58.6	67.4	77.8
1867..............	83.1	68.4	57.9	55.0	64.6	75.4
Mean..............	85.0	70.4	59.7	57.2	66.2	77.2

4.—*Table showing the quality of Atmospheric Electricity, by six daily observations, during seven years, from* 1861 *to* 1867, *at St. Louis, Mo.*

1861—1867.	Positive Electricity.	Negative Electricity.	No Electricity at all.
January	1,091 times.	27 times.	171 times.
February	955 times.	36 times.	177 times.
March	979 times.	66 times.	241 times.
April	821 times.	65 times.	335 times.
May	914 times.	42 times.	307 times.
June	878 times.	22 times.	319 times.
July	919 times.	44 times.	357 times.
August	956 times.	41 times.	286 times.
September	780 times.	27 times.	432 times.
October	1,013 times.	24 times.	266 times.
November	986 times.	27 times.	233 times.
December	921 times.	19 times.	342 times.
	11,213 times.	440 times.	3476 times.

(5) The appearance of *negative electricity* (mentioned in table 4) was connected—

160 times with thunderstorms.
158 times with rain, without thunder and lightning.
103 times with dry storms (high winds without rain, and without thunder and lightning).
17 times with snowing.

(6) *Rain*, without thunderstorms, appeared—

159 times with positive electricity.
153 times with negative electricity.
365 times with no electricity at all.

(7) *Snowing* was accompanied—

162 times with positive electricity.
17 times with negative electricity.
42 times with no electricity at all.

(8) *Fog* is always accompanied with high positive electricity.

(9) Numerical proportion in *direction of winds* in 1861–67, in St. Louis, Missouri:

E.	N.	N.E.	S.	S W.	W.	N.W.	S.E.
655	1279	1676	1856	1935	1950	2072	3631

REMARKS.

Since the days of Benjamin Franklin, who discovered the identity of lightning with the electricity developed on a small scale by electrical machines, atmospheric electricity has been explored by scientific men of all nations. The result of these researches was that not only during thunderstorms, but almost always there is some electricity to be found in the surrounding atmosphere in a certain elevation above the ground;

that the generally prevailing electricity is positive, and only exceptionally negative, and that a certain periodicity exists in the prevailing positive electricity. Atmospheric electricity is therefore one of the regular phenomena in our atmosphere, and ought to be as regularly and carefully observed as barometric pressure, temperature, humidity, etc. By daily regular observations only of meteorological phenomena, continued for many years and extended over the whole globe, are we enabled to discover their complicated laws and to draw from them conclusions useful to mankind.

The zeal with which atmospheric electricity was explored in the last century gradually cooled off on account of the many difficulties met with in these researches. The ethereal nature of the so-called electric fluid, the want of very delicate instruments, the danger, even, complicated sometimes with such observations, deterred physicists from observing atmospheric electricity as regularly as other meteorological phenomena. But within the last fifteen years its exploration has been taken up again in Europe with renewed zeal and with improved instruments, and regular electrical observations form now an important part of meteorology. In the United States and, as far as I know, on the whole continent, no observations of the kind were made. I concluded therefore to supplant this want in our meteorological records, and procured myself for that purpose one of the most delicate and reliable modern instruments, the electrometer of Prof. Dellman, by which the quality as well as quantity of observed electricity can be determined and measured. This instrument is a so-called torsion balance, the essential part of which is a very fine glass thread, suspended vertically, to the lower end of which a very light metallic beam is horizontally attached, moving above another beam, which is fixed. When, by means of a metallic ball, the electricity is collected in the atmosphere and transferred to the two beams, both are loaded with the same electricity, and since equal electricities repel each other, the upper movable beam will be repelled and turn around a circle, divided into degrees, more or less according to the electric charge.

For the last seven years I have made uninterrupted daily observations with this instrument, the numerical result of which is contained in the foregoing tables, to which, for better understanding, I will yet add some remarks.

There are flowing through our atmosphere constant currents of electricity, the equilibrium of which is so easily disturbed that they will accumulate often at one point and cause a vacuum at another.

The electricity prevailing in the usual undisturbed state of atmosphere is positive.

In thunderstorms atmospheric electricity is generally changed into high negative. The negative and positive signs are sometimes changing quick in succession during a thunderstorm, but the prevailing electricity is rather the negative.

In high winds without rain or thunderstorm (dry storms) the atmospheric electricity changes often into high negative, and, when accompanied by a sudden fall of the barometer, it is a sure indication of a storm running over a large extent of territory. Such storms, originating here in the west or southwest, travel generally in a semi-circular curve to the northwest and northeast, and reach the Atlantic coast in about twenty-four hours. By means of the electrometer and barometer such storms may be predicted and telegraphed to the sea coast a day beforehand. But for want of a meteorological centre such forewarning is lost to the public. In England, France, Prussia, and Italy, they have established meteorological boards to make their observations useful to the public by sending telegraphic warnings to the threatened points. If in countries of so small geographical extent benefit is derived from such an institution, how much greater would be the advantage in a country like ours, of continental expansion?

Rain without thunderstorm is as often accompanied by positive as negative electricity, but still oftener by no electricity at all, because in continued rains atmospheric electricity is fast carried to the earth.

Snowing is generally accompanied by high positive electricity. The quantity of positive electricity developed in a snowfall is often so great that it will create a vacuum of the usual positive electricity for a great distance from the snowfall. When, therefore, in winter, in cold, dry weather, with clear sky, the usually high positive electricity disappears suddenly, it is an indication that in a distance (of hundreds of miles) snow falls in considerable masses.

Fog is always accompanied by high positive electricity.

The regular positive electricity of the atmosphere exhibits a three-fold periodicity:

1. A daily one (see table 3), with two maxima and two minima every day; the first maximum appearing about 9 o'clock in the morning, the second about 6 in the evening, and the first minimum appearing about 3 in the afternoon, the second about 9, and still later in the night.

2. A monthly periodicity (see table 1) electricity being higher in the colder months, and lower in the warmer months of the year.

3. A yearly periodicity (see the yearly mean of electricity in table 1). From 1861–1863 the yearly mean of electricity was ascending, while from 1864–1867 it is gradually descending, so that the mean of 1867 is only half the quantity of that

in 1863. This may prove to be an eleven years' period, related to the same periodicity of terrestrial and solar magnetism.

The cause of atmospheric electricity has always been a perplexing question, and is by no means solved yet. As its causes have been supposed the force of wind, the evaporation of water from the earth and sea, the chemical processes constantly taking place on our globe, the act of vegetation, the conflict between polar and equatorial currents of air, the combined action of temperature and humidity, etc.,—most of these supposed causes exercise no doubt an indirect, partial and modifying influence on development and distribution of atmospheric electricity, but none of them seem to be adequate to account for the regular and continuous streams of electricity in our atmosphere. I am inclined, therefore, to look hypothetically for a more direct cause of atmospheric electricity in terrestrial and solar magnetism. The science of terrestrial magnetism is as yet in its infancy, but enough is already known to prove the existence of such a force. The aurora borealis is now generally considered an electrical phenomenon, produced by accumulation of magnetic force near the magnetic poles of the earth. During an aurora electric currents are developed on telegraphic wires, sufficient to serve as a substitute for the ordinary voltaic battery. From pole to pole, as Lamont has proved, electric currents are constantly flowing on the earth's surface, while others are circulating from east to west. There is the same periodicity in atmospheric electricity and terrestrial magnetism every day —two maxima and two minima, two daily ebbs and floods— and longer observation will very likely constitute also an eleven years' period for atmospheric electricity, as it has been proved for terrestrial and solar magnetism—reasons enough to believe in a direct connection between terrestrial magnetism and atmospheric electricity.

The physiological effect of electricity on organic bodies may generally be called stimulating. If the air we inhale contains a good deal of positive electricity, as it happens in cold, dry weather with clear sky, we feel a bracing, invigorating effect from it, and on hot, sultry days without any electricity, a feeling of depression. But as the meteorological phenomena form a unit, and as we cannot separate the effect of electricity from that of temperature, humidity and barometric pressure, it is difficult to say how much of that feeling is due to electricity or to other qualities of the air. The presence or absence of electricity in the air has therefore been often overrated, or wrongly commented upon. In cholera epidemics, for instance, diminution or absence of atmospheric electricity has often been accused of being the cause of this mysterious disease. My observations during the last epidemic have convinced me on the contrary that neither electricity nor any other meteorological phenomenon has any direct connection with the epidemic of cholera, and that we have to search in quite a different direction for its origin. The doctrine of local causes, and of its propagation by some organic seed or ferment, takes justly now the place of former speculations in meteorology.

Electricity is considered also an effect and produce of vegetable life. In germinating seeds under glass cover, traces of electricity will be therein developed, where none was before. But as every chemical process (and growing is a continuation of chemical actions) develops some electricity, it is to be considered more an effect of chemical action than of vegetable life proper.

Electricity is regarded, too, as a stimulant for vegetable life, and it may be worth while to try by experiment to what degree electricity can promote and accelerate vegetable growth. In any hot-house or propagating house such experiments could be tried very conveniently in the following manner: Take two wooden boxes with seeds or buds in them of the same kind, treat them both in precisely the same way in regard to soil, moisture, heat, and light, but insert in the inside of one box, on two opposite ends, a copper-tin plate, connecting them with metallic wires, and observe now if any difference will appear in the development and growth of vegetable life in the two boxes. Such experiments, carefully made and often repeated, would soon settle the point to what extent electricity may be considered a stimulant, and be made useful to the promotion of vegetable life.

On the Character of the persistent Snow-Accumulations in the Rocky Mountains, Lat. 40°–41° *North, and certain features pertaining to the Alpine Flora.*

By Dr. C. C. Parry.

[Read, Oct. 15, 1866.]

A long-felt desire to become personally acquainted with the various forms, and characteristic features, of our Rocky Mountain Flora, having resulted in three different expeditions to that region, there has thus accumulated on my hands, as an incidental fruit of my observations, some general facts in reference to the natural aspects of that region, involving certain scientific conclusions, apparently worthy of record.

Nearly all my previous information in reference to persistent snow accumulations in high mountain ranges having been derived from works descriptive of the European mountains, I was for a long time greatly puzzled to conform what I actually saw in the summer snows of the Rocky Mountains with what I had read in reference to the Alps. How far actual experience and observation have led me to modify these views, will appear from a brief review of the results here arrived at.

My first ascent to the snowy range was made on the 14th of June, 1861, from the upper waters of South Clear Creek, my reliable guide on this occasion being a foaming ice-cold brook, appropriately named Mad Creek, which brawled past my rude cabin door, and which I felt confident, if resolutely followed, would lead me in the most direct course to its snowy sources. With an enthusiasm, which on after experience I learned to temper with more deliberation, I climbed, panting, up the steep rocky slopes, forcing my way through underbrush, and clambering over fallen timber, only allowing myself to rest as some new floral form drew my attention, still intent on reaching the open and commanding summits beyond the pine growth, to which my eyes had been so often directed from the lower plains and valleys. Such interruptions, however, increased with every step as I drew near to the sharply defined line that limits timber growth, the straggling alpine plants increasing both in number and variety, till I was fairly bewildered with the strange novelties by which I was surrounded. The first patches of snow encountered were the wasting remains of winter drifts, entangled in the deep woods which mark the upper belt of timber; these drifts, stained and spattered by the fallen leaves and decayed bark of overhanging pines, were rapidly melting in the warm atmosphere, the spongy bed of moss, and decayed vegetation underneath, being saturated with the icy waters that oozed from their sides. The snow itself, made up of small rounded grains, showed that it had been subjected to alternate thawing and freezing, by which the original feathery mass was converted into agglutinated ice. Some of the smaller trees bore evidence of the depth of snow in which they had been buried by the abrupt inclination of their lower branches forming a sort of circular tent wall around each trunk, which as the melting snows gave way left them in deep pit-holes, apparently sunk away from the general snow level. At and beyond the timber line the snow lay in patches of greater or less extent, occupying depressions in the open valley, or smoothly filling up broad scooped recesses, on the steeper mountain slopes. Along the immediate stream borders, and frequently over-arching the rushing waters, the snow still lay deep, though unsafe to the foot, the constant wasting underneath weakening the support, and by abrupt plunges dropping the unwary traveller into treacherous holes. The warmth of the soil covered by the wasting snows, was farther evidenced by the shooting forth of green leaves and occasional blossoms through a thin covering of snow. In these few observations was mainly comprised all the definite information derived from my first visit to the snowy range at its lower slopes.

Subsequently, however, as practice improved my climbing abilities, and I was enabled to scale the highest summits and look down on snow fields, and ice-girt lakes, the question came up: Where is the snow line? At what determinate line do the regular winter-snows increase beyond the power of the succeeding summer's sun to dissolve, thus leaving a constantly-accumulating mass to give origin to glaciers? In pursuing this investigation I climbed repeatedly to the highest summits within reach, attaining elevations of 13,000 to 14,000 feet above the sea. Still the same general features were observable, vegetation, indeed, becoming scant, but never entirely wanting, even at the highest elevations; no permanent snow deposits of which it could be said that they must necessarily increase from year to year. The fact of the largest bodies of snow being met with in depressions, which, when filled up to a certain point, remained nearly stationary, and did not accumulate by drifting more than the average heat of summer could dissolve—the entire absence of anything like glacier phenomena—soon satisfied my mind that the true "snow line" as understood in European countries was not reached, at least in this particular region.

Being thus fairly divested of all preconceived notions, I was in a proper frame of mind to apply the facts at hand to account for the phenomena to be explained. And now came up distinctly the problem, to explain the persistence of snow through the warm summer months, in this mountain district, lying below the true snow line. Here, then, note first, an uneven surface, variously exposed to the direct action of the sun's rays, on which there is an average annual precipitation in the form of winter snow, which, if regularly spread over the entire surface of the ground, would disappear in the warm season sufficiently early to allow the maturing of its ordinary vegetation; but owing to the surface irregularities it cannot be thus evenly spread, and furthermore, the light character of this alpine snow renders it peculiarly liable to be acted on by the fierce winds sweeping over these open wastes, driving into sheltered hollows, and piling the wintry product in huge drifts, especially abundant in the upper valleys.

As a direct consequence of these conditions we find snow accumulated in all the natural recesses, while the more exposed peaks and ridges are comparatively but thinly covered; hence, when the lengthening days and the more direct rays of the summer sun exert their melting power on these wastes of wintry snow, the thinner portions yield first to its influence, and as the protruding rocks and exposed darkened surface become heated, vegetation starts with unwonted vigor from its long winter sleep of nine months' continuance; rivulets gush freely from the contracting edges of snow drifts, swelling the alpine brooks, and pouring their united tributes of melted snow water through the lower valleys to the distant plains. In this condition of things there is of course no opportunity for the development of glacier phenomena; no accumulated body of snow above to exert pressure on the mass beneath, thus converting its nève to glacier ice. In fact the higher peaks and crests being more exposed to the action of fierce winds, afford the scantiest space for the falling snow to rest upon, and are generally the first to become bare; besides, having no source of supply but what is derived directly from the atmosphere, all that is borne down by the wind is so much taken from its power of resisting the continued action of the sun's rays. It is, indeed, possible that this transporting agency of wind may constitute the process by which, in this region and the more elevated districts of Mexico and the South American Andes, the culminating points are prevented from accumulating that local amount of winter snow which would otherwise be sufficient to establish a definite snow line, and thus give origin to that slower process of descent represented by the glacier phenomena of the old world. It is in the higher mountain slopes above the timber line that the evidences of ancient glacier action are most conspicuous, being here less obscured by the mingled product of subsequent surface denudation. Some of the upper valleys thus exhibit, in their deeply scooped bed and polished rocky sides, the traces of ice movements, that have since given place to the ordinary abrading action of running water derived from melting snows. At many other points along the irregular slopes of the highest crests, we meet with what are termed in the expressive language of mining prospectors as *sags*, representing, as it were, slips, scooped out from the sides of the mountain ridges, and which may be properly regarded as incipient valleys, abandoned in their present unfinished state by their parent glaciers, and now only affording a bed in which the light-drifting snows of winter may find a resting-place.

The outweathering of the natural rock exposures, as exhibited on the peaks and flattened summits of the highest elevations, is instructive as showing the combined effect of frost and atmospheric denudation. Nowhere do we meet with extensive smooth surfaces of level rock, such as we might suppose would result from uniform surface abrasion, but, instead of this, loose angular blocks of all sizes, and piled in every conceivable form, either loosely, leaving extensive cavities, or imbedded in a coarse granitic sand. These detached blocks, variously spotted over with lichen, serve to give a peculiar aspect to the scenery, and the present irregular position can only be satisfactorily explained by referring it to the action of melted snow penetrating the fissures, which, by subsequent freezing, quarry out the immense blocks which strew the surface. These once detached from their bed are readily subjected to the displacing movements of underlying bodies of ice, melting unevenly according to differences of local exposure, and hence frequently poised in unstable equilibrium, rendering the footing insecure, and at times dangerous. Along the mountain slopes these features are of course modified by the action of running waters and occasional avalanches of snow and loosened rocks, all confusedly mixed up with the results of ancient glacier action. Hence it is not uncommon along the flanks of the snowy range to encounter extensive tracts completely bedded with fragments of rock of all sizes, and variously shaped by attrition. Over these traveling can only be accomplished by a succession of leaps from one rock to another, while in the burrowing recesses and crevices the peculiar alpine plants, and animals, find needful shelter from the rigors of an arctic winter. Through these loosely aggregated beds the melted snow waters percolate, and work their sinuous course by unseen channels to form the alpine brooks below. Occasionally a shallow basin accumulating in its bed the finer sediment washed down from above, supports a rank growth of vegetation, being thus gradually converted into an alpine morass. At other points smooth slopes are covered with a rich alpine sward, composed of densely tufted plants, with spreading fibrous roots and matted foliage, whose variously colored flowers complete an enameled carpet, attractive alike to the eye and foot of the mountain traveler.

These several enumerated points comprise the main features of scenery presented during the summer months on these bare exposures, wonderfully varied, it is true, and of which a mere verbal description can give but a very inadequate conception.

THE TIMBER LINE, AND THE UPPER LIMIT OF THE GROWTH OF SHRUBS.

No feature of Rocky Mountain scenery is more strongly marked than that which determines the upper limit of the growth of trees. This can be readily traced by the eye from a distant view, embracing a wider scope of mountain exposure, in which the slighter inequalities are smoothed down to a more uniform level, and thus presents a well marked horizontal line.

This feature is most distinctly marked when the green foliage of the upper pine growth is brought in contrast with a background of glittering snow, such as prevails during the period of winter storms, extending from early autumn to late in the succeeding spring. But when the summer sun lays bare the exposed rocks and smooth alpine slopes, the contrast becomes less marked, and the line itself can be less regularly traced by the eye. Barometric measurements show that this timber line, with slight local variations, marks a very uniform elevation, gradually diminishing with a more northern latitude. Thus, Pike's Peak on the south shows a timber line having an elevation of 12,000 feet above the sea level, while Long's Peak, nearly two degrees farther north, marks the tree limit at an elevation of 10,800 feet. Intermediate points, as Gray's Peak and Mount Flora, give a comparative mean of 11,700 for their respective timber lines.

It would be particularly interesting to know whether this timber line, offering so peculiar and well marked a feature of alpine exposures in different portions of the globe, is connected with a certain range of mean annual temperature, and, if so, what is the actual mean thus indicated. But sufficient data have not yet been furnished for the solution of this interesting problem.

A more simple explanation of the phenomena in question has been suggested by my observations in the Rocky Mountains, and I am inclined to refer the limitation of tree growth to a certain range of minimum temperature. The facts especially bearing on this point are these:

In the first place, there is a very marked distinction in the timber line itself, everywhere easily recognized, and, as we may say, marking at each locality two distinct timber lines, the one of very uniform elevation, consisting of thrifty, often large trees, of *upright* growth, and which terminates sharply, without any manifest dwarfing or stunting of regular growth, though mainly confined to species of pine that higher up become dwarfed and deformed in their struggle with the elements; this first and lowest I would designate as *the true timber line.* But again above this, and straggling irregularly up sheltered ravines and rocky slopes, is a class of depressed tree growth, singularly deformed, often spread out in dense mats on the ground, forming almost inextricable thickets. At other points, it presents itself to view with blighted tips and twisted, gnarled lower branches, and prostrate trunks, creeping snake-like through rocky fissures—everything betokening a struggle for existence. The arborescent forms here represented belong almost exclusively to *Pinus aristata* and *Abies Engelmanni*, both of which, as far as known, are peculiar to the Rocky Mountains. The actual elevation of this line being determined altogether by the local peculiarities of surface, as affording necessary shelter, is of course quite irregular and undulating, and may therefore be properly designated as *the false timber line.*

My explanation of the phenomena here so plainly exhibited is this: *The true timber line*, indicated by the natural growth of erect trees (and which terminates sharply at a regular line of elevation), marks a point of *minimum*, or extreme winter temperature, below which no phænogamous vegetation can survive atmospheric exposure; only two or three of the hardiest forms of tree growth reach this limit, and these, endowed as it were with special powers of endurance, leave all others behind to mark the barrier beyond which the rigid elements absolutely forbid all organized growth that is not protected by the thick covering of winter snow. Such trees as venture above this limit, can only survive by submitting to the condition of a winter burial, by which their otherwise erect forms are bent down and twisted to the earth, while all ambitious branches reaching into the sunlight of this arctic winter are inevitably nipped, and lose their vitality. The features of growth thus developed in their summer resurrection present a grouping of the most strange and weird forms of struggling existence, that mark so peculiarly the alpine scenery. Some future artist will here find scope for his pencil in portraying a character of Rocky Mountain scenery witnessed only in its perfection by the alpine explorer—when once seen, never to be forgotten.

