electrician a study of the fundamental magnetic measurements rather than the perusal of treatises of this nature.

LEDGER'S SUN AND ITS PLANETS.

The sun, its planets, and their satellites. By Rev. EDMUND LEDGER, M.A. London, *Stanford*, 1882. 432 p. 12°.

OF late a considerable number of semi-popular works have appeared on astronomical subjects. They seem to meet a felt want of the community, and have been very successful. We call them *semi*-popular; because, while they are not written for professional astronomers, they are adapted, in their style and mode of treatment, less to the great masses of the business and laboring population than to the educated people who are engaged in various professional occupations. Those, for instance, who are busy in teaching, or with the practice of medicine or law, or who are pursuing geological or biological research (in short, pretty much all who would naturally subscribe for SCIENCE), generally wish to keep *au courant* of what is going on in other than their own special lines of work, and are delighted to find what they want, when they can get it in an attractive form.

Mr. Ledger's book is an excellent one of this class. It is less diffuse than Mr. Proctor's essays, and not quite so imaginative. It is narrower in its scope than Professor Newcomb's Popular astronomy, but easier reading, and fuller of detail in respect to the subjects of which it does treat. It makes no special claims to originality, but is accurate and clear, and the style is unpretentious and agreeable. The book is nicely gotten up, and very well illustrated. Altogether, we have no hesitation in pronouncing it a volume well worth reading and possessing.

It is made up of fifteen lectures read in 1881 and 1882 in Gresham college, London. Two are upon the sun, two are devoted to the moon, two to the earth, and two to Jupiter and his satellites. Each of the other planets has a chapter to itself (counting the group of planetoids as one), and there is a chapter entitled 'Ptolemy *versus* Copernicus.' Naturally, the lectures are not all of equal interest and value; but none of them are poor, or could be well dispensed with. The chapters upon Mars and the planetoids strike us as particularly good, and contain information not otherwise very easily accessible. The chapters on the sun and moon are also excellent, though naturally enough, in the main, only an abridgment and compilation from the recent books on these subjects; to which books the author handsomely acknowledges his obligations.

There are remarkably few mistakes in the work: in fact, in reading it over for this notice, we have found none at all, unless we count as such, a blunder in the illustration on p. 147, representing the comparative size of the sun as seen from Mercury at perihelion and aphelion; the difference being represented very much greater than the truth. Speaking of illustrations, the fine Woodbury-type of the eclipse of 1871 deserves special mention, and several of the pictures of Mars and Jupiter are unusually excellent. It is rather a pity that a few pages of tables were not appended, containing the numerical statistics of the planetary system. They would have greatly increased the value of the book for those who wish not merely to read it once, but to keep it on their shelves for occasional reference.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Flexure of the broken transit. — Professor C. A. Young, after alluding to the fact that the flexure-correction of this peculiar form of transit is not treated of in any of the common text-books on practical astronomy (not even in Sawitsch, who specially describes and discusses the instrument itself), states the theory of the correction to transits of stars observed with the 'broken transit,' which is often so great as to amount to a large fraction of a second of time at the zenith. The constant of flexure must be known, and its effect eliminated, before the collimation error can be determined by reversal of the instrument on a circumpolar star. The correction has the same coefficient with the level-error; and denoting this latter, as usually obtained, by b, the flexure-constant by f, and the pivot-correction by p, the complete formula for the 'level-constant' is $[b \pm (f \pm p)]$. Thus, by flexure, the time of transit of a star is affected by $f \cos z \sec d$. The sign of f changes with the reversal of the instrument, being always plus for eye east, and minus for eye west. Prof. Young gives several methods of determining f: by observing zenith stars in reversed positions of the instrument, by means of the collimating eye-piece and mercury-basin, or a vertical collimator supported above the instrument, and by least-square treatment of equations given by repeated observation of suit-

able stars in both positions of the instrument. Some forms of the 'broken telescope' transit, especially those with a slender axis, require the addition of terms involving other functions of z than its cosine. Prof. Watson found for a Stackpole transit a flexure-correction of the form $(f \cos z + f' \cos^2 z) \sec d$. But if the axis is reasonably stiff, the second term is never sensible. — (*Sid. mess.*, June.) D. P. T. [1

MATHEMATICS.

Double theta-functions. — M. Caspary gives an account of some of the more elementary theorems concerning the theta-functions of two variables. He proves first, in a very simple manner, that the squared functions can be arranged in the form of a determinant of the fourth order which satisfies all the conditions of a determinant of an orthogonal substitution. He derives also the Göpel relations between these functions and their application to Kummer's surface. A number of other fundamental theorems are also arrived at in a very elementary manner, making the paper a valuable introduction to the study of the double theta-functions. — (*Journ. reine ang. math.*, xciv. no. 1.) T. C. [2

Periodic functions. — M. Hurwitz discusses single-valued $2n$-fold periodic functions which throughout a finite region have the character of rational functions, and which are real for real values of their arguments. More exactly he examines the properties of the periods of such Abelian integrals as belong to a real algebraic form (*gebilde*). By a *real* algebraic form he means the aggregate of all pairs of values of (x, y) which satisfy an irreducible algebraic equation $(F(x, y) = 0)$ whose coefficients are all real. Defining a periodic function by the equation

$\phi(u_1 + P_1, u_2 + P_2 \ldots u_n + P_n) = \phi(u_1, u_2 \ldots u_n)$,

the complex of quantities P_a is called a period of the function ϕ, a single one of these quantities being called a modulus of periodicity. A period is then real or pure imaginary when the moduli of periodicity which constitute it are real or pure imaginary. The principal theorem arrived at by the author is as follows: let $\phi(u_1, u_2 \ldots u_n)$ denote a single-valued $2n$-fold periodic function which everywhere throughout a finite region possesses the character of a rational function, and which takes real values whenever its arguments are real; then there are always n period-pairs,

$(P_{1\beta}, P_{2\beta} \ldots P_{n\beta}), (P_1, n+\beta, P_2, n+\beta \ldots P_n, n+\beta)$,

which form together a system of primitive periods of the function, and which are of such a nature, that, for each pair, one of the two conditions following is satisfied: either the first period $(P_{1\beta} \ldots P_{n\beta})$ is real, and the second period $(P_1, n+\beta \ldots P_n, n+\beta)$ is purely imaginary; or the first period is real, and the period $(2P_1, n+\beta - P_1, \beta \ldots 2P_n, n+\beta - P_{n\beta})$ is purely imaginary. — (*Journ. reine ang. math.*, xciv. no. 1.) T. C. [3

PHYSICS.

Liquefaction of nitrogen and carbonic oxide. — S. Wroblewsky and K. Olszewski give a more detailed account of the liquefaction of nitrogen (Science, i. **970**). The gas remained invisible when submitted to a pressure of one hundred and fifty atmospheres and a temperature of $-136°$; but, when the pressure was slowly reduced to fifty atmospheres, the gas was liquefied, presenting a visible meniscus, and evaporating very rapidly. Under the same conditions, the authors succeeded in liquefying carbonic oxide, which formed a colorless liquid with a visible meniscus. — (*Comptes rendus*, xcvi. 1225.) C. F. M. [4

Optics.

Mirage. — In an article entitled "State of the atmosphere which produces the forms of mirage observed by Vince and by Scoresby," Prof. Tait presents some very interesting researches regarding these particular forms of mirage. After an historical note, in which he refers to two valuable contributions to the subject by Wallaston and by Biot, which go far toward a solution of the problem, but have unfortunately fallen into oblivion, he presents his own investigations. His method consists in treating the curvature of a ray of light in the same way as the motion of a projectile; the two cases corresponding when, in the case of mirage, the square of the index of refraction of the air is proportional to the distance from a given horizontal plane.

He finds, however, that, "whatever be the law of refractive index of the air (provided it be the same at the same elevation), all we have to do to find the various possible images of an object at the same level as the eye is to *draw the curve of vertices for all rays passing through the eye in the vertical plane containing the eye and the object, and find its intersection with the vertical line midway between the eye and the object.*" By making suitable suppositions regarding the change of density, he finds that "the conditions requisite for the production of Vince's phenomenon are a stratum in which the refractive index diminishes upwards to a nearly stationary state, and below it a stratum in which the upward diminution is either less, or vanishes altogether." It will be seen that the solution of the problem of atmospheric density and refraction by this means is entirely indeterminate. The supposition of Prof. Tait satisfies the conditions presented by the observations of Vince; but that it is the only law or the true law must be verified by investigations of a different nature.

The method is especially valuable in its inverse form as affording a test of supposed laws of density and refraction in their ability to furnish the various phenomena of mirage. — (*Nature*, May 24.) G. E. C. [5

(*Photography.*)

Concentrated developer in one solution. — Where the photographer intends to travel, and develope on the route, it is very desirable to reduce his chemical outfit to the smallest bulk and to the fewest liquids possible. Mr. G. Cramer, the dry-plate manufacturer, gives the following formula for a developer, which he considers gives the best of results, and at the same time has the advantage of extreme portability.

Stock solution.

Sulphite of soda (crystals)	3 ounces.
Bromide of ammonium	½ ounce.

Bromide of potassium	1½ ounces.
Pyrogallic acid	2 ounces.
Dissolve in distilled water	32 ounces.
Add sulphuric acid (c. p.)	120 minims.
Add aqua ammonia (strongest)	3 ounces.
Add water to make up bulk to	40 ounces.

The sulphuric acid and aqua ammonia should be measured very exactly. Instead of three ounces of crystals, two ounces of granular sulphite of soda may be substituted to produce the same effect. Dilute a sufficient quantity for one day's use as follows: for ordinary purposes, one part in eleven; for very short exposures, one part in three to six; for over-exposed plates, or in all cases where great intensity and contrast are desirable, one part in twenty. This developer may be used repeatedly if it is always returned immediately to the pouring-bottle, which should be provided with a tight-fitting rubber stopper. As long as the solution remains transparent, it is good; but when it looks muddy its use should be discontinued. — (*Philad. phot.*, June.) W. H. P. [6

ENGINEERING.

Mill-engines. — The Southwark iron foundry has constructed for Messrs. Cheney Brothers of South Manchester, Conn., a compound 'Porter-Allen' engine, having steam-cylinders 12 and 21 inches diameter, 2-feet stroke, to run at 180 revolutions per minute. The power is given at 200 horse-power. The ratio of expansion is 16. The expenditure of water was 18.5 pounds per horse-power and per hour. Of this, 11.75 was accounted for by the indicator: the rest was wasted by condensation in the steam-cylinders and by leakage. In these engines the low-pressure cylinder is steam-jacketed, and the exhaust from the high-pressure cylinder passes into an intermediate reservoir, from which the large cylinder is supplied. The reservoir acts as a separator for the water carried in with the steam; and this water is trapped off, and does not reach the low-pressure cylinder. — (*Mechanics*, May 19.) R. H. T. [7

Compressed steel. — Tests have been made at the Watertown arsenal on cold-worked steel made by Naylor & Co. at the Norway steel and iron works, Boston, Mass. The elastic limit is raised from 26,540 pounds per square inch (1,966 kgs. per sq. cm.), in the hot-rolled bar, to 61,000 pounds (4,288 kgs.) in the cold-rolled steel. The ultimate strength is increased from 55,400 pounds (3,895 kgs.) to 70,420 (5,140 kgs.), in one case, and to 81,890 (5,757 kgs.) in another. The results of tests made at the mechanical laboratory of the department of engineering of the Stevens institute of technology are given, showing the increase due to cold rolling to be 70 per cent of the original torsional strength with iron, and over 150 per cent with soft steel. The resilience, or shock-resisting power, was increased, in an average of three tests, nearly 300 per cent in iron, and to double the latter quantity in steel. — (*Ibid.*) R. H. T. [8

Time-fuze for artillery. — Col. Richardson, R.A., finds that all the forms of time-fuzes at present in use are unsatisfactory, since they depend for their accuracy on the length of time during which a given column of composition burns; and this is a matter which is difficult of control at the best. He proposes to take advantage of the rapid and regular rotation of the shell during its flight by which to work a mechanism, which shall liberate a concussion-fuze at any desired moment. — (*Proc. roy. artill. inst.*, April, 1883.) C. E. M. [9

CHEMISTRY.