It appears on this view that what we have above designated as *the false timber line*, exhibits only a particular phase of the alpine flora, represented elsewhere by the growth of shrubs, whose persistence to still higher elevations is due to the same general cause of protection by wintry snow from the otherwise killing effect of winter temperature. That shrub growth is thus limited, is evidenced by noticing that the highest elevation of this class of alpine growth is attained by taking advantage of the shelter of ravines, where snow accumulates the heaviest and most constantly. The shrubs that thus attain to the highest elevations belong to the genus *Salix*, whose general mode of growth, consisting of slender flexible twigs, easily bent down to the earth, peculiarly fits them for complying with the conditions of winter burial. Among the three or four species here represented, *Salix reticulata* takes the palm as the highest climber, being found at an elevation of 12,000 feet above the sea, its prostrate form enabling it to secure the necessary shelter at exposed situations.

In order to give some general idea of the character of our Rocky Mountain alpine flora, I submit herewith a list, as complete as my present means of information furnish, of the alpine plants met with in the district embraced within my personal observation. In this list I confine the term "alpine" to such plants as are met with on the bald exposures above the timber line; by a (*) prefixed, I would indicate those species which are exclusively confined to such localities, while others not thus marked are met with at lower elevations. The subjoined localities, whenever given, denote that the species referred to is not peculiar to the Rocky Mountains, but is also met with in the different regions there named, *Eu.* indicating Europe, and *As.* Asia.

ROCKY MOUNTAIN ALPINE PLANTS.

RANUNCULACEÆ.

Anemone narcissiflora, L. *Eu. As.*
A. Nuttalliana, DC.
Ranunculus Eschscholtzii, Schlecht. Greenland.
* R. adoneus, Gr.
Trollius laxus, Salisb. *Eu.*
Caltha leptosepala, DC.
Aquilegia brevistyla, Hook.

CRUCIFERÆ.

Cardamine cordifolia, Gr.
Erysimum pumilum, Nutt.
* Draba crassifolia, Graham.
D. alpina, L. *Eu.*
* Smelowskia calycina, C. A. Meyer. *As.*
Thlaspi cochleariforme, DC. *As.*

PAPAVERACEÆ.

* Papaver alpinum, L. *Eu. As.*

VIOLACEÆ.

Viola biflora, L. *Eu. As.*

CARYOPHYLLACEÆ.

Lychnis apetala, L. *Eu. As.*
* Silene acaulis, L. *Eu. As.*
* Paronychia pulvinata, Gray.
* Arenaria arctica, Stev.
A. Fendleri, Gray.
Cerastium vulgatum, var. Behringianum, Gr.

PORTULACACEÆ.

* Claytonia megarrhiza, Parry.
C. Virginica, L. var.
* Talinum pygmæum, Gray.

LEGUMINOSEÆ.

* Trifolium dasyphyllum, Torr. & Gr.
* T. nanum, Torr.
* T. Parryi, Gray.
* Oxytropis arctica, R. Br.

ROSACEÆ.

Sibbaldia procumbens, L. *Eu. As.*
* Dryas octopetala, L. *Eu. As.*
* Zeum Rossii, Ser. *As.*
Potentilla fastigiata, Nutt.
* P. nivea, L. *As.*

ONAGRACEÆ.

Epilobium alpinum, L. *Eu.*

GROSULARIACEÆ.

Ribes lacustre, Poir. var. (R. setosum, Dougl.).

CRASULACEÆ.

Sedum rhodanthum, Gray.
S. Rhodiola, L. *Eu.* *As.*

SAXIFRAGACEÆ.

Saxifraga nivalis, L. *Eu.*
* S. cernua, L. *Eu.* *As.*
S. controversa, Sternb. *Eu.*
* S. debilis, Engel.
* S. serpyllifolia, Ph.
* S. flagellaris, Willd. *As.*
S. punctata, L. *Eu.* *As.*
Parnassia fimbriata, Banks.
P. parviflora, DC.

UMBELLIFERÆ.

* Cymopterus alpinus, Gray.
Archangelica Gmelini, DC. *As.*

ARALIACEÆ.

Adoxa moschatallina, L. *Eu.* *As.*

COMPOSITEÆ.

* Erigeron uniflorum, L. *Eu.* *As.*
E. grandiflorum, Hook.
Aster glacialis, Nutt.
A. salsuginosus, Richards. *As.*
Solidago virgaurea, L. *Eu.* *As.*
* Aplopappus pygmæus, Gray.
* A. Lyallii, Gray.
* Actinella grandiflora, Torr. & Gr.
A. acaulis, Nutt. var.
Chænactis achilleafolia, Hook & Arn.
Artemesia arctica, Less. *As.*
* A. scopulorum, Gray.
Antennaria alpina, Gaertn. *Eu.*
Senecio amplectens, Gray.
S. triangularis, Hook.
* S. Soldanella, Gray.
* S. Fremontii, Torr. & Gr.
S. integerrimus, Nutt.
Arnica angustifolia, Vohl. *As.*
A. molis, Hook.
A. latifolia, Bongard.
* Cirsium eriocephalum, Gray.
Troximon glaucum, var. dasycephalum, Torr. & Gr.
Macrorhynchus troximoides, Torr. & Gr.

CAMPANULACEÆ.

* Campanula uniflora, L. *Eu.* *As.*
C. rotundifolia, L. *Eu.* *As.*

ERICACEÆ.

Vaccinium myrtillus, L. var. *As.*
V. cæspitosum, Michx. *As.*

PLANTAGINACEÆ.

Plantago eriopoda, Torr.

PRIMULACEÆ.

* Androsace chamæjasme, L. *Eu.* *As.*
A. septentrionalis, L. *Eu.*
* Primula angustifolia, Torr.
P. Parryi, Gray.

SCROFULARIACEÆ.

Pentstemon glaucus, Graham.
* P. Harbourii, Gray.
* Chionophila Jamesii, Benth.
Mimulus luteus, L. var. alpinus.
* Synthiris alpina, Gray.
* Castilleia breviflora, Gray.
C. pallida, Kunth. var.
* Pedicularis Parryi, Gray.
* P. Sudetica, Willd. *Eu.* *As.*
P. Grœndlandica, Retz.

BORAGINACEÆ.

* Eritrichium aretioides, DC. *As.*
Mertensia alpina, Don.
M. Sibirica, Don. *As.*

HYDROPHYLLACEÆ.

Phacelia sericea, Jacq.

POLEMONIACEÆ.

Polemonium pulchellum, Bunge. *As.*
* P. confertum, Gray.
* Phlox Hoodii, Richardson.
Gilia congesta, Hook.

GENTIANACEÆ.

Gentiana acuta, Michx.
G. barbellata, Engel.
G. prostrata, Hænk. *Eu.* *As.*
G. frigida, Hænk. *Eu.* *As.*
G. Parryi, Engel.
Swertia perennis, L. *Eu.* *As.*

POLYGONACEÆ.

Polygonum bistorta, L. *Eu.* *As.*
P. viviparum, L. *Eu.* *As.*
Oxyria digyna, R. Br. *Eu.* *As.*
Eriogonum flavum, Nutt.

SALICACEÆ.

* Salix reticulata, L. *Eu.* *As.*
* S. glauca, L. *Eu.* *As.*
S. arctica, R. Br. *Eu.* *As.*
S. discolor, Willd. *Eu.* *As.*

CONIFEREÆ.

Abies Engelmanni, Parry.
A. grandis, Lindl.
Pinus aristata, Engel.
P. flexilis, James.
Juniperus communis, L. *Eu.* *As.*

LILIACEÆ.

Zygadenus glaucus, Nutt. *As.*
* Lloydia serotina, Reich. *Eu.* *As.*

JUNCACEÆ.

* Luzula spicata, DC. *Eu. As.*
L. parviflora, DC. *Eu. As.*
Juncus Drumondii, Meyer.
* Juncus Hallii, Engel.
* J. Parryi, Engel.
* Juncus triglumis, L. *Eu. As.*
* J. castaneus, Sm. *Eu. As.*

CYPERACEÆ.

Carex atrata, L. *Eu. As.*
C. rigida, Good.
* C. incurva, Lightf. *Eu.*
* C. filifolia, Nutt.

GRAMINEÆ.

Phleum alpinum, L. *Eu. As.*
* Poa Andina, Nutt.
P. alpina, L. *Eu. As.*
* P. arctica, R. Br.
P. nemoralis, L. *Eu. As.*
Aira cæspitosa, L., var. arctica, Thurb. *Eu.*
Festuca rubra, L. *Eu. As.*
F. ovina, L. *Eu. As.*
Triticum strigosum, Less. *As.*

FILICES.

Cryptogramme acrostichoides, R. Br.

SUMMARY.

As a brief recapitulation of the main points here presented, I offer the following condensed summary:

1. The persistent bodies of snow which, in variable amount at different seasons, are ordinarily met with on the higher elevations of the Rocky Mountains, do not indicate a region above the true snow line, but result from the accumulation of drifted snow, filling up recesses and sheltered depressions to such an extent that the summer sun is not sufficient to melt the deeper portions, which thus remain from year to year, varying in amount according to the quantity of fallen snow, or the character of the succeeding summer season as to its snow-melting power.

2. Hence, we have no constant accumulation of snow, forming what is known in the European Alps as *Nivé*, the pressure of which from the higher elevations gives origin to glaciers.

3. In the absence of glaciers and heavy snow accumulations on mountain slopes, we do not encounter the usual glacier phenomena so often referred to in the European Alps, and only meet occasionally with avalanches due to accidental local causes.

4. The winter snows being of the light character pertaining to the higher regions of the atmosphere, and not subject to condensation by alternate thawing and freezing during the season of their occurrence, are thus peculiarly liable to the

transporting movements of the prevailing winds. Hence results an accumulation of snow in the upper valleys, by which these frozen treasures of winter are safely stored away, to be dispensed in fertilizing streams to the lower valleys during the dry warm season, when most required for agricultural or mining purposes.

5. The peculiar alpine vegetation, attaining to elevations of 14,000 feet above the sea level, is enabled to maintain its existence by the protection afforded by the ordinary winter snows, and, in the more sheltered and deeply covered valleys, includes plants which flourish also at much lower elevations.

6. The true timber line, everywhere exhibited as a well marked horizontal plane, varying in elevation, according to the degree of latitude or character of exposure, from 12,000 feet to 10,700 feet above the sea, indicates a limit beyond which the minimum winter temperature is destructive of all exposed phænogamous vegetation, and whatever in the form of tree growth persists above this point, can only do so by being deeply buried in the accumulation of winter snow, which, weighing down their branches, gives that distorted growth peculiar to such localities.

7. In the accompanying list, comprising 141 species of alpine plants, 56 are noted as exclusively alpine, or confined to the bald alpine exposures; 84 species, as far as at present known, are peculiar to the Rocky Mountain range, or to Northern America, while the remaining 57 species are common to the European or Asiatic Alps, or to high northern latitudes of both continents.

On some future occasion, in connection with a more complete list, the writer proposes to deduce some fuller comparisons in reference to the geographic distribution of the Rocky Mountain alpine flora.

JOURNAL OF PROCEEDINGS.

June 5, 1865.

The President, Dr. ENGELMANN, in the chair.

Seven members present.

Letters were read from the Smithsonian Institution, Washington, dated May 9, 1865, and May 18, 1865, announcing a donation of type specimens of fossils.

The following publications were received:

Mineral Resources of Nevada Territory, in a letter from J. P. Usher, Acting Secretary of the Interior, to the House of Representatives, 37th Congress, 3d Session, from the Hon. Secretary. Amer. Jour. of Science and Arts, No. 117, May, 1865, New Haven. Annals of the Lyceum of Nat. Hist. of New York, vol. vii., Nos. 1–2, 1861, Nos. 13–16, 1862, from the Society. Atti della Società di Acclimazione, T. iv., No. 7–10, Palermo, 1864, from the Society. Trans. Amer. Phil. Soc. of Philadelphia, vol. xiii., pt. i., 4to, 1865, from the Society. Proc. Boston Soc. Nat. Hist., vol. ix., Feb. and March, 1865, from the Society. Report of the 12th Ann. Meeting of the Amer. Pharmaceutical Society at Cincinnati, from Dr. Sander. Report on Mineral Laws of the Richwood Mining Co., with a Geological Map, St, Louis, 1865, by Prof. Swallow and Dr. Shumard, from the Authors.

The Corresponding Secretary presented from the Smithsonian Institution a collection of type specimens of fossils from the Upper Missouri, collected by Lieut. G. K. Warren, U. S. A., and Dr. F. V. Hayden, and also a series of miscellaneous fossils of the United States, collected by F. V. Meek, as a donation to the Academy, for which due acknowledgments were directed to be made.

Dr. Engelmann exhibited a hen's egg, with a corrugated shell, containing a double yolk.

On motion of Dr. Boisliniere, the Anthropological Society, the Entomological Society, and the Meteorological Society, of France, and the name of Dr. Paul Broca, were directed to be placed upon the list of exchanges.

June 19, 1865.

The President, Dr. ENGELMANN, in the chair.

Five members present.

Letters were read from the Smithsonian Institution, Washington, June 3, 1865; K .Preuss. Akad. der Wissenschaften, Berlin, Feb. 28, 1865; K. Akad. der Wissenschaften, Vienna, Feb. 1, 1865, announcing publications sent.

Publications were received, as follows:

Proc. Amer. Acad. of Arts and Sciences, vol. vi., pp. 341–364, from the Academy. Zool. mineral. Verein: Correspondenz-blatt. Jahrg. xviii., Regensburg, 1864, from the Society. K. Preuss. Akad. der Wissenschaften: Monatsberichte, aus dem Jahre 1864, Berlin, 1865, from the Academy. Société Linnéenne de Normandie: Bulletin, vol. ix., année 1863–4, Caen, 1865, from the Society. Académie Imp. de Dijon: Mémoires, 2ne serie, T. xi., année 1863, from the Academy. K. Akad. der Wissenschaften: Sitzungsberichte, 1863, ii. Abtheil. No. 10, 1864, i. Abtheil. Nos. 2–7, ii. Abtheil. Nos. 2–7, Wien, from the Academy. Réforme de la Chimie Minerale et Organique, de la Morphogénie Moléculaire et de la Cristalogénie, etc., par M. A. Gaudin, Paris, 1865, from the Author. Law of Increase and Structure of Man, by F. P. Liharzik, Vienna, 1862, from the Author. Nederlandisch-Indische Maatschappij van Nijverheid: Tijdschrift voor Nijverheid, Oorspronkelijke Bijdragen, Deel i.–v. 1855–1859; Nieuwe serie, Deel i.–iii. 1860–1862; Uittreksels, Deel i.–2. 1854–5, Batavia; Statistiek van den Handel en de Scheepvaart op Java en Madura sedert 1825, door G. F. de Bruijn Kops, Deel i.–ii., Batavia, 1857–9.—from the Society. Proc. Royal Horticultural Soc. of London, vol. v., No. 3, 1865, from the Society.

Mr. Ernest Berchon, D. M. P., of the Imperial Navy of France, was elected a corresponding member of the Academy.

July 3, 1865.

The President, Dr. ENGELMANN, in the chair.

Seven members present.

The following publications were received:

Proc. Amer. Antiq. Society, Boston, 1865, from the Society. Canadian Jour. of Industry, Science and Art, No. 57, May, 1865, Toronto, from the Canadian Institute. Sprossverhältnisse von *Glaux maritima*, L., von Dr. Franz Buchenau, Bremen, 1864, from the Author.

Oscar F. Potter, M.D., was elected an Associate Member.

July 17, 1865.

The President, Dr. ENGELMANN, in the chair.

Nine members present.

A letter was read from the Smithsonian Institution, Washington, July 12, 1865, announcing publications received from Europe.

The following publications were laid upon the table:

Dipendochorion, novum Alismacearum genus, Auctore Dr. Fran. Buchenau, from the Author. Proc. California Acad. of Nat. Sciences, vol. iii., pt. 2, 1864; same, 1865, pp. 174–192, San Francisco, from the Academy. Proc. Amer. Antiq. Soc., Meeting at Boston, April 26, 1865, from the Society. Collection de Précis Histoires: De la Beatification, par Ed. Terwecoren, prétre S. J., No. 13, 1865, from the Author.

August 7, 1865.

The President, Dr. ENGELMANN, in the chair.

Nine members present.

Letters were read from B. Westermann & Co., New York July 17, ordering copies of No. 2, vol. ii., Transactions; Naturhistorischer Gesellschaft, Hanover, Feb. 1, 1865; Verein für Naturkunde, Wurtemburg, June 21, 1865; Naturf. Gesellschaft, Danzig, May 8, 1865; Université Catholique de Louvain, Jan. 13, 1865; Verein für Naturkunde, Presburg, May, 1864, announcing the receipt of the Transactions of the Academy, and the transmission of publications.

Publications received, were laid upon the table, as follows:

Dublin Quar. Jour. of Science, No. 18, 1865, from the Editor. Trans. Amer. Geographical and Statistical Soc. New York, 1864, pp. 117–174, from the Society. Amer. Jour. of Science and Art, vol. xl., No. 118; Proc. Royal Horticultural Soc. London, vol. iv., No. 10, July, 1864, from the Society. Annals of the Lyceum of Nat. Hist., New York, vol. viii., No. 2–3, 1864, from the Society. Illustrated Catalogue of the Museum of Comparative Zoology, No. 1, Ophiuridæ and Astrophytidæ, by Theodore Lyman, Cambridge, 1865, from the Institution. Atti dell' I. R. Istituto Veneto, T. ix., Disp. 10, 1863–4, T. x., Disp. 1, 1864–5, from the Society. XIV. Jahr. der Naturh. Gesellschaft, Hanover, 1863–4, from the Society. Verzeichniss der Namen der fossilen und lebenden Art. der Gattung *Paludina* Lam., von Geo. Ritter von Frauenwald, Wien, 1865; Zoologische Miscellen, 1–3, 1864; Entomologische Fragmente, i.; Ueber *Scenopinus* und *Platypeza*, 1863; Vorkommen des Parasitismus, Wien, 1864, from the Author. Ueber *Juncus pygmæus* Rich. und J., von Dr. Franz Buchenau, from the Author.

August 21, 1865.

The President, Dr. Engelmann, in the chair.

Six members present.

The following publications were received:

Canadian Jour., No. 58, July, 1865, Toronto, from the Canadian Institute; Bulletin de la Société Imp. Zool. d'Acclimatation, T. v., No. 5–6, Paris, 1865, from the Society. 3d and 4th Ann. Rep. of the Supt. of Public Instruction of the State of Kansas, 1863–4, from Isaac T. Goodnow, Superintendent. Proc. Acad. Nat. Sci. Phila., No. 2, 1865, from the Academy. Proc. Amer. Phila. Soc. Phil., vol. x., No. 73, from the Society. La Tatouage aux Iles Marquises, Paris, 1860; Récherches sur la Tatouage, Paris, 1861; Une Chapitre des Lacunes, Erreurs et Imperfections de la Littérature Médicale; De L'Emploi Méthodique des Anasthesiques dans le Service de Santé de la Marine, Paris, 1861; Etude sur les Fractures du Crainé, par M. le Docteur Berchon, D. M. P., from the Author.

Dr. Shumard presented from Dr. M. D. Senter a collection of characteristic minerals from the Copper Region of Lake Superior.

Dr. Potter presented to the Academy a copy of Cook's Voyages of Discovery, in years 1776 to 1780, in 3 vols., Dublin, 1784.

Dr. Engelmann read a report of his meteorological observations for July, compared with those of Mr. Fendler, made in the country.

Mr. Augustus Steitz and Dr. Jas. W. Clements, of St. Louis, were elected Associate Members, and Isaac T. Goodnow, Esq., of Leavenworth, Superintendent of Public Instruction in the State of Kansas, was elected a Corresponding Member.

September 1, 1865.

The President, Dr. Engelmann, in the chair.

Six members present.