(*General, physical, and inorganic.*)

Basic sulphates of copper. — By continued boiling of a solution of cupric sulphate, S. U. Pickering obtained a basic sulphate, to which he assigns the formula $6\,CuO \cdot 2SO_3 \cdot 5H_2O$. Precipitation in the cold with potassic hydrate gave the basic salt $4\,CuO \cdot SO_3$. — (*Chem. news*, xlvii. 181.) C. F. M. [10

The hydrates of chlorine. — E. Maumenè thinks that the hydrate $Cl \cdot 10\,H_2O$, mentioned by Faraday, does not exist. Maumenè observed the formation of the hydrate $Cl \cdot 4\,H_2O$, which crystallized in cubes, and of the hydrate $Cl \cdot 7\,H_2O$ in well-marked crystals. With an excess of water, the hydrate $Cl \cdot 4\,H_2O$ is converted into the form $Cl \cdot 12\,H_2O$, which forms orthorhombic crystals. — (*Bull. soc. chim.*, xxxix. 397.) C. F. M. [11

Ammoniacal bromides and oxy-bromides of zinc. — When zinc oxide is dissolved with the aid of heat in a solution of ammonic bromide, G. André states that the compound $3\,ZnBr_2 \cdot 3\,NH_3 \cdot H_2O$ is formed. This compound is completely decomposed when boiled with a large quantity of water, leaving only the oxide. The compound $3\,ZnBr_2 \cdot 4NH_3 \cdot H_2O$ is formed when the experiment is conducted in the cold. On passing dry ammonia gas into a solution of zinc bromide, it is absorbed, with the formation of the product $3\,ZnBr_2 \cdot 5\,NH_3 \cdot H_2O$. The compound $2\,ZnBr_2 \cdot 5\,NH_3$ results when the ammoniacal bromide $2\,ZnBr_2 \cdot 5\,NH_3 \cdot 2\,H_2O$ is heated. The following oxy-bromides were prepared by methods similar to those which give the oxy-chlorides: $ZnBr_2 \cdot 4\,ZnO \cdot 13\,H_2O$, $ZnBr_2 \cdot 4\,ZnO \cdot 19\,H_2O$, $ZnBr_2 \cdot 5\,ZnO \cdot 6\,H_2O$, $ZnBr_2 \cdot 6\,ZnO \cdot 35\,H_2O$. — (*Bull. soc. chim.*, xxxix. 398.) C. F. M. [12

Artificial hausmannite. — By heating manganous chloride to the point of fusion for several hours, A. Gorgen obtained crystals, on cooling, which possessed all the properties of the mineral hausmannite. — (*Comptes rendus*, xcvi. 1144.) C. F. M. [13

Formation of sulphides by pressure. — W. Spring submitted finely divided magnesium with the amount of sulphur calculated for one atom to a pressure of sixty-five hundred atmospheres. The product proved to be a homogeneous mass which gave off hydric sulphide when heated with water to 50° or 60°. Zinc sulphide was formed by subjecting a mixture of zinc and sulphur to the same pressure. Iron united with sulphur, forming, probably, a polysulphide. Cadmium gave a yellow powder, from which hydrochloric acid liberated hydric sulphide. Sulphides of aluminum, bismuth, lead, silver, copper,

tin, and antimony were obtained by this process. — (*Berichte deutsch. chem. gesellsch.*, xvi. 999.) C. F. M. [14

(*Analytical.*)

Determination of nitrogen. — A new method for determining nitrogen, applicable to all nitrogen compounds, is proposed by H. Grouven. It consists essentially in burning the substance at a bright-red heat in a current of superheated steam. He first applied the process on the large scale to the production of ammonium salts from peat, but has since perfected it as an analytical method. The substance is burned in a boat, and the vapors arising from it are passed over a glowing layer of small fragments of a preparation called by the author 'contact-mass', and then through standard acid, as in the soda-lime method. The contact-mass consists of an ignited mixture of peat, chalk, and cement clay in certain proportions, and must be renewed after about fifty combustions. The advantages claimed for the method are, that combustions may succeed each other rapidly in the same apparatus (constructed of iron, with asbestos stoppers), that large quantities of material (two to three grams) may be used, that no drying or pulverization is necessary, and that it may be combined with an ash determination. Nitrates are dissolved with addition of sugar, sufficient clay is added to make a stiff dough, and the latter is introduced into the apparatus. The method is said to give concordant results, which are slightly higher than those obtained by the soda-lime method. — (*Landw. vers.-stat.*, xxviii. 343.) H. P. A. [15

AGRICULTURE.

Chemistry of 'fairy-rings.' — The formation on pasture-land of so-called 'fairy-rings,' that is, of circles of dark-green grass more luxuriant than the surrounding herbage, has long been supposed to be connected with the growth and decay of fungi, which serve as manure for the grasses which succeed them. The effect has by some been ascribed chiefly to the ash of the fungi, while others attribute it largely to their nitrogen. Two views are possible in regard to the way in which the fungi enrich the soil. They may have the power of attacking those organic and mineral matters in the soil which are not available as food for higher plants, and so of converting them into an available form, or it is possible that they have the power to assimilate free nitrogen from the air, and thus increase the store of this element in the soil. Lawes, Gilbert, and Warington have endeavored to decide between these alternatives by analyzing samples of soil from within, on, and outside of, several such rings. Almost uniformly the percentage of nitrogen in the surface-soil to the depth of nine inches was greatest outside the ring, least within it, and intermediate on the ring. The results of the carbon determinations were similar, but less uniform. The authors conclude that the fungi simply render more available to vegetation materials already existing in the soil; and that, as these materials are taken up and removed in the more abundant growth which follows, the soil is naturally impoverished. This conclusion applies, in the first place, to the nitrogen; but it would seem that it must be equally true of the ash ingredients. Whether there may not also be an evolution of free nitrogen by the fungi, or whether, on the other hand, nitrogen may not be assimilated from the air, are undetermined questions; but the phenomena are explainable without these suppositions. — (*Journ. chem. soc.*, ccxlvi. 208.) H. P. A. [16

GEOLOGY.

Puerco beds in France. — Professor E. D. Cope referred to an analysis by Dr. Lemoine of the marsupial types belonging to the *faune cernaysienne* as having been made considerably later than the speaker's diagnosis of similar forms from the Puerco beds, which belong to the same geological horizon. He claimed, that, as the age of the American formation had been the first to be definitely determined, its name should be applied to the corresponding French deposits. — (*Acad. nat. sc. Philad.; meeting* June 12.) [17

The Allegheny oil-sands. — Mr. C. A. Ashburner stated that he had recently examined the Allegheny oil-fields of western New York, and had been able to determine one or two points of interest both to commerce and to geology. After defining the Bradford and Allegheny oil-fields, the varying horizons of the oil-supply were alluded to. He had determined that the Allegheny oil-sands of New York were not above the Bradford sands of Pennsylvania, but were the same. Investigations extended into Livingston, Steuben, and Wyoming counties, N.Y., established the belief that the sands alluded to belong to the lower Chemung group. Mr. Ashburner further remarked, that, while these sands are doubtless for the most part reservoirs of oil produced in lower strata, some of the material was formed from plants contained in the sands themselves. The oil in Pennsylvania never reaches the reservoirs from above.

Mr. Benjamin S. Lyman stated his belief that the oil always originates in the sand where it is found. — (*Acad. nat. sc.; meeting* June 12.) [18

GEOGRAPHY.

(*Arctic.*)

Northern notes, Atlantic region. — The Germania sailed from Hamburg, June 20, with provisions and instruments for the German expedition at Cumberland Inlet. —— The departure of the Willem Barents in search of the Dutch expedition on the Varna took place as proposed. —— The account recently published of the wintering at Cape Flora, Franz Josef Land, by the Eira party, contains numerous items of interest in connection with the proposed use of this land as a starting-point or base for more northerly expeditions. As might be expected from the insularity of the land, the winter is milder than in the same latitude on the west Greenland coast. The land is probably slowly rising, like most other arctic land. Terraces ninety feet above the sea-level were observed. Resident land-animals, such as reindeer, arctic hares or rabbits, and ptarmigan, there are none. Of wandering arctic animals who live in the sea or on the ice, and are common to the whole frozen re-

gion, and sea-birds, there is a certain supply, the former being present the year round, though only male bears occur in winter, and the small auks for two-thirds of the year. The lowest temperature observed was forty-three degrees below zero, Fahrenheit, and this in latitude 80°. —— Tromholt, whose researches into the aurora borealis have proved its connection with electrical discharges from the earth, proposes to spend the winter 1883-84 in Iceland, devoting himself to similar studies with Lemström's apparatus, and on the lines indicated by him. —— The U. S. S. Yantic sailed June 14, from New York, to join the Proteus at St. Johns. Ensign H. G. Dresel, U. S. N., accompanies the Yantic as naturalist. Later advices announce the departure of both vessels from St. Johns for Lady Franklin Bay, June 29. —— The Danish South Greenland expedition has arrived at its field of work, and at last accounts expected to begin operations immediately. — W. H. D. [19

Northern notes, Pacific region. — June 2, the steamship Dakota left San Francisco for an excursion throughout south-eastern Alaska with a large number of excursionists. Similar excursions are planned for July and August. —— The schooner Leo has sailed from San Francisco to Point Barrow, to relieve Lieut. Ray and his party, and to obtain absolute magnetic astronomical and pendulum observations at the station. Returning, Mr. Clarke of the signal-service will relieve the present officer at St. Michaels, Norton Sound, and take charge of the station, which will be the most northern signal-service station then in operation. —— A vessel for the hydrographic exploration of the waters of Alaska, under the auspices of the U.S. coast-survey, is about to be constructed on the Atlantic coast, and sent out *viâ* Cape Horn, it being found that the expense of building her on the Pacific coast would considerably exceed the funds available. —— The last reports from the mines near Juneau, Alaska, are very favorable: the owners of one mine 'cleaned up' $9,000 in April; $80,000 have been refused by the owners of another claim. A number of miners will have preceded Lieut. Schwatka on his journey down the Lewis and Yukon rivers this season, bound to join the Schreffelin party on the Tananah. If these numerous prospectors and adventurers were to record their observations, doubtless much valuable information on other than mining topics might be preserved. —— The rock upon which the steamer Eureka was lost last month proves to be a previously unknown danger. —— The decrease of salmon in the rivers of Oregon and elsewhere has led to much activity in pushing out into the new north-west in search of unpillaged streams. A great many new salmon-fisheries have been established at various points in British Columbia and Alaska. —— The U. S. S. Adams is to visit the island of Kadiak on her summer cruise. —— The authorities of British Columbia have instituted an exploration of the Queen Charlotte Islands with reference to agricultural lands. The north-eastern portion of the northern island has been noted for nearly a century for its attractive aspect. The Hudson Bay company has long had a station at the entrance of Massett Inlet (named Hancock River by Capt. Crowell of Boston in 1791), where potatoes and other vegetables flourish; and the fat and sleek appearance of the cattle has been often mentioned by more recent visitors. The western coast of these islands has hardly been visited by explorers since Ingraham, in 1791, made his sketch-map of the coast. It is high and mountainous as far as known, and, like the south-eastern part of the group, likely to be chiefly valuable for its timber, minerals, and fish. —— The body of a white man murdered by the British Indians has been found near Milbank Sound, concealed near the shore; while two Alaskan Indians, who enlivened a visit to British Columbia by slaying two Chinamen, have been sentenced to be hanged at Victoria, V.I. —— The steamer Pinta of the U. S. navy, which was prepared for police-duty and exploration on the Alaskan coast, and lately pronounced unseaworthy, has been re-examined, and the decision reversed: she will sail shortly *viâ* Cape Horn under the command of Lieut. Uriel Sebree, U.S.N. This voyage will offer excellent opportunities for scientific observations *en route*. —— The U. S. S. Corwin, under the command of Capt. Healy, has sailed under instructions to visit Juneau, and settle certain quarrels between American and British miners there, then to proceed to the Pribiloff Islands to protect the seal-fisheries; after which St. Lawrence Bay, Bering Strait, will be visited, and the presents from the government to those hospitable Chukchis who preserved the lives of the Rodgers party will be delivered, arctic whiskey-smugglers looked after, and the usual observations made. — W. H. D. [20