Publications received, were laid upon the table, as follows:

Annuaire de l'Université Catholique de Louvain, 1864; Programme des Cours, 1864–5;—Dissertationes: De Hyperdulia; De Jure Ecclesiæ; De Processionne Spiritus Sancti;—Theses: de Theol., 279–291; de Med. 60–62; de Phil. et Lettres, 14–15; des Sciences, de Droit, 1864; Proc. Royal Horticultural Soc. London, vol. v., June, 1865, from the Society. Natur.-hist. Verein der Preuss. Rheinl. u. Westphalens: Verhandl. xxi., Jahrg. 1–26, Bonn, 1864; Bulletin de la Société Vaudoise des Sciences Nat., T. viii., No. 52, Lausanne, 1865, from the Society. Würzburger Med. Zeitschrift, vi. Band, 1–2 Heft, 1865, from the Editors. L'Académie Imp. des Sciences, Belles Lettres et Arts de Dijon: Mémoires, T. xi. and xiii., 1862–3; Bulletin, 1865, from the Academy. Défence des Colonies: iii. Etude Generale sur nos Etages G. et H., etc., par Joachim Barrande, 1864, from the Author. Accademia delle Scienze dell' Istituto di Bologna: Memorie, T. iii & iv., fasc. 1; Rendiconti, 1863–4, from the Academy.

Dr. Engelmann stated that he had received a letter from Dr. Elliot Coues, now in Arizona, concerning the geographical distribution of the Cactus-flora, and particularly the *Cereus giganteus* Eng., and saying he had travelled five days through a district in which very remarkable forms of this plant prevailed.

September 18, 1865.

The President, Dr. Engelmann, in the chair.

Seven members present.

Publications received:

Amer. Jour. of Sci. and Arts, No. 119, Sept., 1865: Annals of the Lyceum of Nat. Hist. New York, vol. viii., No. 4–5, 1865, from the Society. Der Zoologische Garten, vi. Jahrg. No. 1–6, 1865, from the Society. Naturf. Gesellschaft in Danzig: Schriften, i. Band, 2 Heft, 1865, from the Society. Verein für Naturkunde zur Presburg: Correspondenz-blatt, ii. Jahrg, 1863, from the Society. Würtemburgische Naturw. Jahreshefte, xx. 2, 3, 1864; xxi. 1, 1865, from the Society. Naturw. Verein des Harzes zu Blankenburg: Berichte, 1861–2, from the Society. Prize List of the Agricultural Exhibition at Montreal, Sept. 1865; Journal of Education, vol. v., Nos. 7–12, 1861, vol. vii., Nos. 10–12; Ann. Rep. of the Nat. Hist. Society, 1863, '64 and '65, Montreal, from Major L. A. Huguet-Latour.

October 16, 1865.

The President, Dr. Engelmann, in the chair.

Eight members present.

Dr. Wislizenus stated that he had often tried to find traces of ozone in the atmosphere of the city, without discovering any, but that, a few days since, he had made some experiments in the country with perfect success.

November 7, 1865.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

Letters were read from the K. K. Patr.-ökonom. Gesellschaft, Prague, Oct. 6, 1864, and May 26, 1865; K. Accademia di Scienze, Lettere, ed Arti di Padova, 1865; Naturf. Gesellschaft in Emden, Aug. 1, 1865; Schweizerische Naturf. Gesellschaft, Bern, April, 1865, & March, 1865; Amer. Phil. Society, Philad., March 2, 1865, acknowledging receipt of the Transactions, and concerning publications in exchange.

The following publications were laid upon the table:

Bulletin de la Société Imp. Zool. d'Acclimatation, Paris, T. ii., No. 7, July, 1865, from the Society. Naturf. Gesellschaft Graubündens: Jahresbericht, x. Jahrg. 1863-4, from the Society. Schweizerische Naturf. Gesellschaft zu Zurich: Verhandl., 1864, from the Society. Naturf. Gesellschaft in Bern: Mittheil. No. 519-553, from the Society. Naturf. Gesellschaft in Emden: Jahresbericht, 1864, from the Society. I. R. Accademia di Scienze, Lettere ed Arti in Padova: Revista, No. 21-26, 1862, from the Academy. I. R. Istituto Veneto: Atti, T. x., 1864-5, from the Institute. K. K. Geol. Reichsanstalt: Jahresberichte, xv. Bd. No. 2, Wien, 1865, from the Society. K. K. Geograph. Gesellschaft: Mittheil, viii. Jahrg. Heft 1, 1864, from the Society. Hestiae Planetæ Minoris, xlvi.: Elementa Nova, ex obs. 1857-1864; Redux. F. M. Karlinski, Cracoviæ, 1865, from the Author. K. K. patr.-ökonom. Gesellschaft: Centralblatt Jahrg. xiv. and xv., 1863-4, Prague, from the Society. Deutsche Geol. Gesellschaft: Zeitschrift, xvii. Band, 1 Heft, Berlin, 1865, from the Society.

Col. J. F. Meline presented to the Academy vol. xi. of the Pacific R.R. Surveys, 4to, Washington.

Dr. Engelmann reported his observations on the temperature and humidity of the months of September and October; and also exhibited specimens of the flowers and bulbs of the water-lily (*Nymphæa tuberosa*), a species recently described by Mr. T. A. Paine of New York. He remarked that several species were found in this vicinity as well as further north.

November 21, 1865.

The President, Dr. ENGELMANN, in the chair.

Six members present.

Rev. Alexander F. Kemp and Mr. John F. Madison were elected Associate Members.

December 4, 1865.

The President, Dr. ENGELMANN, in the chair.

Seven members present.

The following publications were received:

Bulletin de la Société Imp. zool. d'Acclimatation, Paris, T. ii., No. 8, 1865, from the Society. Proc. Boston Soc. Nat. Hist., vol. x., pp. 1–16, Sept. 1865; Conditions and Doings of same, May, 1865, from the Society. Canadian Journal and Proc. Canadian Inst., vol. x., No. 59, 1865, from the Society. Astronom. and Metereol. Observations at the U. S. Naval Observatory for 1863, by Capt. J. M. Gilliss, U. S. N., Supt., Washington, 1865, from the Observatory. Proc. California Acad. Nat. Sciences, vol. iii., pp. 193–208, 1865, from the Academy. Proc. Royal Horticultural Soc., London, vol. v., No. 7, 1865, from the Society. 16th Ann. Rep. of the University of New York, on Cabinet of Nat. History, Albany, 1863, from Dr. Shumard. Monographie der Boemischer Trilobiten, by Hawle and Corda, Pragne, 1847; Annals of Science: Proc. Acad. of Science of Cleaveland, Nos. 1–3, 7–11, 14–24, 1853, Jan.–May, 1864, from the Academy. Report of U. S. Coast Survey, vols. 1851–1853, and Maps, from the Superintendent.

Dr. Wislizenus made some remarks on Ozone and Antozone, in connection with the experiments and conclusions of Prof. Niesner.

December 18, 1865.

The President, Dr. ENGELMANN, in the chair.

Six members present.

Publications received as followss:

Trans. Amer. Phil. Society, vol. xiii., Pt. 2: Myriapoda of N. Amer., by H. C. Wood, Jr., M.D., 1865, from the Society. Amer. Jour. of Conchology, by Geo. W. Tryon, Jr., from the Editor. Northward Transportation of Drift Materials in the lower peninsula of Michigan, by Prof. A. Winchell, 1865; Descriptions of New Species of Fossils from the Marshall Group of Michigan, &c., by Prof. A. Winchell, from the Author.

Dr. Engelmann submitted his meterological observations for the month of December, showing an extreme range of the thermometer, within six days, not unusual in our climate, from zero to 55° above.

Dr. Sander observed that his experiments with the water of the Mississippi river showed that it was less liable to putrefy by standing than the ordinary well water.

January 8, 1866.

The President, Dr. ENGELMANN, in the chair.

Twelve members present.

Publications received were laid upon the table, as follows:

Proc. Royal Soc. of London, vol. xiii., No. 70, 1864; vol. xiv., Nos. 71–77, 1865, from the Society. Norges Ferskvandskrebsdyr, 1 Afsnit:

Branchiopoda I.; Cladocera ctenopoda af G. O. Sars, Christiania, 1865; Norge Forekommende Fossile, af Dr. Michael Sars, Med. 4, 1864; Meteorologische Beobachtungen, i. Band, 6 Lief., 1837–1863; Meterol. Jagttagelser, 1864, from the University of Christiania. Atti della Società, Ital. di Scienze Nat., vol. viii., fasc. 2, fogli 1–6, 7–12, Milano, 1865, from the Society. XI. Bericht der Oberhessichen Gesellschaft, Giessen, 1865, from the Society. Vereine für Sachsen u. Thuringen in Halle: Zeitschrift, Band 24–25, Berlin, 1864, from the Society. K. Bohm. Gesellschaft der Wissenschaften in Prague: Sitzungsb. Jan.–Dec., 1864; Predneseni Jednatete, 1863; Die Pharmacognostiche Sammlung des Apothekers, iii., No. 219, Prague, 1863, from the Society. Atti dell' I. R. Istituto Veneto, Disp. 6–9, 1864–5, from the Society. Mémoires de l'Academie Imp. des Sciences, Arts et Belles-Lettres de Caen, 1863, from the Academy. Mittheil. aus dem Osterlande, Altenburg, 1865, from the Society. Würzburger Med. Zeitschrift. iv. Band, 3–5 Heft., from the Society. K. K. Geol. Reichsanstalt: Jahrb. xv. Band, No. 3, 1865, Wien, from the Society. Société Imp. Zool. d'Acclimatation: Bulletin, T. ii., Nos. 9–10, Paris, from the Society. Dublin Quar. Jour. of Science, No. 20, 1865, from the Editor. Rep. of Geol. Survey of Miami County, Kansas, by Prof. G. C. Swallow and F. Hawn, from the Authors. Trans. Illinois State Horticultural Soc. for 1864, from the Society. Geol. Survey of Canada: Palæozoic Fossils, by E. Billings, F.G.S., vol. i., 1861–1865, Montreal, from the Author.

Dr. Wislizenus submitted his Annual Report of observations on Atmospheric Electricity, illustrated by Diagrams, for the year 1865. Referred to the Committee on Publication.

Dr. Engelmann exhibited specimens of California pines, with remarks upon the same; and also upon the yellow water lily (*Nuphar advena*).

The President read his Annual Address:

To-day, the St. Louis Academy of Science closes the first decennium of its existence, and on this, our tenth anniversary, we can look back on the past history of our Institution with pleasure and pride, and with hope and confidence in its prospects in the future.

On the 10th of March, 1856, fifteen gentlemen founded this Academy. I need not tell you with what unbounded zeal and with how fond anticipations—that is the character of all young societies—but I am proud to say that not many of these anticipations have not been realized, and that that zeal has not been evanescent. No; our present condition, the number of members of our Academy, our museum, our library and our transactions, are the living proofs of what those fifteen and their associates have done in these ten years. And let me congratulate you that I see many of those fifteen yet here this evening. Only one of them, our late lamented President, Dr. Prout, has been taken from among us by death, while two, I believe, have left the city; but twelve of them remain members, and they are among the most steadfast and most zealous supporters of this Institution.

You are familiar with the history of the Academy. Very soon after its foundation, the late Col. John O'Fallon granted us, through our member, Dr. Chas. A. Pope, the most essential element of existence, a local habitation, the large hall of our museum; and this hall in which we are now assembled, was given us through the liberality of those gentlemen free of charge, and later the adjoining library room was added. We have been induced to believe that in the magnificent building now being erected, and known as the O'Fallon Polytechnic Institute, rooms more appropriate for our purposes will be set aside for our accommodation.

Let us hope that the generous and liberal minded founder's recent demise will not darken our prospects in that respect.

While our collections increased through the liberality of members and lovers of science, our meetings were regularly attended, and soon furnished the material for the publication of our Transactions, the first number of which appeared in 1857: with this modest pamphlet of 92 pages, illustrated by five plates, we boldly knocked at the door of the old and long-established Academies of this country and of the old world, and they were opened to us in the true spirit of cosmopolitan science. Our connections thus began, have ever increased, until we now exchange with 166 Academies and individuals in the old world, besides about 70 in this country, thus receiving a hundred fold return for what we are able to send out.

The first number was followed in 1858 by the second, of 212 pages, with four plates; in 1859, by the third number, of 222 pages, with nine plates; and in 1860, the fourth number, of 200 pages and three plates, closed the first volume of our Transactions. The period of the civil war was not favorable to the pursuit of science, and it was only in 1863, that we were able to issue the first number of the second volume, of 218 pages, with eleven plates. The second number, commenced last spring, has been delayed by unavoidable circumstances, but will be published soon. Let us hope that returning peace and prosperity, and increased scientific activity in our midst, will, in future, permit us to issue our publications annually as we did at first, and thus they will become a worthy monument of our exertions.

The number of our active members is now, according to our books, seventy, six new members having joined us, and one having resigned, since the last annual meeting. The Treasurer's report, however, shows that not a few of those seventy members are remiss in fulfilling their obligations voluntarily and cheerfully assumed, and it is doubtful whether much more than one-half of them prove by their active presence at our meetings, and by their regular contributions to our treasury, that they still consider themselves members.

To the number of Corresponding Members, four have been added, so that our list now shows sixty-eight names.

Our library has been augmented during the last year by three hundred and fifty-four volumes, pamphlets, and numbers of periodicals; all those from foreign countries (and they form the great majority of them) have been, as heretofore, forwarded free of expense by the Smithsonian Institution, without which invaluable aid the intercourse between societies and men of science in this country and other parts of the civilized world would suffer under the greatest impediments, and would not amount to a tithe of what it now is. Besides these exchanges, about thirty volumes and numbers were donated to the Academy by members and correspondents.

The additions to the museum were less numerous, no doubt owing to the fact that in our present cramped condition we are not able to put our collections up to any advantage. Among other donations, I have to make prominent mention of a valuable collection of fossils from the Upper Missouri country, gathered by Lieut. (now General) G. K. Warren and Dr. F. V. Hayden, and other fossils from Mr. F. B. Meek, both received through the Smithsonian Institution; also, a suite of Lake Superior minerals from Dr. Senter of this city.

The following papers and communications were read before the Academy:—

Dr. A. Wislizenus: On Atmospheric Electricity and its Relation to Temperature and Relative Humidity; on Atmospheric Electricity in 1864; Thoughts on Matter and Force; on the Earthquake of New Madrid, August 17, 1865, with a letter from Mr. Scott, of that place, on the same.

Dr. B. F. Shumard: Bibliography and Catalogue of the North American Palæozoic Echinodermata; on the Petroleum Springs of Missouri.

Professor H. Shimer, of Mount Carroll, Illinois: On a new species of Icterus, and on Entomological subjects.

Dr. C. C. Parry, of Davenport: Notice of additional observations on the Physiography of the Rocky Mountains, with Botanical and Hypsometrical additions by Dr. Engelmann.

Mr. Wm. Kackler, of Wilmington, Will county, Illinois, on the Measurement of Binary Stars.

Dr. G. Engelmann: Meterological Report for 1864; Review of the Genus Callitriche; More About Pines; Description of new American species of the Genus Juncus; Remarks on the Genera Viburnum and Cornus.

Mr. L. J. Cist, of this city, entertained and instructed the members by the exhibition of part of his extensive collection of autographs of prominent men of science in all nations.

Last, but not least, I take the pleasure of informing you that according to the Treasurer's books our old debts have all been paid off, and a balance of over seventy dollars remains in his hands; the publication of the number of our Transactions, now in press, has also been secured by the liberal subscription of members.

A diploma with an appropriate seal has been finished, and the members may avail themselves of the opportunity of obtaining it from the Recording Secretary.

Thus I have exhibited to you an abstract of the history and the present condition of our Academy. Its future is in your hands, and I trust in good hands it is, which will not let the work so well begun lag and decay, but will on the foundation, which we have been constructing for ten years, build up a stately superstructure worthy of ourselves, our city, and our great Mississippi Valley.

Officers for the ensuing year were elected as follows:

President,	George Engelmann, M.D.
1st Vice President,	Adolphus Wislizenus, M.D.
2nd Vice President,	Hon. N. Holmes.
Corresponding Secretary,	B. F. Shumard, M.D.
Recording Secretary,	Spencer Smith, Esq.
Treasurer,	Enno Sander, Ph.D.
Librarian,	G. H. E. Baumgarten, M.D.
Com. of Publication,	G. Engelmann, B. F. Shumard and N. Holmes.
Board of Curators,	C. W. Stevens, B. F. Shumard, Spencer Smith, J. S. B. Alleyne.

The Treasurer submitted his Annual Report, which was examined and approved.

Mr. Henry Flad was elected an Associate Member.

January 22, 1866.

The President, Dr. Engelmann, in the chair.

Six members present.

Letters were read from several societies, announcing the transmission of publications, and acknowledging the receipt of the Transactions of the Academy.

The following publications were received:

Sitzungsb. der K. Akad. der Wissenschaften, Band L., Heft 2-5, li· Heft 2-3, Wien, 1865; Register zu den Banden 43-50, from the Academy. Canadian Journal, No. 60, Nov., 1865, Toronto, from the Institute. Theory of Parallels: Demonstration of the celebrated Theorem, Euc. I., Axiom 12, by Matthew Ryan, Washington, 1866, from the Author. Proc. Acad. Nat. Sciences, Philad., vol. vii., 1854-5, from Dr. Shumard. Proc. Boston Soc. Nat. Hist., vol. x., pp. 17-48, 1865, from the Society. Senckenbergische Naturf. Gesellschaft: Jahresbericht, Jahrg. 1862, Frankfort, 1865, from the Society. K. K. Geol. Reichsanstalt: Jahrbuch, xv. Band, Jan.-May, 1865, Wien, from the Society. Report of the Com's of St. Louis Water Works, from Dr. Sander.

Dr. Engelmann presented from Mr. Feuchtwanger a specien of crystalized borax from a lake in California.

James Leete, M.D., and Nathan Hayward, M.D., were elected Associate Members.

February 5, 1866.

The President, Dr. ENGELMANN, in the chair.

Eight members present.

Publications received:

Mémoires de l'Académie Imp. des Sciences de St. Petersburg, T. v., No. 1, 1862, T. vii., 1-9, viii., 1-16; Bulletin, T. vii., 3-6, T. viii., from the Academy. Nova Acta Reg. Soc. Scientiarum Upsal., vol. v., fasc. 2, 1865, from the Society.

Dr. Englemann made some remarks upon specimens exhibited of a fibrous material from the *Albutilon Avicennæ*, and cocoons found upon the same, suggesting the question, whether the caterpillars use this and the *Morus papyrifera* as the elements of the silk they make.

Some remarks were made upon the appearance of frost on the stems of *Actinomeris helianthoides.* Dr. Engelmann observed that he had seen a similar appearance on the dead stems of the *Verbesina Virginica* also, and connected it with the wings of the stems of these plants and their porous pith.

Dr. Shumard submitted some observations on the distribution of the Echinodermata.

February 19, 1866.

The President in the chair.

Eight members present.

Dr. Boisliniere presented some specimens of Nutmeg from the island of Guadaloupe.

Dr. Wislizenus remarked that his observations with the Electrometer proved that instrument to be a more delicate and sensitive indicator of the approach of storms than the barometer.

Dr. Engelmann called the attention of members to a new self-registering barometer, lately invented at the Dudley Observatory at Albany, which he considered a valuable instrument.

Charles E. Briggs, M.D., was elected an Associate Member.

March 5, 1866.

The President in the chair.

Ten members present.

Letters were read from several societies concerning exchanges.

The following publications were received:

Naturf. Verein in Brunn: Verhandl. ii. Band. 1864, from the Society. St. Gallisch. naturw. Gesellschaft: Bericht, 1863–4, from the Society. Zwillingsbildungen am Stein, mit 85 fig., von Theodore Von Gutzeit, Riga, 1865, from the Author. Würzburger Med. Zeitschrift, vi. Heft, 1865, from the Society. Naturh. Verein in Augsburg: xvii. Bericht, 1865, from the Society. K. K. bayer. Akad. der Wissenschaften: Sitzungsb. 1864, ii. Heft 3–4, 1865, i. Heft 1–4, ii. Heft 1–2, München; Induction und Deduction von Justus Liebig, 1865; Annalen der Sternwarte, xiv. Band, 1865; Enstehung und Begriff der Naturhist. Art, von Dr. Carl Nageli; Vortrage ueber die Florenreiche, von Dr. C. T. Ph. Von Martius, 1865, from the Academy. Verein für Naturkunde: 31 Jahresb., Mannheim, 1865, from the Society. Société Imp. Zool. d'Acclimatation: Bulletin, T. ii., Nos. 11–12, 1865, from the Society. Naturf. Gesellschaft: Berichte, iii. Band, Heft 3–4, Freiburg, 1865, from the Society. Vaterl. Museum Carolino-Augusteum: Jahresbericht, 1864, Salzburg, from the Society. Overijss. Vereeniging: Verslag, 1864; Programma, 20–24 Juni, 1864, from the Society. K. Akad. van Wetenschappen: Verslag en Med., Dl. 7–8, Amsterdam, 1865; Jaarboek 1863–4; Verhandel. 2–3 Deel, 1864–5; Carmen Elegiacum, 1864; Musée Vrolik: Catalogue de la collection d'Anatomie, from the Academy. Naturf. Verein in Brunn: Verhandl. iii. Band, 1864, from the Society. Sitzungsb. der Isis zu Dresden, 1861–4, from the Society. K. Svenska Vetenskaps Akad.: Ofversigt, 1864; Handlingar, 1863; Meteorol. Jakttagelser, Band v., i., 1863, Stockholm, from the Academy. K. Nederl. Meteorol. Institut: Meteorol. Waarnemingen, 1864, from the Institute. Ann. Meteorol. Synopsis for 1865, by J. B. Trembly, M.D., Toledo, from the Author. Proc. Boston Soc. Nat. Hist., vol. x., pp. 17–48, 49–80, 1865, from the Society. Annals of the Lyceum of Nat. Hist. of New York, vol. viii., Nos. 6–7, from the Society.