BOTANY.

Cryptogams.

Notes on Laminariae. — In the fourth part of his Observationes phycologicae, Prof. J. E. Areschoug gives a revision of some species of Laminaria and related genera, including several of the forms found in the United States. He considers that L. platymeris, De la Pyl., is the same as L. Cloustoni, which he places in the genus Hafgygia, to which he considers that L. Andersonii also belongs. — W. G. F. [21

Iowa fungi. — Professor J. C. Arthur gives very full descriptions of twelve species of Iowa Uromyces, including one new species, U. acuminatus, on Spartina. At the end is an index of synonyms and host-plants. — (*Bull. Minn. acad.*, ii.) W. G. F. [22

Injurious Algae. — In a paper on some Algae of Minnesota supposed to be poisonous, Prof. J. C. Arthur gives an account of a species of Rivularia infesting the water of ponds at Waterville, Minn., and supposed to be the cause of death or injury to cattle. He also describes the condition of Lake Phalen, near St. Paul, in which he found several species of Nostochaceae. — (*Bull. Minn. acad.*, ii.) W. G. F. [23

Ohio fungi. — In a continuation of his paper on the mycologic flora of the Miami valley, Mr. A. P. Morgan gives a description of the Hyporhodii, Dermini, Pratelli, and Coprinarii of the region mentioned, including sixty-five species. — W. G. F. [24

Phenogams.

Formation of cystoliths. — Chareyre has examined the development of these bodies with special reference to the source of the materials from which they are produced. He finds that the food-reserve in seeds of Urticaceae is composed of aleuron grains possessing 'globoids;' and yet the calcareous matter forming the globoids, though disappearing at the period of germination, does not contribute to the formation of the cystoliths. Sometimes, when grown upon pure sand, the seedlings exhibit the *pedicle* of the cystolith, but nothing more. Upon chalky soil, or even ordinary earth, the cystoliths appear very soon, — in fact, as soon as the cotyledons are disengaged from the seed-coats. If the seeds are made to germinate in darkness, even if other conditions are favorable, the cystoliths remain in the rudimentary state. Furthermore, in some cases, cystoliths already formed disappear upon keeping the plants in darkness. — (*Comptes rendus*, May 28.) G. L. G. [25

ZOÖLOGY.

Coelenterates.

A new hydroid polyp. — Professor E. D. Cope described an interesting form of hydroid polyp found in large numbers on the bark of submerged trees in Upper Klamath Lake, Oregon. Its coenoecium is a mass of creeping yellowish stems embedded in sarcode. Each zoöid is of an elongate oval form, sessile, and with six rays of equal size, each one-half as long as the body. The zoöids are translucent, but with two oval bodies in the lower half of the body-cavity of a yellow color. These are collected in masses as large as the fist. The length of each zoöid is one millimetre. They did not extend themselves beyond this length, neither did the rays elongate to beyond half the same during the time they were observed. They retracted themselves on being irritated. They do not possess any fringes like the arms of the polyzoa. As the possession of a coenoecium distinguishes this genus from all the fresh-water hydroids, it was proposed to distinguish it as the type of a new genus with the name Rhizohydra, the species being named flavitincta. An attempt to preserve some of the masses of zoöids in alcohol was not successful. — (*Acad. nat. sc. Philad.; meeting* June 19.) [26

Mollusks.

Abyssal mollusks. — The fifth part of the Mollusca of the Lightning and Porcupine expeditions, by Dr. J. Gwyn Jeffreys, has been received. It treats of the Solenoconchia, Polyplacophora, Docoglossa, and scutibranchiate limpets, contains supplementary notes to the preceding four parts, and is illustrated by two excellent plates. The number of species first described herein is not large; but a surprising number of facts as to distribution, synonymy, biography, and external anatomy, are brought together. In adopting a later name than Acmaea for that genus, he observes that in the original description no type or species was mentioned by Eschscholtz, but has apparently overlooked the fact that the same is true of the genus Tectura, by which he would replace Acmaea. —— Parts xv. and xvi. of the preliminary descriptions of the Mollusca of the Challenger expedition, by Rev. R. Boog-Watson, are at hand. They cover the Ranellidae, Muricidae, Scalariidae, and Solariidae in the first, and the Fissurellidae and Cocculinidae in the second part. Quite a number of the species are from comparatively shallow water. Eight new species of Puncturella were obtained from one dredging at a locality north of Culebra Island, near St. Thomas, in the Danish West Indies. One of these is the largest yet known. The common Puncturella noachina Linn. of British, north-east American, and Alaskan seas was obtained in the Straits of Magellan, at Kerguelen Island, and at a station between these two, which seems truly remarkable. The operculum of Nassaria kampyla Watson, and the dentition of a new species of Cocculina from the Philippine Islands, are figured. The teeth closely resemble in general features those of the American species, except that the median tooth is more, and the major laterals less, developed than in the forms obtained by the U. S. fish-commission. The descriptions are in the full and faithful manner characteristic of Mr. Watson's work. — W. H. D. [27

Crustaceans.