Dr. Shumard deposited in the museum two specimens of sandstone with carved foot-prints.

Drs. Homer Judd and William N. Morrison were elected Associate Members, and Prof. Theodore Gill, of Washington, D. C., was elected a Corresponding Member.

March 19, 1866.

The President, Dr. Engelmann, in the chair.

Eleven members present.

Publications received:

An Essay on the Life in Nature, by Louis Mackall, M.D.; on the Law of Muscular Motion, by same; on Physical Force, by same, from the Author. Proc. Acad. Nat. Sciences, Philad., No. 5, 1865, from the Academy. Constitution, By-laws and Reports of the Chicago Acad. of Sciences, 1865, from the Academy. Historical Notice of the Essex Institute, Salem, 1866, from the Institute. Catalogue of the Palæozoic Fossils of N. America, Pt. i., Echinodermata, by B. F. Shumard, M.D., from the Author. Enumeration of Fossils of the Niagara Limestone at Chicago, with descriptions of new species, by Profs. A. Winchell and Oliver Marcy, 1865, from the Authors. Illustrated Catalogue of Museum of Comp. Zoology, No. 2, Acalephæ, by Alexander Agassiz, Cambridge, 1865, from the Author. Proc. Amer. Pharmaceutical Asso., Boston, 1866, from the Society. Medical Reporter, No. 2, St. Louis, 1866, from Dr. Potter.

Mr. G. C. Broadhead donated to the Academy a numerous collection of geological specimens from Cass and Jackson counties in Missouri.

Rev. Mr. Kemp made some remarks upon certain Algæ of the genus *Vaucheria*.

Dr. Oscar F. Potter was elected Recording Secretary in place of Mr. Spencer Smith, resigned.

Mr. Felix McArdle was elected an Associate Member.

April 2, 1866.

The President in the chair.

Ten members present.

Publications were received as follows:

Canadian Journal, No. 61, 1866, Toronto, from the Society. Proc. Boston Soc. Nat. Hist., vol. x., pp. 81-144, 1865, from the Society. Trans. Illinois State Horticultural Soc., 10th Ann. Meeting, Chicago, 1866, from the Society. Morphologische Bemerkungen über *Lobelia Dortmanni* L., von Franz Buchenau, Bremen, from the Author. Proc. Essex Institute. vol. iv., No. 7, 1865, from the Society. Medical Reporter, No. 4, St. Louis, from Dr. Potter.

Dr. Engelmann stated that it was a curious fact that certain species of the genus *Juncus*, and other salt water plants, which are known in Europe only as sea-plants, have been found on our lake and river shores.

April 16, 1866.

The President in the chair.

Six members present.

Dr. Wislizenus presented for publication a paper entitled "Observations on Ozone," by Adolph F. Bandelier, of Highland, Illinois, which was read, and referred to the Committee on Publication.

Dr. Engelmann read a paper, entitled "A Revision of the North American species of Juncus, with a description of new and imperfectly known Species." Referred to the Committee on Publication.

Mr. Alexander E. R. Agassiz, of Cambridge, Mass., was elected a Corresponding Member.

May 7, 1866.

The President in the chair.

Twelve members present.

Letters were read.

The following publications were received:

Contributions to the Nat. Hist. of N. America, by Louis Agassiz, LL.D., vols. iii. and iv., 4to., from the Author. Prodrome of a Monograph of the Pinnipeds, by Theodore Gill, 1866, from the Author. Catalogue d'une belle collection de Livres d'Histoire Nat., composée principalement d'Ouvrages concernant les Mollusques, les Polypières, les Animaux Fossiles, etc., from Mr. Alexander Agassiz. Société des Sciences Nat. de Luxembourg: Bulletin, T. viii., 1865, from the Society. Verein der Freunde du Naturg. in Meklenburg: Archiv. xix. Jahrg., 1865, from the Society. Monograph of the Order *Pholadacea*, by George Tryon, Jr., Philad., 1862, from the Author. Verein für Naturk. im Herzogthum Nassau: Jahrbucher, 1862–3, Heft 17–18, from the Society. Zool.-mineral. Verein in Regensburg: Correspondenz-Blatt, xix. Jahrg., 1865: Flora oder Allgemeine Bot. Zeitung, xxiii. Jahrg., Regensburg, 1865, from the Society. K. K. Geol. Reichsanstalt: Jahrb., xv. Band. 1865, Wien, from the Society. Der Zoologische Garten, vi. Jahrg., No. 7–12, 1865, Frankfurt, from the Society. Proc. Boston Soc. Nat. Hist., pp. 145–175, 1866, from the Society. Proc. Royal Horticultural Society, London, vol. v., No. 8–9; Jour. of same, new series, vol. i., pt. 1, 1866, from the Society. K Gesellschaft der Wissenschaften: Nachrichten, aus dem Jahre 1865, Göttingen, from the Society. Trans. of the Royal Soc. of Victoria, vol. vi., 1861–4, Melbourne, 1865, from the Society. Société Imp. d'Acclimatation: Bulletin, T. iii., No. 2, 1866, from the Society. Société Vaudoise des Sciences Nat..: Bulletin, T. viii., 53, Lausanne, 1865, from the Society. Atti dell' I. R. Istituto Veneto, T. x., 1864–5, from the Society. Naturh. Verein in Passau: Jahresb. xvi., 1863–4, from the Society. Nov. Actorum Acad. Cæsar Leopoldino-Carolinæ, T. xiii., pars I., Dresden, 1865, from the Academy. President's Message and Documents, 1864–5, from Hon. John Hogan. Lives of Eminent Physicians and Naturalists of Bremen, from Dr. Buchenau.

The Corresponding Secretary presented, in the name of the Smithsonian Institution, a large collection of shells from the coast of the Gulf of Mexico, as a donation to the Museum.

May 21, 1866.

The President in the chair.

Six members present.

Letters were read from the Smithsonian Institution, announcing the transmission of publications received from Europe: from Bushrod D. Washington; from Alexander Agassiz, acknowledging his election as a Corresponding Member; from the Royal Society of Victoria, Naturh. Verein in Passau, and other societies, concerning exchanges.

Publications received:

Proc. Boston Soc. Nat. Hist., vol. x., pp. 177–224, 1866, from the Society. Essay on the Velocity of Light, by M. Delauney, of the Institute of France, from the Author. K. Preuss. Akad. der Wissenschaften: Monatsbericht, Jan., 1866, Berlin, from the Academy.

George H. Bixby, M.D., was elected an Associate Member.

June 4, 1866.

The President, Dr. Engelmann, in the chair.

Seven members present.

Dr. Sander presented a specimen of the rock salt, in the form of a large crystal, from the island deposit in Vermilion Bay, on the coast of Louisiana, and submitted an analysis and comparison with other kinds of salt, in respect of solubility and use for practical purposes, by which it appeared that this salt was equal to any in purity and value, consisting of 98.8 per cent. of chloride of sodium, with remainder of sulphate of magnesia and chloride of calcium. The bed was over sixty feet in thickness. In the loam deposits above the salt, remains of elephant and mastodon, and Indian implements, such as stone axes and arrow-heads, had been found.

Dr. Engelmann exhibited a living specimen of the spreading adder (*heterodon platyrhinus*), and also rushes (*equisetum robustum*), interesting as the highest order of cryptogamous plants, representing the calamites of the geological strata; and also the *Isoëtes*, a cryptogamous plant from a locality in Illinois.

Dr. Boisliniere exhibited a specimen of the Vanilla Bean, raised in the West Indies, and stated that it was found necessary to bring the pollen in contact with the pistils, artificially, for fructification.

Dr. Engelmann remarked that it belonged to the class of orchidaceous plants, the pollen of which is waxy, and must, many of them, be brought in contact with the pistils by the external agency of insects, or man artificially.

July 2, 1866.

The President in the chair.

Five members present.

Letters were read concerning exchanges.

Publications received and laid upon the table:

Proc. Royal Horticultural Soc. London, vol. i., new series, No. 1–3, from the Society. Entomologische Zeitung, Stettin, 1865, 26 Jahrg. No. 1–3, from the Society. Annuaire de Ville-Marie, &c., Année 1863, Montreal, 1864, from Major L. A. Huguet-Latour. Prodrome of a work on the Ornithology of Arizona Territory, by Elliot Coues, M.D., Philad., 1866, from the Author. Proc. Essex Institute, vol. iv., No. 8, 1865, from the Institute. Proc. Acad. Nat. Sci. Philad., No. 1, Jan. to March, 1866, from the Academy. Proc. Boston Soc. Nat. Hist., vol. x., pp. 241–288, from the Society. On Cephalization, No. iv., by J. D. Dana, from the Author. Canadian Jour. and Proc. Canad. Institute, No. 62, 1866, Toronto, from the Society. Proc. Chicago Acad. Nat. Sciences, vol. i., pp. 1–48, from the Academy. Bulletin de la Société Imp. Zool. d'Acclimatation, Paris, T. iv., No. 3, 1866, from the Society. Dublin Quar. Jour. of Science, No. 21–22, 1861, from the Editor. Jour. of the Royal Geol. Soc. of Ireland, vol. i., pt. i., 1864–5, from the Society. Trans. Royal Scottish Soc. of Arts, vol. vii., pt. i., Edinburgh, 1865, from the Society. Offenbacher Verein für Naturk.: vi. Bericht. 1864–5, from the Society. Museum Francisco-Carolinum: xxv. Bericht, from the Institution.

Dr. Baumgarten presented several publications on Geology, from Dr. Hermann Credner, requesting the Transactions in exchange. So ordered.

July 16, 1866.

The President in the chair.

Twelve members present.

On motion of Mr. Churchill, the following resolutions were adopted:

Whereas, the late disastrous fire at Portland, Me., destroyed the building containing the valuable collection of specimens and books belonging to the Portland Society of Natural History; and whereas it becomes us to assist kindred societies under such reverses: be it, therefore,

Resolved, That the St. Louis Academy of Science donate to the Portland Society of Natural History such duplicates of transactions, minerals and other objects of interest as they are able to offer, and that the Corresponding Secretary be instructed to send a copy of this resolution to the President of said Society, and learn from him at what time the Society will be ready to receive the above named donations.

On motion of Dr. Shumard, the Society at Chicago, which lost its collection by fire, was included in the above resolution, and Dr. Shumard, Mr. Churchill and Dr. G. H. E. Baumgarten, were appointed a committee to carry the same into effect.

August 6, 1866.

The President in the chair.

Seven members present.

Letters were read from several societies relating to exchanges.

Publications were received as follows:

K. K. Geol. Reichsanstalt, Jahrg. 1866, Band xvi., from the Society. Verhandl. für die Gesammte Mineralogie, zu St. Petersburg, Jahrg. 1863, from the Institution. Naturh. Verein der Preuss. Rheinl. u. Westphalens: Verhandl. 22 Jahrg. 3 folge, Bonn, 1865, from the Society. Atti dell' I. R. Istituto Veneto, T. xi., Disp. 1–4, 1865, from the Institution. Verhandl. u. Mittheil. des Siebenburg. Verein für Naturw. zu Hermannstadt, xxi. Jahrg., from the Society. Mercato Centrale della Citta capitale dell' Imperio e Residenza de Vienici, 1865. Proc. Royal Horticultural Soc. London, vol. i., N. S., 1866, from the Society. Blattarum Novarum Species aliquot conscripsit H. DeSaussure, 1864, from the Author. De la Constitution du Soleil, par Emile Gautier, from the Author. Offenbacher Verein für Naturk.: vi. Bericht, 1865, from the Society. Verein für Erdkunde zu Dresden: i.–ii. Jahresb. 1865, from the Society. Naturw. Verein zu Bremen: i. Jahresb. 1864, from the Society. Accademia delle Scienze: Rendiconto, Anno 1864–5, Bologna, from the Academy. Bluthenstand der Juncuceen, von Dr. Franz Buchenau, Bremen, from the Author. K. Preuss. Akad. der Wissenschaften zu Berlin: Monatsb., April–May, 1866, from the Academy. Catalogue of the Library of the Literary and Phil. Soc. of Leeds, 1866; Annual Report for 1864–5; Proc. Geol. and Polytechnic Soc. of the W. Riding of Yorkshire, 1864–5, from the Society. Jour. of the Royal Dublin Society, No. 34, from the Society. Actes de la Soc. Helvetique des Sciences Nat., 49 Sess., Comptes Rendu, 1865, from the Society. Proc. Amer. Academy of Arts and Sciences. vol. vi., pp. 365–567, from the Academy. Société des Sciences Nat. de Neuchatel: Bulletin, T. vii., cahier 1865, from the Society. Naturf. Gesellschaft in Bern: Mittheil. 1865, No. 580–602, Bern, 1866, from the Society. Catalogue of the Amer. Phil. Soc. Library, pt. ii., Philad., 1866; Proc., vol. x., No. 75, from the Society. Proc. Boston Soc., Nat. Hist., vol. x., pp. 289–320, 1866, from the Society. Annals of the Lyceum of Nat. Hist. New York, vol. viii., No. 8–10, 1866, from the Society. Mittheil. aus Justus Perthes' Geograph. Anstalt, von Dr. A. Petermann, from the Author. Storia Nat. dei Dintorno del Golfo della Spezia, del Cav. Prof. G. Capellini; Descrizione Geologica; Carta Geologica; Delfini Fossili del Bolognese; Balenottere Fossili del Bolognese, from the Author. Phylites Cretacées du Nebraska, par MM. G. Capellini et O. Heer, Zurich, 1866, from the Author. Accademia dell Scienze: T. iv., fasc. 2–4, T. v., fasc. 1–2, Bologna, 1865, from the Academy. Acta Universitatis Lundensis, 1864, Lund, 1864–5, from the University. K. Akad. der Wissenschaften: Sitzungsb. Band. li.–lii., 1865, Wien, from the Academy. Société Imp. Zool. d'Acclimatation, Paris: Bulletin, T. iii., No. 6, 1866, from the Society.

Dr. Engelmann presented from Mr. Ackerman, of Montana Territory, a box of minerals from that region, as a donation, for which the Secretary was directed to return the thanks of the Academy.

Dr. Engelmann presented also from Mr. J. W. Matthews, of Troy, Ills., some specimens of iron-stone, from a coal-shaft in Madison county, Ills.; and also specimens of limestone, from Ste. Genevieve Co., Mo.

Charles O. Curtman, M.D., of St. Louis, was elected an Associate Member.

September 3, 1866.

The President in the chair.

Five members present.

Letters were read from several societies.

Publications were received, as follows:

Actes de la Soc. Linnéenne de Bordeaux, T. v., Livr. 4–6, from the Society. Etat actuel de la Sericulture et Description du nid d'un Bombyx exotique, par Henry Trimoulet, 1865, from the Author. Notice sur les gisements des Centilles trilobitiféres taconiques de la Point Levi, au Canada, par M. Jules Marcou; Le Niagara quinze ans apres, par M. J. Marcou; Une Reconnaissance Geologique au Nebraska, par M. Jules Marcou; from the Author. Wurzburger Med. Zeitschrift, xvii. Band, i. Heft. 1866, from the Society. Der Zoologische Garten, vii. Jahrg., Jan.–June,1866, from the Editor. K. K. Botan. Gesellschaft: Verhandl. xv. Band, Wien, 1865, from the Society. The Grand Traverse Region in Michigan: Report by Prof. A. Winchell, 1866; A Plea for Science: An Address, by A. Winchell, June 28, 1866, from the Author. K. Preuss. Akad. der Wissenschaften: Monatsb. Feb., 1866, Berlin, from the Academy. Bulletin de la Soc. Imp. Zool. d'Acclimatation, T. iii., No. 5-7, Paris, from the Society. Proc. Acad. Nat. Sciences, Philad., No. 2, 1866, from the Academy. Geol. Survey of Canada: Report to 1863, with Atlas and Appendix, Montreal, 1865, from the Director. American Jour. of Science and Arts, vol. 42, No. 125, 1865. Proc. Boston Soc. Nat. Hist., vol. x., pp. 369-384, from the Society.

Drs. Engelmann and Wislizenus stated that their meteorological observations gave no peculiar results in reference to the prevailing cholera epidemic.

September 17, 1866.

The President in the chair.

Four members present.

Letters were read from correspondents.

Publications received.

Notes on the Affinities of the Belenophontidæ, by F. B. Meek, from the Author. Le Bassin hydrographique du Conzeau dans ses Rapport avec la vallée de la Dordogne; le question Diluviale et les silex ouvrés, par M. C. Des Moulins; Etudes sur les Cailloux roulés de la Dordogne, par C. Des Moulins; Note sur la Lettre de M. Alphonse de Rochebrune relative aux Plantes importées; Etymologie du nom de l'Aconit, par M. Le Chev. de Paraney, from M. C. Des Moulins. Message and Doc.: State Depart., Pts. 1-4, 1864-5; Navy Depart., 1864-5; Interior Depart., 1864-5; War Depart., 1864-5; Patent Office Rep., vol. 1-2, 1863; Smithsonian Rep., 1864; 8th Census U. S., 1860, from Hon. B. Gratz Brown.

Dr. Engelmann communicated from Dr. A. Schott a paper on the Cactaceæ of Yucatan, Mexico, which was read and referred to the Committee on Publication.

October 1, 1866.

The President, Dr. Engelmann, in the chair.

Eight members present.

Letters were read from various correspondents.
Publications received as follows:

Annals of the N. Y. Lyceum of Nat. Hist., vol. viii., No. 11-12, from the Society. Trans. Conn. Acad. of Arts and Sciences, vol. i., pt. 1, New Haven, 1866, from the Academy. Geol. Survey of Ills., vol. i., Geology, A. H. Worthen, Director, from the Author. Memoirs of the Boston Soc. Nat. Hist., vol. i., pt. 1; Proc., vol. x., pp. 353-368, from the Society; Proc. Acad. Nat. Sci., Philad., No. 3, 1866, from the Academy. Canad. Jour. Sci. and Art and Proc., No. 63, 1866, from the Society. Proc. California Acad. Nat. Sci., vol. iii., pt. 3, 1866, from the Academy.

Mr. R. Hayes stated some results of his observations on a meteoric shower seen at Stoneham, Mass., on the nights of the 10th and 11th of August, 1866. He pointed out especially that nearly all the meteors radiated from a certain point of constant altitude—about N. 12° E., and 20° above the horizon, and that while the stars rose, that point did not change. His observations tended to show that the meteors started from a fixed point in the heavens toward which the earth was moving.

Dr. Engelmann observed that between Aug. 31 and Sept. 26, there had fallen 13¼ inches of rain, seven days only being without rain in that time; and that this had been the wettest September he had ever observed here.

Dr. Engelmann presented some specimens of parasitic plants (*monotropa uniflora*), and a fruit of *Philodendron pertusum*, (a native of Brazil,) raised in Mr. Shaw's Botanic Garden at St. Louis.

October 15, 1866.

The President in the chair.

Six members present.

Dr. Engelmann presented for publication a communication from Dr. C. C. Parry, which was read and referred to the Committee on Publication.

Henry P. Sartwell, M.D., of Penn Yan, New York, was elected a Corresponding Member.

November 5, 1866.

The President in the chair.

Ten members present.

Several letters were read.

Publications were received as follows:

Dublin Quar. Jour. of Sci., No. 23, 1866, from the Editor. Proc. Royal Horticul. Soc. London Jour., vol. i., pt. 3, 1866; Proc., vol. i., No. 5, from the Society. Proc. Royal Soc. London, No. 78-86, from the Society. Zoologische Miscellen. iv., Abbildung der Arten der Gattung *Paludina* Lam.; Bericht über eine Sammelreise, von G. Ritter von Frauenfeld, from the Author. Société Imp. Zool. d'Acclimatation: Bulletin, T. iii., Nos. 8-9, 1866, Paris, from the Society. Société des Sciences Nat. de

Cherbourg; Mem. T. x., 2e Ser., T. i., from the Society. Académie Imp. des Sciences de St. Petersbourg: Mem. T. ix., T. x., Nos. 1-2; Bull. T. ix., from the Academy. K. Akad. der Wissenschaften zu Berlin: Monatsb. Jahrg., 1845, from the Academy. Société Vaudoise des Sciences Nat.: Bull., vol. ix., No. 54, from the Society. Authorship of Shakespeare, by Nathaniel Holmes, New York, 1866, from the Author.

Hon. N. Holmes read the following communication from Prof. Jules Marcou, of Paris, France, on the Dyas in Nebraska, as follows:

[TRANSLATION.]

The Dyas commences upon the right bank of the Missouri river, five miles below Aspinwall and the mouth of the Little Nemaha river, in the northeast corner of the county of Richardson. It penetrates the State of Missouri precisely at the mouth of the Nishnabatona river, and forms a part of Atchison county, and thence enters into the State of Iowa, where it appears to form a large band which extends to St. Mary, opposite the mouth of the Platte river.

In Nebraska, the Dyassic rocks form the right bank of the Missouri river from Aspinwall to Plattesmouth and Aureopolis, that is to say, all the bluffs of the counties of Nemaha, Otoe, and Cass. They repose in discordance of stratification upon the Carboniferous formation, the rocks of which dip to the west northwest at an angle of 4 degrees, whilst the rocks of the Dyas incline generally to the south southwest at an angle of 5 or 6 degrees. Elsewhere the Dyas is found in a little basin with a very slight anticlinal line, which passes between Brownsville and Aspinwall.

The rocks of the Dyas differ a good deal from those of the Carboniferous upon which they repose. They consist of clays of red, green, and grey color, i. e. *variegated;* of whitish, grey, and yellowish limestones; of dolomites and yellow and grey sandstones.

The best section of the Dyas of Nebraska, and the most easy to be studied, is that formed by the bluff at the Nebraska City landing, at Otoe City, at Peru, and at Brownsville, where the strata are higher in the Dyassic series than at Nebraska City; whilst at Rock Bluff, Plattesmouth, and Aureopolis, on the contrary, we find the lower layers forming the base of the Nebraska Dyas.

In the section of Nebraska City may be seen all the details, layer by layer, beginning at the base at the level of the river. It is proper to remark that the section was taken in the month of October, when the waters of the river were so low that navigation was interrupted.

SECTION AT THE LANDING OF NEBRASKA CITY.

A. a.	Red clay with sandstone slab of red and grey colors.	8 ft.
a^{i}.	Green clay with nodular limestone, containing *Productus Koninckianus* Vern. and *Spirifer cameratus* Morton.	
a^{ii}.	Fossiliferous limestone with *Schizodus Rossicus* Vern., *Productus Koninckianus* Vern., and *Chonetes mucronata* M. & H.	
a^{iii}.	Grey clay, unfosiliferous.	
B. b.	First crinoidal limestone with *Orthis crenistria* Phill., *Stenopora columnaris* Schlot., *Dyadocrinus inflexus* Gein.	11 ft.
b^{i}.	Green clay with *Spirifer cameratus* Mort., *Chonetes mucronata* M. & H., *Stenopora columnaris* Schlot.	
b^{ii}.	Blond limestone, fossiliferous.	
b^{iii}.	Green clay.	
b^{iv}.	Blond limestone, fossiliferous, with *Productus punctatus* Mort., and *Orthis crenistria* Phill.	
b^{v}.	Green clay.	
b^{vi}.	Limestone.	
b^{vii}.	Black clay with a coal seam 2 to 4 inches thick.	
b^{viii}.	Second crinoidal limestone with *Stenopora columnaris* Schlot.	

C. c. Green clay.
c^{i}. Limestone, fossiliferous.
c^{ii}. Green clay, fossiliferous with *Productus Orbignyanus* De Kon., *P. cancrini* Vern., *Strophalosia horrescens* Vern., *Orthis crenistria* Phill., *Spirifer plano-convexus* Shum., *Chonetes mucronata* M. & H., *C. glabra* Gein., *Spirifer laminosus* McCoy, *Athyris subtilita* Hall (variety), *Rhynconella angulata* L., *Camarophoria globulina* Phill., *Dyadocrinus inflexus* Gein., *Cyathaconia cornu* Mich., *Stenopora columnaris* Schlot., and *Polypora biarmica* Keyserl.
c^{iii}. Limestone, fossiliferous with *Schizodus Rossicus* Vern., *Edmondia Calhouni (?)* M. & H., and *Productus semireticulatus* Flem.
c^{iv}. Plastic clay, red, green, and dark grey, very fossiliferous, containing *Serpula planorbites* Munst., *Bellerophon Marcouianus* Gein., *B. interlineatus* Portl., *B. Montfortianus* Norw. & Prat., *Allorisma elegans* King, *Solemya biarmica* Vern., *Astarte Nebrascensis* Gein., *Schizodus Rossicus* Vern., *Nucula Kazanensis* Vern., *Edmondia Calhouni (?)* M. & H., *Clidophorus Pallassi* Vern., *Clid. solenoides* Gein., *C. occidentalis* M. & H., *Mytilus concavus* Swal., *Avicula pinneformis* Gein., *Gervillia longa* Gein., *Pecten neglectus* Gein., *Lima retifera* Shum., *Spirifer plano-convexus* Shum., *Chonetes glabra* Gein., *Dyadocrinus inflexus* Gein., *Fenestella elegantissima* Eichw., *Polypora marginata* McCoy, *Pynocladia virgulacea* Phill., *Stenopora columnaris* Schlot., and *Guilielmites permianus* Gein.
c^{v}. Red and green clay, sub-schistose.
c^{vi}. Variegated clay.
c^{vii}. Green clay with nodular limestone containing fossils: *Belerophon carbonarius (?)* Cox, *Pleurotomaria subdecussata* Gein., *Orthoceras corbrossum* Gein., *Leda* or *Nucula sub-acuta* M & H., *Nucula Beyrichi* Von Schaur., *Myalina subquadrata* Shum., *Schizodus Rossicus* Vern., *Sch. obscurus* Sow., *Pecten Missouriensis (?)* Shum., *Chonetes mucronata* M. & H., *Orthis crenistria* Phill., *Productus Flemingi* Sow., *Strophalosia horrescens* Vern., *Turbonilla Swalloviana* Gein., *Pleurotomaria Grayvillensis* Norw. & Prat., *Murchisonia Nebrascensis* Gein., *Murch. subtæniata* Gein., *Dentalium Meekianum* Gein., *Pleurotomaria Haydeniana* Gein., *Schizodus Rossicus* Vern., *Allorisma elegans* King, *Nucula Kazanensis* Vern., *Avicula speluncaria* Schlot., *Gervillia longa* Gein., *Ancella Hausmanni* Goldf., *Pecten Missouriensis* Shum., and *Eocidaris Hallianus* Gein.
c^{viii}. Blue limestone with *Schizodus Rossicus* Vern., *Sch. obscurus* Sow., *Clidophorus Pallassi* Vern., *Chonetes mucronata* M. & H., *Bellerophon carbonarius (?)* Cox, *Pleurotomaria Marcouiana* Gein., and *Pleur. sub-decussata* Gein.

} 34 ft.

D. d. Grey clay without fossils.
d^{i}. Yellow sandstone with fragments of leaves and stems of *Odontopteris* and *Cyclopteris*.
d^{ii}. Yellow sand.
d^{iii}. Yellow sandstone.

} 10 ft.

DRIFT: Composed of grey sand and pebbles of granite and quartz from the Rocky Mountains. } 2–8 ft.

All the fossils which I collected in this section at Nebraska City, as well as other localities in Nebraska, as at Wyoming, Bennett's Mill, and

Morton's Farm, near Nebraska City, at Rock Bluffs and Plattesmouth, have been determined by my friend, Prof. H. B. Geinitz, of Dresden (Saxony), who has described the new species in a large memoir, with fine plates, in the Acts of the Leopoldine Academy of Natural Sciences (*Leopoldinisch-Carolinische Akad. der Naturforscher*), under the title of the "Carboniferous Formation and the Dyas in Nebraska."

A great number of the fossils of Nebraska City are identical with species found in Europe in the *Zechstein* or Magnesian Limestone, as *Serpula planorbites, Schizodus Rossicus, Allorisma elegans, Solemya biarmica, Nucula Kazanensis, Clidophorus Pallassi, Stenopora columnaris*, etc., etc. The new species are allied, or very near, to Dyassic species of Saxony, Russia, and England. Finally, there are some Carboniferous species, which, in Nebraska as in Europe, pass into the Dyas. Naturally the more we descend in the series of the Dyassic rocks, and approach the strata which are in contact directly above the Carboniferous rocks, the fossils of the Carboniferous epoch become more numerous and more nearly the same in certain places; as in the section at Plattesmouth they prevail over the Dyassic forms. The Brachiopods, especially, are the fossils which pass in this manner from the Carboniferous into the lower Dyas.

Dr. Shumard presented a collection of plants, donated to the Academy by Dr. H. P. Sartwell, of Penn Yan, N. Y.

November 19, 1866.

The President in the chair.

Six members present.

Dr. E. F. Baumgarten presented for the Library a German and Italian Dictionary.

G. M. B. Maughs, M.D., was elected an Associate Member.

December 3, 1866.

The President in the chair.

Five members present.

Letters were read.

Publications received:

On the Latitude and Longitude of the U. S. Naval Observatory, and the Declinations of certain Circumpolar Stars, by Prof. Simon Newcomb, U. S. N., from the Observatory. Amer. Educational Monthly, Sept., 1866, from the Editor. K. danske Videnskab. Selskabs, Oversigt, 1865, No. 1-3, from the Academy. K. Preuss. Akad. der Wissenschaften zu Berlin: Monatsb., June-July, 1866, from the Academy.

The Librarian submitted his report on the condition of the Library.

W. E. Eames, M.D., was elected an Associate Member.

December 17, 1866.

The President in the chair.

Twelve members present.

Letters were read.

The following publications were received:

Rep. of Com. on Reconstruction, Dec., 1866; Commercial Relations, 1864; President's Mess. and Doc., 1865-6; Rep. on Cotton; Rep. on Revenue, U. S. Senate, from the Hon. P. Gratz Brown. Proc. Amer. Antiquarian Soc., 1866, from the Society. Dublin Quar. Jour. of Sci., No. 24, 1866, from the Editor. Jour. of the Royal Geol. Soc. of Ireland, vol. i., pt. 2, from the Society. K. K. Geograph. Gesellschaft, Mittheil. viii., Jahrg. 1864, Heft 2, Wien, from the Society. I. R. Istituto Veneto, Atti, T. xi., Disp. 5-7, 1865-6, from the Institution. Würzburger Med. Zeitschrift, Band viii., Heft 2, from the Society. Naturw. Gesellschaft Isis in Dresden: Sitzungsb., Jahrg. 1866, Nos. 1-12, from the Society.

On motion of the Corresponding Secretary, the Buffalo Society of Natural History was placed on the list of exchanges.

Dr. Engelmann read a paper on the genus *Isoëtes*, allied to the Ferns. Referred to the Committee on Publication.

January 7, 1867.

The President in the chair.

Nineteen members present.

Letters were read.

Publications received:

Proc. Literary and Phil. Soc. of Leeds, vol. 3-4; Memoirs, 3d series, vol. ii., from the Society. Overijss. Vereeniging tot Ontwikk. van Prov. Welvaart, Verslag. 1865, Zwolle; Register van Charters, Dl. iii., 1528-1584; Annuaire Meteorol. des Pays Bas pour l'an 1865, 1-2, from the Society. Naturw. Gesellschaft zu Marburg: Schriften, Supp. Heft 1866, from the Society. Bataafsch Genootschap: Verhand., Dl. xii., 2-3 stuck, Rotterdam, from the Society. Université Catholique de Louvain, Annuaire, 1846-48, 1851-54, 7 vols; Programme des Cours., 1865-6, Theses, 15, from the University. Steiermarkisch-Laudschaftl. Ober-Realschule in Gratz: Jahresb., Nos. 11-14, 1862-5; Rechnungs-Abschluss, 1864; Industrie u. Gewerbe-Blatt, Jahrg. 9-10, Gratz, from the Society. Zeeuwsche, Genootschap der Wetenschappen: Verslag, Nov. 15, 1865, Middelburg; Archief. vi., 1866; Bericht der Direction, 1863-4-5; Zelandia Illustrata, 1 afl. 1866, M. T. Lautsheer; Aequivalent Gewichten van 24 Metalen, L. Mulder, Utrecht, 1853, from the Society.

Dr. Engelmann read his Annual Report of Meteorological Observations for the year 1866. Referred to the Committee on Publication.

Dr. Wislizenus read his Annual Report of Observations on Atmospheric Electricity, with tables showing comparisons for the last six years. Referred to the Committee on Publication.

Mr. Holmes submitted some remarks upon the Loess and Drift in connection with the Big Mound at St. Louis, as follows:

An interesting chapter on "Surface Geology" is to be found in the "Geological Survey of Illinois, by A.H. Worthen, Director" (Vol. I., 1866, pp. 24-39), which it may be well to compare with Prof. Swallow's

"Geological Survey of Missouri" (1855, pp. 69-78), in respect of the line of separation between the fresh-water Loess and the marine Drift.

Drift is a pretty comprehensive term in geology, and may be said to embrace both fresh-water and marine drift. Geological Reports do not always very carefully mark the difference, or they fail to define the limits of the two kinds of deposit, either in area, or in the section. In this respect, there appears to be some discrepancy between the Missouri and the Illinois surveys.

In the Missouri survey, the *Alluvial*, the *Bottom Prairie*, and the *Loess* appear to have been minutely observed and accurately described, but the line of separation between the fresh water Loess and the marine Drift does not seem to have been well defined, either in area or in section. The Loess, containing fresh-water and land shells, and several species of extinct mammalia, is made to comprise all the deposits between the *Bottom Prairie* and the *Drift*, which is defined by Prof. Swallow as consisting, first, of *Altered Drift*, composed of sand and pebbles, or the finer materials of the Drift, removed and re-arranged by aqueous agency, "subsequent to the Drift period and prior to the Loess"; and second, of the *Boulder* formation, consisting of sand, gravel and boulders, or water-worn fragments of the local rocks mixed with those of igneous and metamorphic rocks, which were transported from the north; and third, the *Pipe Clay*, lying directly below the *Boulder* deposit. The drift as thus defined is said to have a range extending from the Osage and Meramec rivers to the northern boundary of the State. In respect of range, the Loess is said to cap all the bluffs of the Missouri, from Council Bluffs to the mouth, and those of the Mississippi from the Des Moines to the Ohio, "and forms the upper stratum beneath the soil of all the high lands, both timber and prairie, of all the counties north of the Osage and Missouri, and also St. Louis and the other Mississippi counties on the south."

It is apparent that this *Loess* is thus made to comprise all the yellowish or brown clays, or clayey loam, which lies between the marine drift as above defined and the *Bottom Prairie;* and both the range and the characteristic fossils of the Loess are asserted of the whole: it is included in the Loess, and the Loess is made to extend over all the high lands and prairies of the northern part of the State, constituting the subsoil. The Loess being a fresh-water deposit, if this were true, it would carry the ancient expansion of the rivers, or inland lake, over all that wide area, and even far beyond. Indeed the fresh-water lake could scarcely have found a limit and a shore, short of covering all northern Missouri, and a large part of Iowa, Kansas and Illinois, reaching even into the Great Lakes of the North. A comparison of the elevations from the mouth of the Mississippi to Council Bluffs will show that such an inland lake would imply, if real, a great change in the relative level of the surface of the continent, since that day. That there has been a considerable change of level, besides a cutting down of the barrier at Grand Tower on the Mississippi, may be quite certain, but probably not by any means so much as this theory would require.

In the Illinois survey, the Loess is described as "mainly restricted to the vicinity of our great river valleys," averaging in thickness "from twenty to sixty feet in the river bluffs, and thinning out rapidly as we recede from the river towards the summit level of the interior." This is sufficiently indefinite; but it would seem to mean that the Loess follows up the river valleys to the higher levels, and reaches not much beyond the tops of the bluffs; for the "Drift proper" (that is, the marine drift) is, at the same time, described (beginning from the bottom) as consisting, first, of *blue plastic clay*, containing small pebbles, fragments of wood and trunks of trees; and second, of *buff and yellow clays*, gravel, and beds of sand, with water-worn boulders of various sizes; and thirdly, of *reddish brown clays*, free from boulders, "and forming the subsoil of those portions of the State remote from the streams, and where the Loess is wanting." This again is pretty vague; but the inference fairly to be drawn from the whole description would seem to be, first, that the two lower portions of this "Drift proper" correspond with the *Pipe Clay* and *Boulder* formations of Prof. Swallow; and second, that the *reddish brown clays* (if not also some part of the *buff and yellow clays*), which form the subsoil away from the streams, (containing, probably, a greater or less mixture of sand and other materials, and therefore, perhaps, more correctly called, in other parts of the volume, *yellowish or chocolate brown loam*,) correspond with that yellowish or brown clayey loam which underlies the true Loess where it exists, and (probably) covers the bluffs and hills about St. Louis as well as the uplands and prairies of northern Missouri, forming the subsoil away from the river valleys in Missouri in the same manner as in Illinois, and which Prof. Swallow appears to have included in his *Loess*. It is very clear that Mr. Worthen does not suppose the Loess to extend over the higher uplands and prairies of Illinois; and if this be true of Illinois, it must be just as true of Missouri; and the necessity for an inland lake of such immense extent must disappear, though an expansion of the larger rivers so as to fill the valleys in which they ran to the tops of the bluffs, and penetrate far up the valleys of the tributary streams, would still have to be supposed.

In the chapter on the "Origin and Formation of the Prairies," by Leo Lesquereux (Geol. Sur. of Ills., p. 246), may be found a fine specimen of scientific reasoning upon this subject of the Prairies, which is at once exhaustive and satisfactory. Mr. Lesquereux conceives the black mould (which is half peat, half humus), and the immediate clayey subsoil of the prairies, to have been formed in shallow waters by the decay and transformation of animal shells and vegetable matters, during the process of slow emergence of the continent out of the ocean, after the Champlain epoch of subsidence, and that the horizontal surfaces of the prairies were thus successively left covered with vast sheets of shallow water, in which the surface soil and mould of the prairies were gradually formed and successively deposited. This deposit would, of course, be made upon the brown clays and loam of the marine-drift period. Nor would this theory imply the existence, at any one time, of a vast inland fresh-water lake, extending over the whole area of the prairie country. Nor does Mr. Lesquereux suppose that this kind of formation is confined to fresh water only, but remarks that it is produced in the same manner in the salt marshes of the sea as in the fresh-water swamps of our lakes. But whether these sheets of water were salt, brackish, or fresh, they are quite distinguishable from rivers, or river expansions from which the true Loess was deposited; and they would be left covering separate areas, at different times, as the sea gradually retired from the land, until the surface drainage drew off the waters into the river valleys, forming the river expansions at first, and at length the rivers. This may explain how it happened that the Loess was limited to the river valleys, and never extended to the upland prairies.

In the yellowish or brown clay or loam which forms the compact mass of the hills about St. Louis, no fresh-water and land shells are to be found. They have been searched for, many times, in the cuts of streets and quarries, but never found, to my knowledge, in that clay or loam; but they have often been found, in many places, along the bluffs of the river on either side in deposits and remaining patches of the true Loess, overlying this brown clay or loam. It would seem to be very questionable, whether this brown clay or loam, containing no shells, is not a part of the marine drift proper, deposited in the river valleys before the present rivers ran in them (and apparently not included in Prof. Swallow's *Altered Drift*), and, more probable, if not quite certain, that it is no part of the fresh-water drift or Loess.

The Illinois survey states that the *Blue Clays* at the base of the Drift contain fragments of wood and trunks of trees, but no fossil remains of animals; but that the *brown clays* above, underlying the Loess, contain remains of the Mammoth, the Mastodon, and the Peccary, and that bones of *Mastodon* were found in a bed of "local drift" near Alton, underlying the Loess *in situ* above, and also, in the same horizon, stone axes and flint spear-heads, "indicating," says Mr. Worthen, "that the human race was cotemporary with the extinct mammalia of the Quaternary period." (P. 38.) This "local drift" is not particularly defined, further than that it was older than the Loess. The fact would seem to show that Man inhabited the uplands together with the Mastodon, in the earlier part of the epoch in which the Loess was deposited out of these fresh-water rivers. The Loess itself is nothing but an altered drift, and differs from any other fresh-water altered drift, not so much in containing fresh-water and land shells, as in some difference in the character, arrangement and appearance of the materials.

Mr. Worthen further states that the mounds of the American Bottom, "when carefully examined, are found to consist of *drift clay* and *loess*, remaining *in situ*, just as they appear along the river bluffs, where similar mounds have been formed in the same way by the removal of the surrounding strata by currents of water"; and he observes that he had found the Big Mound of St. Louis "to consist of about fifteen feet of *common chocolate brown drift clay* at the base, which was overlaid by thirty feet or more of the ash-colored marly sands of the Loess, the line of separation between the two deposits remaining as distinct and well-defined as they usually are in good artificial sections in the railroad cuts through these deposits." (P. 34.)

It is evident that this observation was made since the region around the mound proper was graded down to the present level of the streets, and to about that depth below the real base of the original mound; but I know, as many others do, from observations made while the process of grading was going on, and before, that what Mr. Worthen has taken to be a line of separation between the upper and basal portions of his mound, is only the line that marks the bottom of the original mound where it stood upon the natural surface of the ground; and the idea that the basal portion was composed of the drift clay, and the top part of loess, is so far a mere illusion. It is nevertheless true that the ground on which the mound itself stands was this same chocolate brown drift clay, containing no shells. This brown clay or loam is thus identified by Mr. Worthen as a part of his "Drift proper," and so is by him taken out of Prof. Swallow's *Loess*. Neither does the mound proper contain any fresh-water or land shells. It is composed of a confused mass of ash-colored sandy loam of various shades, having an appearance very much like the Loess. It is very possible that it may be a knoll of loess left standing there on a ground of the marine drift brown clay or loam; and if the characteristic fossils of the Loess were found in it, it might certainly be declared to be a remnant of the Loess. No such fossils have been found in it; but I have found embedded in it a fragment of pottery, which is now in the Museum of the Academy. (See Trans. Acad. of Sci. of St. Louis, vol. I., p. 700.)