Haemoglobin in the blood of Branchiopoda. — Some years ago E. Van Beneden discovered a double system of circulation in some of the parasitic Copepoda like that in many annelids, and described a complicated system of vessels with true walls, filled with a red fluid containing haemoglobin, but no corpuscles, and entirely distinct from the lacunar system with colorless fluid containing corpuscles. P. Regnard and R. Blanchard find a similar system in Apus, and believe that it exists also in some Cladocera and Ostracoda. Chemical examination convinces them that true haemoglobin is present in the blood of Apus, is always combined with oxygen, and plays some part in respiration. — (*Zool. anz.*, May 7, 1883.) S. I. S. [28

Fresh-water Copepoda. — F. W. Cragin enumerates the genera of free-swimming Copepoda known to inhabit inland waters, describes and figures ten species of Cyclops, half of them new, from Cambridge, Mass., and publishes a translation of descriptions in Russia of several species of Cyclops by Poggenpol. Mr. Cragin notes the occurrence of the gregarinian, Lagenella nobilis, in North American species of Cyclops. — (*Trans. Kansas acad. sc.*, viii. 1883.) S. I. S. [29

Insects.

The male genital armature of Lepidoptera. — Considering how important a use has been made of these organs to distinguish species in nearly all other groups of insects, it is a little surprising to see how few lepidopterists have availed themselves of the excellent marks of distinction they afford. Rambur in 1839 (whose writings Gosse in the paper before us entirely overlooks), de Haan in 1842, and recently Buchanan White, are the only European authors who have paid any attention to these organs in butterflies; and Scudder and Burgess stand alone in this country.

In the present paper, Gosse describes and figures their appearance in eleven species of Ornithoptera, and fifty-six species of Papilio, including our own Thoas and Turnus. In one, P. Schmeltzi, he found a slight asymmetry in the armature of the two classes. Gosse gives new names to nearly all the parts. The side-plates, or flaps, which conceal the whole, he terms, as usual, 'valves;' the inwardly projecting armature of the interior of these, the 'harpes;' the beak-like mesial prolongation of the eighth abdominal segment, the 'uncus;' the unpaired appendage lying between it and the intromittent organ, the 'scaphium.' He has done particular service in the care with which he has reproduced the scaphium, — an organ consisting, in the swallow-tails, of chitinous points on a membranous body, and therefore badly distorted in dried specimens. This portion was studied and drawn after it had been made to assume its natural fresh appearance by absorbing a drop of water. The variety and strangeness of form and armature assumed by these parts, and particularly by the so-called scaphium and harpes, is very remarkable. In his naming of these parts anew, Gosse has burdened us with new terms for organs which are abundantly named already; but they will, perhaps, have their advantages, if they do not survive after homologues in other insects are pointed out. In his remarks on these organs in other butterflies, Gosse fails to see the homologies which exist, and which Burgess points out in part in a paper which Gosse appears not to have seen (*Anniv. mem. Bost. soc. nat. hist.*), and Buchanan White as well (*Trans. Linn. soc., Zoöl.*, i. 358). In brief, it may be stated that the organs in butterflies consist, besides the intromittent organ, of simply an unpaired upper organ, and paired lower appendages; both of which are attached, the upper immovably, to the ninth abdominal segment. The upper organ usually takes the form of a hook, and the lower, of claspers. In the Papilionides, however (including in that both swallow-tails and pierids), the dorsum of the *eighth* segment of the abdomen is prolonged posteriorly into a terminal hook overlying and concealing the true upper appendage, and at first readily mistaken for it, as shown in the swallow-tails by White and in the pierids by Burgess. Burgess also shows that false claspers exist in Danais, differing only from true claspers in not being articulated. Bearing in mind the attachment of the different external organs ancillary to generation, their homologies throughout the insects are not difficult to trace.

Buchanan White termed the 'upper organ' of Scudder and Burgess the 'tegumen,' and their 'clasps,' 'harpagones.' The uncus of Gosse (which on rare occasions is wanting in some swallow-tails) is therefore no proper part of the ordinary organs ancillary to generation, but a prolongation of the eighth abdominal segment. The scaphium is the upper organ, or the tegumen, of White; the valves of Gosse, the clasps of Scudder and Burgess or the harpagones of White; and the harpe, merely the armature of the clasp, which is extremely varied and complex, not only in the group where Gosse has so well illustrated it, but also in many skippers: indeed, this bizarre form of armature, both of 'scaphium' and 'harpe,' is a new indication of the alliance between the swallow-tails and skippers. We may further remark, that, if the old genus Papilio is the sooner broken up by the additional help afforded by these new studies, Gosse will have done systematists a real service. — (*Trans. Linn. soc. Lond., Zoöl.*, ii. 265.) S. H. S. [30

VERTEBRATES.

Chemistry and physiology of blood-serum. — In dogs which have been starved for a period of five or six days, and which previous to the commencement of the starvation had been fed for two or three weeks on horse-flesh freed as far as possible from fat, Burckhardt finds a diminution in the total amount of proteids in the blood-serum, the loss varying from 4% to 16% of the original amount of proteids present. Of the two proteids of serum, the quantity of serum-globulin increases during starvation, the increase ranging in his experiments from 22.8% to 66.4% of the quantity present before starvation. Serum-albumen, on the other hand, suffers a marked diminution, from 5.3% to 21.66% of the normal quantity. A calculation of the probable loss of albumen from the blood and lymph on the basis of his experiments, when compared with the amount of urea excreted by dogs, according to Voit, in the first five days of starvation, shows that the quantity of albumen lost from the circulating liquids is much too small to account for the proteid destruction indicated by the urea. Burckhardt made use of dialysis chiefly in determining the quantity of serum-globulin present in serum. The serum-albumen was estimated as the difference between the total proteids and the serum-globulin. He states that Hammarsten's method of obtaining serum-globulin by means of $MgSO_4$ is not reliable. Complete saturation with $MgSO_4$ throws down not only the serum-globulin, but also a large amount of proteid, which resembles serum-albumen, as usually understood, in every respect except in its precipitation by $Mg.SO_4$. — (*Arch. exper. path. pharmak.*, xvi. 322.) W. H. H. [31