This pottery may furnish some evidence that the mound is artificial, though not conclusive. If the mound be natural loess, then the pottery would furnish another proof that Man existed here in the age of the Mastodon and the Loess deposit; but if it be artificial, the pottery may have been carried into the mound with the materials of which it was constructed, at a much later date.

In the "Geological Survey of Missouri" (p. 72), some analyses of the Mississippi Loess are compared with those of the Loess of the Rhine, and among them an analysis of one specimen from the Big Mound of St. Louis, which corresponds very nearly with those of specimens from other localities of the Loess, and all of them are said to show "a striking coincidence" in composition with the European Loess. But considering that the materials of the Loess were chiefly derived from the finer materials of the marine drift clay and loam, no great difference should be expected, perhaps, in these analyses; and as the mound would be composed of similar materials, whether artificial or natural, nothing definite can be inferred from these analyses, any more than from the mere appearance of the mass, as to the question of its origin.

The observations of Messrs. Squier and Davis upon this mound, and that called Monk's Mound in the American Bottom, comparing them with other similar mounds of the Mississippi valley, which were ascertained to be artificial, satisfied them that these two, at least, were artificial, and belonged to the class of Temple Mounds; but it may still be possible, however, that these, like the smaller mounds of the Illinois bottom, were naturally formed, and that they were only used, as found by the Indians, for superstitious purposes. The facts known are all against such an hypothesis.

Dr. De Haas, being present, upon invitation, stated, in confirmation of the artificial character of the Big Mound at St. Louis, that his investigations had left no doubt on his mind as to its artificial origin.

The President read his Annual Address:

We look back to-day on a series of eleven years since the foundation of our Academy, and can do so with satisfaction and with pride. If we have not succeeded as well as eleven years ago some of us may fondly have hoped we should or could do; if we have not raised a palace to Science, and filled it with the natural productions of ours and other countries; if we have not issued volumes and volumes of scientific discoveries to enlighten the world; we have done more than could reasonably be expected from so small a number of active men, who had only a few hours left to them by professional or business avocations to give to their scientific labors, and whose financial means, not aided by the heavy men of our city, scarcely enabled them to hold together and preserve what they had accumulated of scientific treasures, and to publish in modest pages the results of their researches and explorations. Yes, it fills us with satisfaction and with pride to see that we have been able to gather together such a museum as we possess in the large hall, to accumulate that highly valuable library wnich you see in the adjoining room, and to proclaim to the scientific world through six numbers of our publications, that out here, on the banks of the Mississippi, here in this vast community of business men, some at least find inclination and leisure to prosecute the more abstract but none the less important and useful study of science.

What we want now, in order to make our Academy what such an institution in this great central city of North America ought to be, are, first, a large number of *active members*, not only what our constitution terms active members, but *laboring* members, and, secondly, *funds*: funds to exhibit, put up, preserve and properly increase our collections; funds to preserve and increase our library; funds to publish and illustrate our transactions.

Fortunately, we have found in the late Col. O'Fallon and our member Dr. Chas. A. Pope generous promoters of our aims, who have granted us, gratuitously, the use of the different halls we occupy in this building. But even free of rent we could not have been able to get along if liberal-minded members and friends, imbued with the importance of our undertaking, had not from time to time aided us with considerable pecuniary assistance.

Our regular income from the contribution of members amounts to about four hundred and fifty dollars annually, and our most necessary current expenses may be defrayed by about two hundred dollars, so that two hundred and fifty dollars would remain for all the above mentioned objects of the Academy. The printing of one number of our transactions alone, of the ordinary size, costs, say, eight hundred dollars, and with illustrations, such as we have been in the habit of giving, one hundred and fifty to three hundred dollars more. These surplus expenses have heretofore been partly lessened by publishing one number of the Transactions only every second or even third year, and to a great part they have been borne, as before stated, by voluntary extra contributions of members; but if we intend to publish one number every year, as we ought to in justice to our correspondents, we must try to raise about eight hundred dollars annually more than we do now. Our present debt amounts to near six hundred dollars, due principally to the Republican office, which has treated us with great liberality, but ought to be paid before we can proceed with the publication of another number. As an offset, our Treasurer exhibits thirty-seven dollars in cash, and available accounts against members amounting to about one hundred and twenty-five dollars.

An urgent claim is also made on our exchequer by the Librarian, of which I will have to speak below.

After an interval of three years we have, in May last, published another number (the second number of the second volume) of our Transactions and distributed it to our paying members, to the institutions with whom we exchange, and to subscribers. A third number which would close the second volume is in part in the hands of the printer, and will, if means can be procured, be issued by May next.

The number of our active paying members is at present 68, 12 of which have joined us during the past year. Some of the older members have declined further to act with us, and two, Drs. Hayward and Roesch, have been removed from among us by death. We have now 140 corresponding members, only three of whom were elected the past year.

A diploma and seal have been finished, and duly authenticated diplomas have been issued to all the members, active or corresponding, who desired it.

We correspond and exchange with 74 societies and individuals in the United States and Canada, and our foreign exchange list now exhibits 170 names of societies and academies, among them those of the oldest standing and highest renown, who send us their voluminous and important publications in exchange for our transactions.

As heretofore, the Smithsonian Institution, unrivalled in this respect in any country, has been the gratuitous mediator between these foreign institutions and our Academy. Principally through these exchanges, and also from donations, our library possesses now 1581 volumes and 843 pamphlets, together 2424, which have been arranged and made accessible and useful through the zealous and intelligent labors of our Librarian, Dr. G. Baumgarten. You will find a more detailed account of the treasures of our library in his report, and will not neglect, I hope, his suggestion, that the largest part of our books, being unbound and mostly in detached numbers, ought to be well bound, so as to prevent loss and deterioration. He reports that at least one thousand volumes are in that condition, which, to bind, would involve an expense of at least five hundred dollars. As I have stated above, our overburdened exchequer will not be able to bear this expense, and we must, if you resolve to snatch these valuable, and, to a great extent, unreplaceable, works from otherwise inevitable loss, call on the liberality of members and well-wishers of our institution for the necessary aid.

Our collections have been enriched during the past year, in the different departments of Zoology, Botany, Mineralogy and Geology. Among the former, I only mention a collection of shells, from the coast of the Gulf of Mexico, from the Smithsonian Institute; in botany a standard collection of *carices* from Dr. H. P. Sartwell, and in geology, Mr. G. C Broadhead's collection from the western parts of this State.

To the societies of Portland, Maine, and Chicago, Illinois, who had met with heavy losses by fire, donations of duplicates from our collections have been made.

In the meetings of the Academy the following papers, besides numerous smaller communications, were read:

1. A. F. Bandelier; Observations on Ozone.
2. Dr. Boisliniere: On the Deterioration of the Mixed Races.
3. Judge N. Holmes: On Prehistoric Man.
4. Dr. C. C. Parry: On the Permanent Snows in the Rocky Mountains.
5. Dr. E. Sander: On the Rock Salt Formation of the Coast of Louisiana, and its Chemical Composition.
6. Dr. Arthur Schott: On the Cactus Flora of Yucatan.
7. Dr. A. Wislizenus: On Atmospheric Electricity; and other communications on the Relation of the same to Cholera, and on the Relation of Thunderstorms to the Fire Alarm Telegraph.
8. Dr. G. Engelmann: Meteorology of 1865; and other Meteorological communications; on the Stage of the River in 1865; on Californian Pines; on the American Species of the Genus Juncus, and on the Genus Isoëtes.

Some of these communications have already been published in the last number of our Transactions; others it is expected to communicate to the scientific public through our next number.

I have thus laid before you a fair statement of the present condition of our Academy. I feel confident that you, and those who may join us hereafter, will use your utmost exertions for the attainment of those high aims for which our Academy was founded, and that our fellow-citizens will appreciate and aid our labors in the fields of science, as our co-laborers in other communities and other countries so generously do.

The Librarian, Dr. G. Baumgarten, also read a report on the number and condition of the library.

EXTRACT FROM THE REPORT OF THE LIBRARIAN.

In a detailed tabular statement of all the books which is appended to this report, I extract the following items:

The library of the Academy contains—

	9	folio volumes,
	394	quarto volumes,
	243	quarto pamphlets,
	1,178	octavo volumes, and
	601	octavo pamphlets,
being	1,581	volumes and
	843	pamphlets,

Total, 2,424, adding to which some 20 volumes and pamphlets not stamped, we obtain a grand total of 2,444.

Of this number, 82 are deposited.

The principal wealth of the library consists in its long lists of serials obtained in exchange for the Academy's own publications. This list embraces 192 quarto vols., 37 quarto pamphlets, 784 octavo vols., and 177 octavo pamphlets; total, 1,190. Of this number, 261 are American publications; from Canada we received 40; from Great Britain, 51; from Germany, including Austria, 468; from Switzerland, 50; France and Belgium, 89; Italy, 59; Spain and Portugal, 10; Holland, 77; Sweden, Norway and Denmark, 34; Russia (aside from the Memoirs of the St. Petersburg Academy, which are classified as separate works), 34; from Bohemia and Hungary, in the Bohemian and Magyar language, 17.

Of works on Natural Sciences, we have 6 folio and 84 quarto vols., 140 quarto pamphlets, 239 octavo volumes, and 305 octavo pamphlets—total 774; among which 248 belong to Geology, 89 to Botany, and 207 to Zoology. Of the other classes I will mention that of Geography, in which are ranged 97 works, 49 of which are quarto volumes, as valuable as they are bulky.

I regret to communicate the fact that of all these works not many more than 400 volumes are bound. I would not here allude to the painful subject of the want of pecuniary means from which the Academy has ever been suffering, were I not confident of advancing the best interests of the institution by earnestly calling the attention of members to the urgent necessity of providing means for the preservation of the library. The latter has gradually attained a size which demands more care and expenditure than it has hitherto received. During the time in which I have controlled the library, I have become fully convinced that it will be impossible to save it from unnecessary loss and destruction without devoting to it a sum large enough to allow *most* books to be bound as soon as practicable after their receipt. Experience has taught me that the prompt binding of all books will be the means indispensible both to preserve the library and to make it readily accessible and useful. Other expenditures are very essential to increase its durability, but for the present I will confine myself to press this one point, and hope that members will bear in mind its necessity and its *urgency*.

There is another matter of some importance to which I would draw attention. Excepting a very few purchases, the books now in our possession have been obtained by either exchange or donation. But the accessions from the latter source have been so trifling within the last years that the growth of the library has been essentially due to exchange alone. Hence, although the serial literature of science is so well represented on our shelves, systematic works and monographs on special branches are relatively deficient. Being confident, that the private libraries of many members contain much material which is of no great value to them, while it would be precious to a general library like ours, I believe it only necessary to announce how welcome would be such donations in order to reopen this source of augmentation, and to induce gentlemen in disposing of their superfluity kindly to remember the wants of the Academy.

G. Baumgarten, M.D., *Librarian.*

The following gentlemen were elected officers of the Academy for the ensuing year:

President—George Engelmann, M.D.
First Vice-President—A. Wislizenus, M.D.
Second Vice-President—Hon. N. Holmes.
Corresponding Secretary—B. F. Shumard, M D.
Recording Secretary—O. F. Potter, M.D.
Librarian—G. H. E. Baumgarten, M.D.
Treasurer—Enno Sander, Ph. D.
Committee of Publication—G. Engelmann, M.D., B. F. Shumard, M.D., Hon. N. Holmes.

The Treasurer submitted his report for the year 1866, which was examined and approved.

January 21, 1867.

The President, Dr. Engelmann, in the chair.

Eight members present.

Dr. Englemann laid before the Academy his reduction of the observations of the City Engineer, on the stage of the Mississippi for the year 1866, with diagrams showing the comparison for the last six years. Referred to the Committee on Publication.

Prof. Swallow presented a copy of his Report of the Geological Survey of Kansas.

The following members were elected as the Board of Curators for the ensuing year: Dr. J. S. B. Alleyne, Dr. B. F. Shumard, and Mr. Spencer Smith.

John Green, M.D., of St. Louis, was elected an Associate Member.

February 4, 1867.

The President in the chair.

Eleven members present.

Letters were read.

Publications received were laid upon the table, as follows :

Geol. Survey of Illinois, by A. H. Worthen, State Geologist, vol. ii., Palæontology, from the Author. Rep. of Com. on Petroleum, from Hon. B. Gratz Brown. Meteorol. Synopsis for 1866, by J. B. Trembly, M.D , Toledo, O., from the Author. Proc. Amer. Pharmaceutical Soc., at Detroit, 1866, from the Society. American Journal of Science and Arts, No. 127, 1867; Proc. Boston Soc. Nat. Hist., vol. iv., pp. 17-32; vol. x., pp. 385-417; and xi., pp. 1-16; Condition and Doings, May, 1866, from the Society. Geol. Rep. on the Old Mines of Washington Co., Mo., by B. F. Shumard, M.D., from the Author. Proc. Essex Institute, vol. v., No. 2, Salem, 1867, from the Society. Naturf. Gesellschaft Graubündens: Jahrb. vi., Jahrg. 1864-5, Chur, 1856, from the Society. Mannheimer Verein für Naturk.: xx. Jahresb., 1866, from the Society. Würtemburgische Naturw. Jahresb. xxi. Jahrg., Heft 1-3, Stuttgart, from the Society. Elliptiske Functioners Rackkendvikling af Dr. O. J. Broch, Stockholm, 1864, from the Author. Société Imp. Zool. d'Acclimatation: Bulletin, T. iii., No. 10-11, Paris, from the Society. Naturw. Verein zu Bremen: Abhandl. i. Band, 1 Heft, 1866, from the Society. Naturf. Verein zu Riga: Correspondenz-blatt, xv. Jahrg., i. Arbeiten, i. Heft, from the Society. Verein des Krain. Landes Museum: Mittheil. i. Jahrg. Laibach, 1866, from the Society. Naturw. Gesellschaft Isis: Sitzungsb. No. 7-9, Dresden, 1866, from the Society. K. K. Geol. Reichsanstalt: Jahrb. xvi. Band, Wien, 1866, from the Society. K. K. Geograph. Gesellschaft: Mittheil. ix. Jahrg. 1865, from the Society. Naturf. Gesellschaft zu Halle: Abhandl. ix. Band, Heft 1-2, from the Society. K. Norste Universitet: Aarsberetning, 1864-5, Christiania, 1866; Bidrag, Heft i., 1865; Geol. Excursioner, af Th. Kjeruif, 1865; Ezechiels Lyner, af C. A. Holmbos, 1866; Maerker efter en Jisted i., af S. A. Sexe, 1866; Meteorol. Jagttagelser, 1865; Quellen zur Geschichte an Taufsymbols, von Dr. C. Caspari, 1866; Entomologiske Undersagelser, 1864-5; from the University. Mittheil. aus dem Osterlande, xvii. Band, Altenberg, 1866, from the Society. Naturf. Gesellschaft in Emden: li. Jahresb. 1865; Festschrift, from the Society. K. Preuss. Akad. der Wissenschaften: Monatsb., Aug. to Oct., 1866, Berlin, from the Academy. Ober Realschule in Gratz: Jahresb. 1-4, 1862-6, from the Society. Two German books, from Dr. C. O. Curtman. Works of Dr. John Davy, 2 vols., from Dr. O. F. Potter.

Mr. Mosberger presented a specimen of magnetic iron ore from Shepherd's Mountain.

February 19, 1867.

The President in the chair.

Fourteen members present.

Letters were read.

Publications were received, as follows:

Dictionary of Congress, 1866; Navy Register, for 1867; Laws of the United States, 1863-6; Reports of Heads of Departments, 1866; Report of Commissioners of Revenue, 1866; Commercial Relations, 1865; Agricultural Report, 1865; Message and Documents, 1866-7; Rep. on Com. and Nav., 1865; Smithsonian Rep., 1865; Interoceanic, Railroad and Canals, 1866; Finance Rep., 1866; Cong. Globe, vols. i.-v., 1865-6, from the Hon. B. Gratz Brown. Researches on Solar Physics, London, 1866, by W. de La Rue, Balfour Stewart and Benj. Locroy, from the Authors. Proc. Amer. Phil. Soc., vol. v., No. 16, 1866, from the Society. Proc. Acad. Nat. Sci. Phila., No. iv., 1866, from the Academy. Leeds Literary and Phil. Society: 46th Rep. of Council, 1865-6; Annual Report for 1865, from the Society. Trans. Geol. Soc. of Glasgow, vol. ii., pts. 1-2, 1865-6; Address of President and Vice-President, from the Society. Proc. California Acad. Nat. Sciences, vol. iii., pp. 273-312, from the Academy. Société des Sciences Nat. de Strasbourg: Mémoires, T. vi., Liv. i., from the Society. Académie des Sciences et Lettres de Montpellier: Mémoires, T. vi., fasc. 1, 1864, T. iv., fasc. 1-2, 1863-4, from the Academy. Académie Imp. des Sciences, Arts et Belles-Lettres de Caen: Mémoires, 1866, from the Academy. Société Linnéenne de Normandie: Bulletin, vol. ix.-x., 1863-6, from the Society. Naturw. Verein für das Fürstenthum Lüneburg: Jahresb. 1865, from the Society. Sur le Dyas, par Jules Marcou, 1866; Sur divers armes, outils et traces de l'Homme Américaine; La Faune Primordiale dans le pays de Galles et la Geologie Californienne, par Jules Marcou, from the Author. Bulletin de la Soc. Imp. Zool. d'Acclimatation, Paris, T. iii., No. 12, 1866, from the Society.

Mr. Augustus Fendler, of Allenton, Mo., was elected a Corresponding Member.

March 4, 1867.

The President in the chair.

Seven members present.

Dr. Engelmann exhibited specimens of the plant *Eupaterium ageratoides*, and offered some remarks on the supposed discovery that it was the cause of milk-sickness.

Dr. Wislizenus exhibited an improved copper lightning-rod, and explained its qualities.

Dr. Edward Hale, Jr., was elected an Associate Member.

March 18, 1867.

The President in the chair.

Thirteen members present.

Letters were read, and publications received and laid upon the table, as follows:

Rep. of the U. S. Sanitary Commission; Amer. Naturalist, vol. i., No. 1, Salem, Mass., from the Editors. Rep. on the Condition of the Indian Tribes, from Hon. B. Gratz Brown.

Mr. Holmes presented from Prof. Jules Marcou, of Paris, France, a copy of Prof. Geinitz's Descriptions of Fossils from the Carboniferous and Dyassic formations in Nebraska.

The Corresponding Secretary read a paper by Mr. Edwin Harrison, on the Porphyry Hills of South-east Missouri, presented for publication. Referred to the Committee on Publication.

Dr. Engelmann remarked that the present month of March had been the coldest he had observed here in thirty-eight years.

April 1, 1867.

The President in the chair.

Eleven members present.

Letters were read.

The following publications were received:

Annual Rep. of the Entomological Soc. of Canada, Quebec, 1867, from the Society. Jour. of the Soc. of Arts, vol. xiv., 1865-6, from the Society. Jour. of the Royal Horticultural Soc. of London, vol. i. pt. iv., 1867; Proc., vol. i., No. 6, 1867, from the Society. Trans. Royal Scottish Soc. of Arts, vol. vii., pt. 2, Edinburgh, 1866, from the Society. Deutsche Ornithol. Gesellschaft zu Halberstadt: Bericht, 1862, from the Society. K. Akad. der Wissenschaften: Sitzungsb. i. Abtheil., lii. Band, 4-5, Heft, 1865; liii. Bd., 1-5, Heft, 1866; liv. Band, 1 Heft, 1866; ii. Abtheil., liii. Band, 1-5 Heft, 1866; liv. Band, i. Heft, 1866, Wien, from the Academy. K. bayer. Akad. du Wissenschaften: Sitzungsb. i., Heft 1-4; ii., Heft 1-4, München, 1866; Annalen der Sternwarte, v. Band, from the Academy. Der Zoologische Garten, vii. Jahrg. 1866, No. 7-12, from the Society. K. Danske Videnskabernes Selskabs: Oversigt, 1864-1866, No. 2-4, from the Society. K. Akad. der Wissenschaften zu Erfurt: Jahrb. 1866, Heft 4-5, from the Society. Société des Sciences Nat. de Neuchatel: Bulletin, T. vii., pt. 2, 1866, from the Society. Offenbacher Verein für Naturkunde: vii. Bericht, 1865-6, from the Society. Entomologische Zeitung, Stettin, 1866, from the Society. Senkenbergische Naturf. Gesellschaft: Abhandl. vi. Band. 1-2 Heft, Frankfurt a M. 1866, from the Society. Nova Acta Reg. Soc. Scientiarum Upsal., vol. vi., fasc. 1, 1866, from the Society. Blicke in das Universum, von L. Grusen, Leipzig, from Dr. B. F. Shumard.

April 15, 1867.

The President in the chair.

Seven members present.

Publications were received as follows:

Proc. Boston Soc. Nat. Hist., vol. vi., pp. 33-64, from the Society. Proc. Acad. Nat. Sci., Philad., No. 5, 1866, from the Academy. Bulletin de la Soc. Imp. Zool. d'Acclimatation, T. iv., No. 1-2, Paris, 1867, from the Society. Deutsche Naturh. Verein von Wisconsin, Bericht, 1866, from the Society. K. Preuss. Akad. der Wissenschaften: Monatsb. Dec., 1866, Berlin, from the Academy.

May 20, 1867.

The President in the chair.

Nine members present.

Letters were read.

Publications received were laid upon the table, as follows:

Proc. Boston Soc. Nat. Hist., vol. vi., pp. 65-80, 1867, from the Society. Proc. Acad. Nat. Sci., Philad., No. 1, 1867, from the Academy. Amer. Jour. of Sci., No. 129, 1867; Canadian Jour. and Proc., No. 63, 1867, from the Society. Preliminary Notice of new Genera and Species of Fossils, by C. A. White, State Geologist of Iowa, and O. H. St. John, Assistant, from the Authors. On Species of Fossil Plants, from the Tertiary of Mississippi, by Leo Lesquereux, from the Author. Proc. Royal Horticul. Soc. of London, vol. i., No. 7, 1867, from the Society. Bulletin Imp. de la Soc. Zool. d'Acclimatation, T. vi., No. 3, 1867, from the Society. K. Zoologisch-bot. Gesellschaft: Verhandl., xvi. Band., 1866, Wien; Nachtrage zur Flora von Neiderosterreich, von Dr. Aug. Neilreich, Wien, 1866; Contribuzione pella Fauna de Molluski Dalmati per Spiridione Brusina, Vienna, 1866, from the Society. K. K. Geol. Reichsanstalt: Jahrb. xvi. Band, No. 4, 1866, from the Society. K. Gesellschaft de Wissenschaften und des Georg.-August. Universitat: Nachrichten, 1866, from the Society. Naturf. Verein in Brunn: Verhandl. iv. Band, 1865, from the Society. Verein der Freunde der Naturg. in Mecklenburg: Archiv. xx. Jahrg. 1866, from the Society. Verein für Naturkunde in Presburg: ix. Jahrg., 1866, viii. Jahrg., 1864-5, from the Society. Jahresbericht über die der Krankanstalten und die Gesundheitsverhältnisse der Freien Stadt Frankfurt, vii. Jahrg. 1863, from the Society. Naturh. Gesellschaft zu Nurnberg, iii. Band, 2 Halfte, 1866, from the Society. Naturw. Verein in Hamburg: Abhandl. v. Band, 1 Abtheil., 1866, iv. Band, 4 Abtheil., from the Society.

Dr. Baumgarten presented from Dr. Ward, of Rochester, N. Y., an illustrated catalogue of fossils.

Dr. Sander exhibited a reddish powder which fell during a rain-storm in Tennessee, which proved to be the pollen of Pines, supposed to have been carried by the winds from the pine forests lying to the southward of that State.

Dr. C. C. Parry reported some observations which he had made on the Pines and other trees of the Rocky Mountains.

June 3, 1867.

The President in the chair.

Eleven members present.

The following publications were received:

Smithsonian Contributions to Knowledge, vol. xiv., 1865; Misc. Collections, vols. vi., vii., 1867, from the Institution: Herbarium Diluvianum; Versteinerungen aus der Kalkschiefer Formation von Solenhofen von Edward Rüppel, Frankfurt a M., 1829, from Dr. B. F. Shumard. K.

Preuss. Akad. der Wissenschaften: Monatsb., Jan.-Feb., 1867, Berlin, from the Academy.

Dr. Boisliniere presented to the Library a copy of the work of Champollion, Jr., on Egyptian Archæology and Monuments.

Mr. Hayes stated that he had observed, on the night of the 20th of May, about twenty shooting stars, which appeared to radiate from a point a little to the S.E. of Lyra, near the beak of the Swan. They left a continuous line of light, and were quite luminous.

Dr. Maughs read a paper on Free-will and Force.

June 17, 1867.

The President in the chair.

Five members present.

T. Gallatin Lyon, M.D., of Jerseyville, Ills., was elected a Corresponding Member.

July 1, 1867.

The President in the chair.

Six members present.

Letters were read by the Corresponding Secretary, and publications received were laid upon the table, as follows:

Proc. Essex Institute, vol. iv., No. 5-6, 1865, from the Society. Trans. of the Albany Institute, vol. v., from the Society. Museum Francisco-Car., Linz: xxvi. Bericht, 1866, from the Society. Naturf. Gesellschaft, zu Freiburg: Berichte, iv. Band, 1-2 Heft, 1867, from the Society. Werner-Verein zur Geol. Durchforschung von Mähren und Schlesien: xv. Jahresb. 1865, Brünn, 1866, from the Society. Zool.-mineral. Verein in Regensburg: Correspondenz-blatt. xx. Jahrg., 1866, from the Society. St. Gallische naturw. Gesellschaft: Bericht, 1864-5, 1865-6, from the Society. Naturw. Verein für Sachsen und Thuringen in Halle: Zeitschrift, Jahrg. 26-28, 1865-6, from the Society. K. Akad. du Wissenschaften: Sitzungsb. liv. Band, 2 4 Heft, 1866-7; Der Meteorsteinfall am 9 Juli bei Knyahinya, von W. Ritter von Haidinger, 1866, from the Academy. Ann. Rep. of the Museum of Comp. Zoology, 1866, from the Institution. Proc. Amer. Acad. of Arts and Sciences, vol. vii., pp. 97-184, from the Academy. Geol. Survey of California: Mollusca, San Francisco, 1867, from the Survey. Treatise on the Nohl Smelting Furnace, by Edward Daniels, from the Author. Mém. de la Soc. des Sciences Nat. de Bordeaux, T. iii. and iv. 2d cahier, from the Society. Description of Fossil Plants, from the Chinese Coal-bearing Rocks, by J. S. Newberry, 1867, from the Author. Reale Accademia della Scienze di Napoli: Rendiconti, anno iii. fasc. 2-12, iv. fasc. 1-3, from the Academy. Acta Acad. C. L. C. G. Nat. Curiosorum, vol. 32, pt. 2, from the Academy. Wochenschrift für Gartnerei und Pflanzenkunde, No. 1-54, 1866, Berlin, from the Editor.

Dr. Potter presented specimens of lead ore, from Pettis Co., Mo., and of gold-bearing quartz, from Lucas Lode, in Montana Territory, and a vanilla bean and pod from Mexico.

August 19, 1867.

The President in the chair.

Nine members present.

The Corresponding Secretary read several letters from correspondents, and laid upon the table the following publications:

Bulletin de la Soc. Imp. d'Acclimatation, T. iv., No. 6-7, 1867, Paris from the Society. Annals of the New York Lyceum of Nat. Hist., vol. viii., No. 13-14, 1867, from the Society. K. Preuss. Akad. der Wissenschaften: Monatsb., Marz-April, 1867, Berlin, from the Academy. Real Sociedad Economica: Memorias, T. ix., 4-6. x. 1-12, xi. 1, Habana, from the Society. Proc. Boston Soc. Nat. Hist., vol. xi., pp. 81-128, from the Society. Proc. Acad. Nat. Sci., Philad., No. 2, 1867, from the Academy. Naturh. Verein der Preuss. Rheinl. und Westphaliens, xxiii. Jahrg. 1-2 Halfte, from the Society. Proc. R. Horticul. Soc. London, vol. i., No. 8, 1867, from the Society. Naturw. Gesellschaft Isis: Sitzungsb., 1866, No. 10-12, 1867, 1-3, from the Society. Rapport d'une Commission sur le livre de Frasier; Note sur le *Scirpus Duvallii*, Hopp, par M. C. Des Moulins, from the Author. Actes de la Soc. Linnéenne de Bordeaux, T. vi., pt. 1, 1867, from the Society. Die Thiere des Waldes, von Brehm und Rossmässler, from the Authors. Oberhessische Gesellschaft für Natur und Heilkunde: xii. Bericht, Giessen, 1867, from the Society. Mémoires de la Académie Imp. des Sciences de Caen, 1867, from the Academy. Bulletin de la Soc. Vaudoise des Sciences Nat., vol. ix., No. 55-56, 1866, from the Society. The Fruit-bearing Belt of Michigan, by A. Winchell, from the Author. Naturf. Gesellschaft zu Danzig: Schriften, i. Band, 3-4 Heft, 1866, from the Society. Naturw. Verein zu Bremen: Abhandl. i. Band, 2 Heft, 1867, from the Society. Proc. Essex. Institute, vol. ii., pp. 193-352, from the Society. Mem. Boston Soc. Nat. Hist., vol. i., pt. 2, from the Society. Reale Istituto Lombardo: Memorie, vols. vii.-x.; Atti, vol. 2-3; Rendiconti, Classe Lettere e Sci. morali e politiche, vols i.-iii.; Scienze Math. e Naturali, vols. i.-iii., Milano, from the Society; Atti della Fondazione Scientifica Cagnola, vol. 3, Milano, 1862, from the Society.

Dr. Sander presented from Col. Merrill, U. S. A., Chief Engineer of the Department of Mo., a map of the Territories of the United States, for which he was directed to return the thanks of the Academy.

September 2, 1867.

The President in the chair.

Eight members present.

Letters were read.

The following publications were received:

Atti della Fondazione Scientifica Cagnola, 1862, vol. ii., pt. 3; vol. iv., pt. 1-3, from the Society. R. Istituto Lombardo di Scienze, Lettere et

Arti: Solenni Adunanze, 1864-5-6; Annuario, 1864; Confini e Denominazione della Regione orientale dell'Alta Italia, del Prof. Amato Omato, Milano, 1866; Sulla Vinificazione, del Prof. Francisco Dini, Milano, 1865; Sulla Polarizzazione Rotatoria della Luce, del Dottore G. Codazza; Guiacimenti metalliferi e bituminose nei Terreni Triassici de Besano, di Giulio Curioni, 1863; Del Cretinismo, Milano, 1864; Appendice sulla successione normale dei diversi membri del Terreno Triassico nell Lombardo di G. Curioni: Della Liberta delle Banche, del Prof. Baldassare Poli, Milano, 1866; Construzione dei Generatori di Vapore di G. Codazza; Saggi Storici e Filosofici di Giurisprudenza, par T. Rossi, Milano, 1865; Mallottie da Fermento morbifico, del Dr. G. Poli, 1864; Rendiconti, classe di Lettere e Scienze morali e politiche, vol. iv. fasc. 1-3, classe di Sci. math. e naturali, vol. iv., fasc. 1-2, Milano, 1867, from the Institution. Atti della Società Ital. de Scienze Nat., vol. viii., fasc. 3-5, vol. ix., fasc. 1-3, from the Society.

A. H. Agard, M.D., and Mr. L. P. Wheelock, of Sandusky, Ohio, were elected Corresponding Members.

September 16, 1867.

The President in the chair.

Eleven members present.

Letters were read.

Publications were received as follows:

Detroit Rev. of Med. and Pharmacy, vol. ii., No. 7, from the Editor. Proc. Boston Soc. Nat. Hist., vol. vi., pp. 129-144, 193-208; vol. vii., pp. 385-401; vol. viii., pp. 209-352; vol. x., pp. 97-112, 129-208, 1866, from the Society. K. Preuss. Akad. der Wissenschaften: Monatsb., May, 1867, Berlin, from the Academy. Naturf. Gesellschaft in Zurich: Vierteljahrschrift, ix. Jahrg. Heft 1-4; x. Jahrg., Heft 1-4; xi. Jahrg. Heft 1-4, from the Society. K. danske Videnskabernes Selskabs: Oversigt, 1865-6, No. 4-6; 1867, No. 1-3, from the Society. Cephalapodes Siluriens de la Bobéme, par J. Barrande, from the Author; K. K. Geol. Reichsanstalt: Verhandl. No. 1, 1867; Jahrb. xvii. Band, No. 1, 1867, Wien, from the Society. Proc. Amer. Phil. Society, vol x., No. 77, from the Society.

Mr. E. H. Clark, of St. Louis, was elected an Associate Member.

November 4, 1867.

The President in the chair.

Eight members present.

Dr. Wislizenus presented from Hon. C. D. Drake, U. S. Senate, a copy of the Smithsonian Report for 1866.

Dr. Engelmann presented from Dr. Bernays, of Ste. Genevieve, a specimen of the fibre of *Abutilon* of the Malvaceae, which grows in abundance near Ste. Genevieve.

December 2, 1867.

The President in the chair.

Eight members present.

Letters were read.

Publications were received, as follows:

Path of the Total Phase of the Solar Eclipse, Aug. 17-18, 1868, from Aden to Torres Straits; Mem. de la Société des Sciences Phys. et Nat. de Bordeaux, T. iv. cahier i., T. v. i., 1866-7, from the Society. Annales de la Soc. d'Agriculture, d'Histoire Nat., et des Artes Utiles de Lyon, T. viii., 3d series, 1864, from the Society. Mem. de l'Académie Imp. des Sciences, Belles-Lettres et Arts de Lyon, classe des Sciences, T. 13-14, from the Academy. Würzburger Med. Zeitschrift, vii. Band, 4-6 Heft, from the Society. Verein für Erdkunde: Notizblatt, 1866, Darmstadt, from the Society. K. K. Geol. Reichsanstalt: Jahrb. xvii., Bd. No. 2, 1867; Verhandl. No. 10, 1867, Wien, from the Society: K. Phys.-ökonom. Gesellschaft zu Königsburg: Schriften. Jahrg. vi., 1865; vii., 1866, from the Society.

Mr. Fendler presented a specimen of *Endoceras proteiforme*, from the Devonian strata, in the western part of this county.

Dr. Shumard offered for publication the Geological Report of Dr. G. G. Shumard, of the U. S. Expedition for Boring Wells in Texas and New Mexico, edited by Dr. B. F. Shumard, with notes, which was read and referred to the Committee on Publication.

The Corresponding Secretary announced the decease of Dr. George G. Shumard, of Cincinnati, O., and Dr. Henry P. Sartwell, of Penn Yan, N. Y., late Corresponding Members of the Academy.

January 1, 1868.

The President, Dr. Engelmann, in the chair.

Eighteen members present.

Letters were read.

Publications received were laid upon the table, as follows:

Acta. Acad. Car-Leopold. G. Nat. Curiosorum, vol. xxxiii., Dresden, from the Academy. K. Akad. der Wissenschaften: Sitzungsb. math. naturw. classe, Bd. liv., Heft. 4-5, Bd. lv., Heft. 1-3, Wien, from the Academy.

Dr. Wislizenus presented for publication his Annual Report of Observations on Atmospheric Electricity for the year 1867, with tables and diagrams, showing monthly means and variations of electricity, temperature, and humidity for the past six years. Referred to the Committee on Publication.

Dr. Engelmann laid before the Academy his Annual Report of Metereological Observations, made at St. Louis, for the year 1867, and his reduction of the observations of the

City Engineer on the stage of the Mississippi river at St. Louis, during 1867, with tables and diagrams. Referred to the Committee on Publication.

The President read his Annual Address:

This, the twelfth anniversary of our Academy, still finds us in this hall, where we have met for eleven years through the liberality of one of our members, Dr. Pope, now in Europe, a liberality now nobly continued by his successor, Dr. Hodgen.

The familiar faces around me, many of them the founders of this institution, and those of our friends which in later years have become associated with us, give encouraging proof of ever active zeal and of abiding faith in our future. Notwithstanding the manifold obstacles found in the way of the unpaying, though never unrequited, pursuit of science, the private business and duties of every one of us, the difficulties of the times, and let me boldly state it, the cool apathy of the great public; and, connected with this, the difficulty of our financial position—notwithstanding all these drawbacks and impediments, you have nobly built up and sustained this Academy, and made it what it is to-day, one of the scientific institutions of our city, and I may proudly add, of the country.

We have active and zealous members; we have a most valuable library; we have collections important and instructive, and in some respects unique; but we have not funds to make all these advantages, these fundamental conditions of a scientific institution, fully available. Our members do not only pay their contributions in brains, they pay them also in money, and they, many of them, have besides taxed themselves considerably for the better prosecution of our objects. But to fully unfold our scientific treasures, to make them properly available and useful, more funds, more than the limited number of our members are able to contribute among themselves, are necessary.

Our regular income amounts to about $400; our absolutely necessary expenses, exclusive of rent, which we happily do not have to pay, can be defrayed by $200; but with the meagre balance of $200 we cannot bind our books, not to say anything of buying necessary works; we cannot furnish cases so as to exhibit our collections and make them instructive and useful to the public; we cannot salary a curator, who would have to devote his whole time to our museum; we cannot publish our transactions in regular annual numbers and properly illustrate them. It will, therefore, become an important duty for you to devise means to improve our financial condition.

The number of our active paying members is given to me by the Treasurer as sixty-eight, three of whom have joined us during the past year; most of them regularly pay up their contributions; the few who have been remiss the Treasurer is convinced will not be found wanting.

Our Corresponding Members number 142; four have been elected during the last year, and two were taken away by death.

We correspond and exchange with seventy-four societies in the United States and Canada, and our foreign exchange list exhibits 172 names of Societies and Academies in Europe and other parts of the world, two of which have been added last year.

Though we have not been able to send them an equivalent since May, 1866, they have, with praiseworthy liberality, transmitted to us during the year over 300 volumes and pamphlets through the efficient and gratuitous assistance of the Smithsonian Institution.

The following members and friends of the Academy have donated about thirty volumes, pamphlets or maps, to us: Dr. Baumgarten, Dr. Boisliniere, Dr. Curtman, Senator Drake, Prof. Marcou, Col. Merrill, Dr. Potter, Dr. Shumard, Prof. Swallow, Dr. Ward, and Dr. White.

Thus our library possesses now 1798 volumes in folio, quarto and octavo; 968 pamphlets, and 22 maps and charts, together 2788 numbers, kept in admirable order and accessibility by our librarian, the largest and most valuable scientific library in the West, which together with the private libraries of some of our members—among which I mention the geological and paleontological library of Dr. Shumard, and the botanical library of Mr. Shaw, and my own—furnish a most important aid to study in almost all branches of natural sciences. A catalogue comprising, with our own library, the scientific works contained in the different public and the attainable private libraries in St. Louis, would furnish important aid to the student in our city.

As suggested in my last annual report, and through the exertions of our official librarian, $163 45 have been collected from members and friends as a fund for binding, for which amount 168 volumes, some of them large and costly ones, have been bound, and are thus preserved from gradual destruction. It is recommended that the exertions of those friendly to our cause be continued in this important undertaking.

Our museum has been enriched during the past year through contributions in the various branches of natural sciences, from Dr. Bernays, Mr. Fendler, President Perry, Dr. Potter, Dr. Reuss, Mr. Smith, Dr. Shumard, and the President.

The following papers were read in the meetings of the Academy:

E. Harrison, on the Age and Formation of the Porphyry Hills of Missouri.

Prof, Jules Marcou, on the Dyas of Nebraska.

Judge N. Holmes, on the Loess Formation of Illinois and Missouri; on Prehistoric Man.

Dr. Maughs, on Free Will and Force.

Dr. C. C. Parry, on the Timber Vegetation of the Rocky Mountains.

Dr. G. G. Shumard, on the Geology of New Mexico and Texas, with plates; with additions by Dr. B. F. Shumard.

Prof. Swallow, on the Oil Springs of Missouri.

Dr. A. Wislizenus, on Atmospheric Electricity; on Indian Graves below the Meramec.

Dr. G. Engelmann, Metereology of 1866; Stage of the River in 1866; Notes on Dr. Parry's Hypsometrical Observations in Western Kansas and New Mexico; on the Plants of the Genus Lemna and Wolffia in the United States; on the Pollen of Coniferæ; on the species of the Genus Vitis in the United States.

A great many verbal communications on different important scientific or practical objects were made in the meetings of the Academy, and furnished the subject of discussions.

The last number of our Transactions was issued in May, 1866. It was found financially impossible to publish another number during the past year; but it is expected that our business matters can be so arranged that the accumulated material, or at least a part of it, can in the coming spring be given to the scientific public in a third number, which would complete the second volume of our Transactions. Our active members expect, our correspondents demand, such action. We owe to the former the gratification of seeing the results of their scientific researches published, and to the latter we are in duty bound to communicate at least an indication of the existence of active scientific life in our Academy in return for the numerous favors we are constantly receiving from them.

Permit me to close this address with a few personal remarks. On the point of going to Europe for a year or more, let me take a friendly farewell from you all who have made for me the position of President—which you have, for the past five years, kindly and indulgently trusted me with—one of pleasure and of pride, and, I hope, of usefulness. In Europe, I. shall ever remember our Academy with the fondest feelings, and shall do what may be in my power to promote its interest there, while you, I know, will zealously and faithfully continue here to make it even more worthy of its great purposes. Farewell!