Double staining blood-corpuscles. — Dr. Vincent Harris has made a series of systematic experiments on double staining of nucleated blood corpuscles with aniline dyes, and gives in connection therewith a table of the aniline dyes, and their solubility in water and alcohol. A little blood was dried rapidly in a thin layer on a slide, and treated with two dyes in succession. The only entirely successful combinations were the following: rosein and aniline green, fuchsin and methylen blue, fuchsin and Bismarck brown, eosin and resuvin, iodine green and Bismarck brown, Hoffman's violet and Bismarck brown, aniline violet and methylen blue. The greens were not at all permanent. The results were often variable and uncertain. For success the solutions must be quite fresh. The time each dye is allowed to remain greatly affects the results. — (*Quart. journ. micr. sc.*, 1883, 292.) C. S. M. [32

The primitive mouth of vertebrates. — According to Rauber, the gastrula mouth (original blastopore

or prostoma) is represented by various parts in vertebrates. In Pretromyzon, sturgeons, and Amphibia it is undivided. In sharks it is divided into two parts; i.e., primitive furrow, and posterior marginal opening. In birds it consists of the primitive furrow and marginal notch of the germinal area, and includes also the various small openings formed at the terminal swelling of the embryo; viz., the neurenteric canal, the passage observed by Gasser in the embryo of the Cochin-China breed of hens, and the break which sometimes occurs between the allantois sack and the ectodermal ingrowth behind the tail (caudal sack).

Rauber also asserts in the same paper that the bilateral outgrowths from the primitive streak of amniote embryos are homologous with the divesticula forming the mesoderm in Amphioxus. — (*Zool. anz.*, vi. 143, 163.) [33

Reptiles.

Venom of serpents. — The constitution of the venom of certain of the poisonous serpents has been examined by Mitchell and Reichert with interesting and somewhat remarkable results. According to them, three distinct proteids may be isolated from the venom of the moccason and the rattlesnake (C. adamanteus). These they propose to call respectively, venom-peptone, venom-globulin, and venom-albumen. The venom-peptone may be obtained from fresh venom, or from the aqueous solution of the dried material by dialysis, or by boiling and filtering off from the precipitated proteids. It is soluble in water, not coagulated by boiling, and readily dialyzable. Its solutions, while answering to all the general tests for peptones, exhibit certain peculiar reactions which distinguish it from the class of peptones as usually understood. The most marked of these specific reactions are its precipitation from aqueous solutions by saturation with potassium hydroxide or sodium chloride, and by the addition of dilute acetic acid. Its solutions possess the poisonous properties of venom, though in a less marked degree, giving rise to putrefactive changes when injected into the living animal.

The solution of the peptone obtained by boiling venom, and filtering from the precipitate of coagulated proteids, breaks up on drying with the formation of two proteids, one of which is soluble, and gives all the reactions of the original substance, with the exception that it is not poisonous. The other is insoluble in water, and likewise innocuous.

If an aqueous solution of venom is allowed to stand for some time, a precipitate occurs which gives the usual reactions of globulins. This substance possesses all the toxic powers of fresh venom.

After the separation of the peptone and globulin, a third proteid remains in solution which is apparently closely connected with the albumens, though the authors have not been able to obtain it in a state of sufficient purity to make decisive tests. It is soluble in water, coagulates below 70° C., and is precipitated from its solutions by weak alkalies and acids. It is probably not poisonous. — (*Medical news*, April 28, 1883.) W. H. H. [34

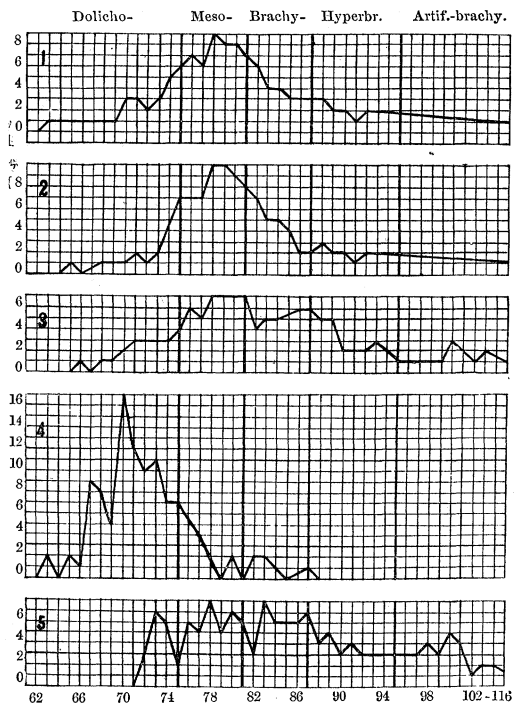
Mammals.