The following members were elected officers of the Academy for the ensuing year:

President,	Benjamin F. Shumard, M.D.
1*st Vice-President,*	Adolphus Wislizenus, M.D.
2*d Vice-President,*	Charles W. Stevens, M.D.
Cor. Secretary,	Hon. Nathaniel Holmes.
Rec. Secretary,	Oscar F. Potter, M.D.
Treasurer,	Enno Sander, Ph. D.
Librarian,	G. H. E. Baumgarten, M.D.
Curators,	Dr. E. F. Baumgarten, Dr. Charles E. Briggs, Dr. John Green, and Dr. I. Forbes.

The Treasurer submitted his Annual Report of Finances, which was examined and allowed.

January 20, 1868.

The President, Dr. B. F. SHUMARD, in the chair.

Seven members present.

Dr. Engelmann exhibited some cactus plants of the genus *Opuntia*, from Mr. Shaw's Botanic Garden, near St. Louis.

The standing committees were appointed, as follows:

On Publication.—A. Wislizenus, N. Holmes, J. Green, and B. F. Shumard.

Library.—Dr. G. Baumgarten, Dr. Potter, and Dr. Maughs.

Finance.—Dr. Pollock and Spencer Smith.

Ethnology,	N. Holmes.
Botany,	Geo. Engelmann.
Comparative Anatomy,	G. Baumgarten.
Mammalogy,	C. W. Stevens.
Embryology,	C. E. Briggs.
Ornithology,	S. Pollak.
Ichthyology,	E. F. Baumgarten.
Mineralogy,	E. Sander.
Geology,	G. C. Swallow.
Entomology,	J. S. B. Alleyne.
Chemistry,	C. O. Curtman.
Physics,	S. Smith.
Astronomy,	R. Hayes.
Meteorology,	A. Wislizenus.

Edward Montgomery, M.D., Mr. Otto Mallinckrodt, and Mr. Edward Mallinckrodt, of St. Louis, were elected Associate Members.

February 3, 1868.

The Vice-President, Dr. C. W. STEVENS, in the chair.

Ten members present.

Letters were read.

Publications were received, as follows:

Detroit Rev. of Med. and Pharmacy, vol. iii., No. 1, 1868, from the Editor. Proc. Essex Inst., vol. v., No. 5, 1867, from the Society. Amer. Jour. of Science, No. 133, 1868, New Haven. Trans. Royal Society of Victoria, vol. vii., 1866, vol. viii., pt. i. 1867, Melbourne, Australia, from the Society.

Dr. Engelmann presented to the Museum a collection of lavas and other minerals from Mt. Vesuvius; also, a specimen of Cactus of the genus *Opuntia*, from Arizona.

The amendment to the By-Laws, offered at a previous meeting, raising the semi-annual dues of members from three to five dollars, was adopted.

On motion, it was ordered that the Librarian place at the disposal of Dr. Engelmann such number of copies of the Transactions of the Academy as he may desire to take with him for distribution and exchange in Europe.

February 17, 1868.

The President, Dr. B. F. SHUMARD, in the chair.

Seventeen members present.

Dr. Engelmann presented for the Museum a collection of fresh-water shells, from the vicinity of St. Louis, and from the Meramec river, in St. Louis Co., Mo.

Dr. Engelmann read a paper, communicated from Arizona, by Dr. C. C. Parry, being "An Account of the Passage through the Great Cañon of the Colorado River, by Mr. James White, with Geological Remarks," which was referred to the Committee on Publication.

Frank G. Porter, M.D., and Mr. Charles F. Moeller, of St. Louis, were elected Associate Members.

March 2, 1868.

The President in the chair.

Fourteen members present.

Letters from correspondents were read.

Publications were received, as follows:

Proc. Boston Soc. Nat. Hist., vol. ii., 1867, from the Society. Detroit Rev. of Med. and Pharm., No. 2, 1868, from the Editor. Bernard Quarritch: Catalogue of Rare Books, No. 222, London, 1868, from the Publisher. K. Preuss. Akad. der Wissenschaften: Monatsb., Sept.-Oct., 1867, Berlin, from the Academy. Soc. Imp. d'Acclimatation: Bull. T. iv., No. 12, 1867, Paris, from the Society. Mem. of the California Acad. of Sciences, vol. i., pt. 1-2, quarto, San Francisco, from the Academy. Jour. de l'Instruction Publique, vol. iii., 1-2, 1859, Montreal, from Major L. A. Huguet-Latour. Lippincott's Mag., vol. i., No. 2, Philad., 1868, from the Publisher Jour. Royal Soc. of Dublin, No. 36, 1867, from the Society. Catalogues des Livres publiées en Langues étrangères par l'Académie Imp. des Sciences de St. Petersbourg, 1867, from the Academy. Entomol. Verein: Zeitung. 28 Jahrg., 1867, Stettin, from the Society. Naturf. Gesellschaft Isis: Sitzungsb. No. 4-6, 1867, Dresden, from the Society. Naturf. Gesellschaft in Basel: Verhandl. iv. Bd. 1867; Festrede, von Dr. F. Burckhardt, 4 Mai, 1867; Festschrift, Basel, 1867, from the Society Mannheimer Verein für Naturkunde: 33 Jahresb., 1867, from the Society. Naturf. Gesellschaft zu Freiburg, i. B.: Bericht. iv. Bd. 3 Heft, 1867, from the Society. Deutsche naturforscher und Aerzte in Frankfurt a. M.: Tageblatt, 1867; Jahresb. viii. Jahrg., 1864, from the Society. K. norske Universitet: Morkinskinna, af C. R. Unger, Christiania, 1867; Ægyptische Chronologie, von J. Lieblein, 1863; Resultate Magnetische, Astronom., &c.; Meteorol. Beobachtungen auf einer Reise nach dem Siberien, 1828-1830, von Prof. C. Hansteen u. Lieut. Due, 1863: Etudie sur les affinités chimiques, par C. M. Guldberg et P. Waage, 1867; Aarsberetning for Aaret 1866; Obersigt af Norges Echinodermer, von Dr. Michael Sars; Meteorol. Jagttagelser 1866; Index Scholarum, 1867, from the University. Dorpater naturf. Gesellschaft: Archiv. iii. Bd. Lf. 1-4, iv. Bd. 1-2, vi. Bd. 1-2, vii. Bd. 1.; Sitzungsb., Lf. 9-14, from the Society. Accad. della Scienze dell' Istituto Bologna: Memorie, T. vi. fasc. 1-4, T. v, fasc. 3-4; Rendiconti, 1865-6, 1866-7, from the Academy.

On motion of Dr. Engelmann, it was ordered that one of the duplicate specimens of the skull of the fossil ox (or bison), now in the museum of the Academy, should be presented to the Zoological Society of Berlin, in exchange for other fossils proposed to be sent to us by them.

Dr. Engelmann donated to the Academy a collection of fresh-water and marine shells, and various specimens of objects in natural history preserved in alcohol, for the museum. Dr. E. also presented to the Academy the Seal of the old Western Academy of Natural Sciences, of St. Louis, as a memorial of the efforts of our predecessors, in former times, in behalf of natural science in the West.

Prof. G. C. Swallow read a paper, which he offered for publication in the Transactions, on the Permian formation in Kansas, being a review of Messrs. Meek and Hayden's Notes on his Preliminary Report on the Geology of that State. Referred to the Committee on Publication.

Dr. B. F. Shumard exhibited a human skull, with fragments of others, from an ancient Indian mound near Little Rock, in the State of Arkansas, it being the same mound from which the artificially flattened skull, heretofore presented to the Academy by his brother, Dr. G. G. Shumard, was taken. The skull (or calvarium, rather) was small and round, but quite unsymmetrical, and had probably been subjected to compression in the anterior and posterior directions. No accurate description of the mound was given, but it was very probably an ancient mound. It is well known that the Natchez, and other tribes of modern Indians inhabiting the southwestern parts of the United States, were in the habit of flattening the skull by artificial compression; and if it were certainly ascertained that this mound was different from those that are attributable to the modern Indians, and belonged to the class of ancient mounds of the Mississippi Valley, these skulls would be highly interesting, as going to establish the fact that this practice prevailed in North America, as well as in Peru, at a period of great antiquity.

Further Additions to the Revision of the Genus JUNCUS.

(Continued from p. 498.)

1 β. JUNCUS COOPERI, n. sp. rhizomate . . . foliis . . . . caule (fere bipedali) robusto rigido; spatha rigida paniculam compositam strictam vix æquante; glomerulis 2–5-floris; sepalis demum induratis nervosis, exterioribus convexis lanceolatis subulato-acutatis, interioribus ovato-lanceolatis mucronatis paulo brevioribus stamina 6 vix superantibus; antheris, late linearibus, filamentis brevissimis; capsula e basi ovata acutata vix angulata indurata (virescente) paulo exserta; seminibus majoribus appendiculatis costato-reticulatis.

Camp Cady, in the southern part of the State of California, *Dr. J. G. Cooper*, 1861.—A single incomplete specimen, preserved in the botanical collection of the Geological Survey of California, discovered by the zealous naturalist whose name it bears, proves this plant to be closely allied to and intermediate between *J. acutus* and *J. maritimus*, and therefore most probably leaf-bearing. The panicle is 3 inches long and 1 inch wide, green even at full maturity; flowers with the fruit 3 lines long, anthers $1\frac{3}{4}$ lines in length; seeds with white rhaphe and broad white appendages $\frac{3}{4}$ line long; marked with irregular longitudinal reticulation. *J. acutus* (also found at San Diego by Dr. Cooper) has smaller flowers of different shape, and a deep brown almost globose capsule, and smaller differently marked seeds; *J. maritimus*, not yet found in North America, has all the parts much smaller, an ovate mucronate capsule, smaller seeds with short appendages.

J. acuminatus, var. *diffusissimus*, exactly corresponding with the Texan plant, found by the late Dr. Clapp near New Albany, Indiana, is preserved in Hb. Torrey.

LIST OF THE OFFICERS AND MEMBERS

OF THE

ACADEMY OF SCIENCE OF ST. LOUIS,

In 1868.

President,
Benj. F. Shumard, M.D., For. Cor. G. S. of London, and Memb. Geol. Soc. of France, &c., &c.

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Second Vice-President,
Chas. W. Stevens, M.D.

Corresponding Secretary,
Hon. Nathaniel Holmes, A.M.

Recording Secretary,
Oscar F. Potter, M.D.

Treasurer,
Enno Sander, Ph.D.

Librarian,
G. H. E. Baumgarten, M.D.

Curators.

E. F. Baumgarten, M.D.,
Charles E. Briggs, M.D.,
John Green, M.D.,
Isaiah Forbes, D.D.S.

Committee on Publication.

B. F. Shumard, M.D.,
A. Wislizenus, M.D.,
Hon. Nathaniel Holmes, A.M.,
John Green, M.D.

Associate Members.

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Bates, Hon. Edward, LL.D.
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Baumgarten, G. H. E., M.D.
Bent Silas
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Broadhead, James O.

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Chappell, W. H.
Chouteau, Charles P.
Churchill, F. A.
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Coleman, Norman J.
Curtman, Charles O., M.D.,

Dyer, Wm. S., M.D.

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Eames, W. E., M.D.
Eliot, Rev. Wm. G., D.D.
Engelmann, Geo., M.D., A.A.S.

Flad, Henry
Forbes, Dr. Isaiah

Gray, Melvin L.
Green, John, M.D.
Gregory, E. H., M.D.

Hale, Dr. Edward, Jr.
Harrison, Edwin, S.B.
Hausmann, C., M.D.
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Herthel, Geo. P.
Hill, Britton A.
Hitchcock, Henry
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Holmes, Hon. Nathaniel
How, John
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Johnson, J. B., M.D.
Judd, Homer, M.D.

Kaime, James E.
Kennard, Thomas, M.D.
Kennett, Hon. Luther M.

Leete, J. M., M.D.
Lemoine, E. S., M.D.
Linton, M. L., M.D.

Madison, John F.
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Mallinckrodt, Otto
Maughs, G. M. B., M.D.
McArdle, Felix H.
McKellops, Dr. Henry J.
Moeller, Charles F.
Montgomery, Edward, M.D.
Morrison, Dr. W. N.
Mosberger, Frederick
Moses, S. Gratz, M.D.

Oliphant, R. W., M.D.

Pallen, M. M., M.D.
Pallen, M. A., M.D.
Partridge, George
Pennell, C. S.
Pollak, S., M.D.
Pope, Charles A., M.D.
Porter, Frank S., M.D.
Potter, O. F., M.D.
Post, Rev. T. M., D.D.

Reber, Hon. Samuel
Robinson, Geo. R.

Sander, Enno, Ph.D.
Shaw, Henry
Schuyler, Rev. M., D.D.
Shumard, B. F., M.D.
Smarius, Rev. C. F., S.J.
Silvers, Dr. G. H.
Smith, Spencer
Stevens, Charles W., M.D.
Soulard, Benj. A.

Tafel, Prof. R. L.
Taussig, William
Todd, Albert

Walker, G. S., M.D.
Washington, J. R., M.D.
Watters, J. H., M.D.
Whittelsey, C. C.
White, F. W., M.D.
Wislizenus, A., M.D.

Corresponding Members.

Agard, A. H., M.D. - - - - - - Sandusky, O.
Agassiz, Prof. Louis, LL.D., A.A.S., F.R.S., &c. Cambridge, Mass.
Agassiz, Alexander E. R., S.B., A.A.S. - Cambridge, Mass.
Ayres, W. O., M.D. - - - - - - San Francisco, Cal.

Baird, S. F., Asst. Sec. S. I. - - - Washington, D. C.
Bandelier, Adolph F., Jr. - - - - Highland, Ills.
Barrande, Joachim - - - - - Prague, Bohemia.
Barris, Willis H. - - - - - Iowa City, Iowa.
Beebe, Edward H. - - - - - Galena, Ills.
Behr, Hermann, M.D. - - - - San Francisco, Cal.
Berchon, Ernest, D.M.P., Imp. Navy - - France.

Bigelow, John M., M.D.	Detroit, Mich.
Bigsby, John J., M.D., F.G.S.	London, Eng.
Billings, E., F.G.S.	Montreal, Can.
Blake, James, M.D.	San Francisco, Cal.
Blatchford, Thomas W., M.D.	Troy, N. Y.
Bosquet, Prof. J.	Maestricht.
Broadhead, G. C.	Columbia, Mo.
Bryan, Col. F. T., Top. Engrs. U. S. A.	Washington, D. C.
Bunsen, Albert, M.D.	Belleville, Ills.
Bunsen, Charles	" "
Bunsen, Geo.	" "
Capellini, Cav. Prof. Giovanni	Bologna, Italy.
Case, Francis M.	Denver, Col.
Coues, Elliot, M.D.	Washington, D. C.
Dall, Rev. Charles H., A.M.	Calcutta, India.
Daniels, Prof. Edward	Madison, Wis.
Davidson, Thomas, F.G.S., F.R.S.	London, Eng.
Ehrenberg, Hermann	Arizona Ter.
Engelmann, Henry, Asst. Geologist	Springfield, Ills.
Fendler, Augustus	Allenton, Mo.
Flagg, Willard C.	Moro, Ills.
Fleming, R. B., M.D.	Mine La Motte, Mo.
Fry, Major C. H.	Ft. Union, Neb.
Gill, Prof. Theodore	Washington, D. C.
Gilpin, Gov. Wm.	Denver, Col.
Goodnow, Isaac T.	Leavenworth, Kan.
Hagenow, Frederick von	Greifswald, Prussia.
Hall, James, A.A.S., State Geologist	Albany, N. Y.
Harney, Maj. Gen. W. S., U. S. A.	St. Louis, Mo.
Haidinger, W. Ritter von	Vienna, Aus.
Hawn, Maj. F.	Kansas.
Hayden, F. V., M.D.	Albany, N. Y.
Henry, Joseph, LL.D., Sec. S. I.	Washington, D. C.
Henry, J. C., M.D.	Nebraska.
Higginbotham, Rev. John	Halifax, N. S.
Hilgard, E. W., State Geologist	Oxford, Miss.
Hitchcock, Prof. Charles H.	Amherst, Mass.
Hoy, Philo R., M.D.	Racine, Wis.
Holtzmann, Prof. Adolph	Heidelberg, Germ.
Horine, Solomon, M.D.	Memphis, Tenn.
Huguet-Latour, Maj. L. A.	Montreal, Can.
Hunt, T. Sterry, F.G.S., F.R.S., A.A.S.	" "
Irwin, J. T.	Ravenna, Mo.
Jackson, Prof. John B. S., M.D., A.A.S.	Boston, Mass.
Jackson, Charles T., M.D., A.A.S.	" "
Johnson, D. M.	Coshocton, O.
Lane, Hon. E.	Chicago, Ills.

Lapham, I. A., LL.D. - - - -	Milwaukie, Wis.
Le Conte, John L., M.D. - - - -	Philadelphia, Pa.
Leidy, Prof. Joseph, M.D., A.A.S., &c. -	" "
Lindheimer, Ferdinand - - - -	New Braunfels, Tex.
Locke, Prof. John - - - - -	Columbia, Mo.
Logan, Sir W. E., F.G.S., A.A.S., F.R.S., &c.	Montreal, Can.
Lyon, Sidney S. - - - - - -	Jeffersonville, Ind.
Lyon, T. Gallatin, M.D. - - - -	Jerseyville, Ills.
Marcou, Prof. Jules - - - - -	Paris, France.
Marcy, Brig. Gen. R. B., U. S. A. - -	Washington, D. C.
Marsh, Hon. George P., LL.D. - - -	Burlington, Vt.
Mayer, Martin, M.D., LL.D. - - -	Leavenworth, Kan.
Meek, F. B. - - - - - - -	Albany, N. Y.
Meline, Col. James F., U. S. A. - - -	St. Louis, Mo.
Morerod, E. R., M.D. - - - -	Silver Top, Tenn.
Mosbleck, Prof. P. W., Ph.D. - - -	Bethany, Va.
McAdams, William, Jr. - - - -	Jerseyville, Ills.
McClellan, Maj. Gen. Geo. B. - - -	Chicago, Ills.
McGregor, A. L., M.D. - - - -	Chamois, Mo.
McMasters, Rev. S. Y., D.D., LL.D. - -	Palmyra, Mo.
Newberry, Prof. J. S., M.D., N.A.S. - -	New York.
Norris, Benjamin, M.D. - - - -	Pittsfield, Ills.
Norwood, Prof. J. G., M.D. - - -	Columbia, Mo.
Owen, Prof. Richard - - - - -	Bloomington, Ind.
Parry, C. C., M.D. - - - - -	Davenport, Iowa.
Peter, Prof. Robert, M.D. - - - -	Lexington, Ky.
Pope, Maj. Gen. John, U. S. A. - - -	Washington, D. C.
Rauch, John H., M.D. - - - -	Burlington, Iowa.
Reuss, Adolphus, M.D. - - - -	Belleville, Ills.
Riddell, Prof. W. P., M.D. - - -	Austin, Texas.
Robb, James - - - - - -	Chicago, Ills.
Robin, Charles, M.D. - - - -	Paris, France.
Russell, Prof. John - - - - -	Bluffdale, Ills.
Schoneich, Henry, M.D. - - - -	St. Charles, Mo.
Schultz, C. H., M.D. - - - - -	Deidesheim, Bav.
Seeman, Berthold, Ph.D. - - - -	London, Eng.
Sharswood, William, A.M., Ph.D. - -	Philadelphia, Pa.
Sheldon, Prof. D. S. - - - - -	Davenport, Iowa.
Shepard, Prof. Charles U., M.D., A.A.S. -	New Haven, Conn.
Shimer, Henry, A.M., M.D. - - -	Mt. Carroll, Ills.
Sloan, Wm. J., M.D., Surg. U. S. A. - -	Santa Fé, N. M.
Squier, E. George, A.M., F.S.A. - -	New York, N. Y.
Snyder, John F., M.D. - - - -	Bolivar, Mo.
Snyder, Hon. William - - - -	Belleville, Ills.
Steele, George, M.D. - - - - -	Austin, Texas.
Suess, Prof. Edward, Director Imp. Museum of Mineral., - - - - - - -	Vienna, Aus.
Swallow, Prof. G. C.	Columbia, Mo.
Trécul, M. Auguste - - - - -	Paris, France.

Vasey, George, M.D. - - - - - -	Ringwood, Ills.
Vaughan, Col. A. J. - - - - - -	Nebraska.
Warren, Maj. Gen. G. K., U. S. A. - -	Washington, D. C.
Warriner, Henry A., M.D. - - - -	Yellow Springs, O.
Weiss, Prof. Adolph - - - - -	Vienna, Aus.
Wells, Lemuel T. - - - - -	Cincinnati, O.
Wheeler, G. W., M.D. - - - -	Perryville, Mo.
Wheelock, L. P. - - - - -	Sandusky, O.
White, Charles A., State Geologist - -	Burlington, Iowa.
Whittelsey, Col. Charles - - - -	Cleveland, O.
Winchell, Prof. A., State Geologist - -	Ann Arbor, Mich.
Woodruff, William S. - - - -	Marshall, Mich.
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