Cutaneous nerves in mammals. — Dr. Harrison Allen has succeeded in tracing nerve-filaments to the larger setae-bearing hair-follicles in mammals as exposed after depilation. He believes that the hair-follicles of the oral, the mental, the supra-orbital and the disto-carpal tufts, as well as those placed on the lateral aspects of the limbs, are in all cases supplied with nerve-filaments, as are the pteryls of birds. In specimens in which the follicles are rudimentary there is a corresponding failure of the nerve, thus indicating a close relation between the two. — (*Acad. nat. sc. Philad.; meeting* June 12.) [35

Nerves of the human eyelid. — Von Mises describes the results of his studies. The nerves enter in bundles from the sides as well as from above, and are distributed more or less parallel with the blood-vessels, and form a rich plexus along the edge of the lid. Some details are given as to the distribution of the nerves to the conjunctiva. — (*Sitzungsb. akad. wiss. Wien*, lxxxv., *abth.*, iii. p. 172.) C. S. M. [36

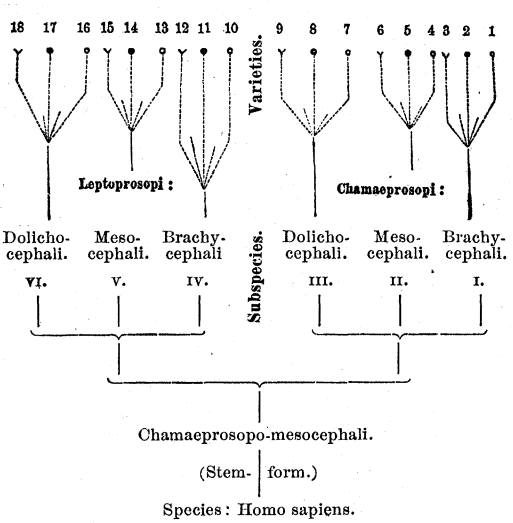
ANTHROPOLOGY.

The autochthones of America. — Dr. J. Kollman of Basel gives his views of American craniology, based on a study of the breadth indices of 1,500 crania, quoted from published measurements, and representing all the countries between Bering Strait and Tierra del Fuego. Five curves are appended,



which reproduce graphically the breadth indices of five groups of American skulls. Curve I. represents 1,292 crania of aborigines of America, whether from

ancient Indian burying-places or picked up on recent battle-fields; curve II., 917 North Americans, including the territories of the United States and British America, with the exception of the Eskimo; curve III., 248 Central and South Americans, including the Mexicans on account of their peculiar civilization; curve IV., 127 Eskimo, consisting of all crania from the arctic regions of North America; curve V., 208 pre-Columbians, discriminated from other North Americans by their manner of burial, i.e., mound-builders and stonegrave people. A study of these teaches, 1°. The plurality of varieties in America; 2°. The diffusion of these varieties over the whole continent. As an illustration, the stonegrave people of Tennessee are cited. Their remains are those of a single people, as Mr. Putnam has shown by the correspondence of their customs, and grade of civilization; while the measurements of their skulls by Mr. Carr show a varying proportion of dolichocephali, mesocephali, brachycephali, and artificially shortened crania. A people is an ethnic unity, which, according to the results of craniology, may consist of an anatomical plurality of races; but a race is an anatomically characteristic variety of the human species. Like the Germans, the mound-builders consist of many races which have combined to an ethnic unity. The term 'race,' as here employed, is equivalent to a sub-species of the species Homo sapiens of Dr. Kollman's system, illustrated by the following diagram.



The varieties are distinguished by peculiarities of the hair: 1, 4, 7, being smooth-haired, indicated by the sign ○; 2, 5, 8, etc., straight-haired, by the sign ●; 3, 6, 9, etc., woolly-haired, by the sign **V**. So far as is known, only straight-haired varieties have immigrated into America, of the following sub-species: 1. Broad-faced dolichocephali (Eskimo); 2. Broad-faced mesaticephali (Indians); 3. Broad-faced brachycephali (mound-builders); 4. Long-faced brachycephali (ancient Peruvians).

Like the European, the American varieties of the species Homo sapiens have long since passed into the condition of permanent types. The time of elasticity, of the organization of new physically diverse forms, has long gone by. Wherever human remains are found in the glacial formations of Europe, they are as highly organized as to-day. Undoubtedly they represent men of a lower plane of civilization. It is erroneous at every footstep of advance in civilization to infer a new and more highly organized race. Craniology demonstrates that varieties, unchanged physically since the glacial epoch, are continually making their way to higher grades of civilization. — (*Zeitschr. ethnol.*, 1883, 1.) C. A. S. [37

Madagascar. — The vast island of Madagascar, 960 by 300 miles in extent, is unique in its proximity to a continent with which it has such feeble connections. Its population is about 4,000,000; but it is subject to great fluctuations through epidemics, witchcraft, infanticide, intertribal wars, and murders. The peculiar formation of the island effects a tropical, malarial climate around the coast, and a nearly temperate climate elsewhere. All around the island there is a belt of forest, often splitting into two parts, which enclose fertile valleys teeming with people. The natives are the Hovas, of Malay origin, and the Malagasy proper, of African origin, who for the past hundred years have been augmented by importation of slaves from central Africa. The system of government among the negro tribes is purely African in form. Among the Hovas, however, a queen holds sway, through the agency of a prime-minister, who is *ex-officio* husband of the queen. The religion of all the Malagasy is fetishism, with a shadowy recognition of a superior power. They believe in ghost-souls who are capable of good or harm to us, and this belief leads to great respect for the dead. Their beliefs, witchcraft, burials, roads, commerce, and language have been carefully studied by Dr. G. W. Parker, who has communicated a paper on the subject to the London anthropological institute. The island became known to the Portuguese, Dutch, French, and English early in the seventeenth century; although the Arabs traded there long before that. At the beginning of the present century the Hovas became the firm friends of the English, — a connection which has remained unbroken except during the reign of Queen Ranavalona I. Upon the assassination of her son, Radama II., the present system of queens and prime-ministers began.

The languages belong to the class of purely spoken tongues, no one of them having ever been reduced to writing by the natives. The vowels are *ah, ay, ea, ō, oo;* the consonant sounds, *b, d, f, g, h, j, k, l, m, n, ng, p, r, s, t, v, z;* the diphthongs are *eye* and *ow.*

The number of consonantal combinations is very small, which occasions many euphonic changes in compounds. The meaning of words and sentences depends little on the tone, but much on accent, position, and the discriminative particle *no.*

Onomatopoeia is common. The grammatic structure is quite regular. A large percentage of the words are traceable to verbal and denominative roots, which

are affixed and compounded to an indefinite extent. Gender is indicated by the affixes for male and female, and there is no distinction between animate and inanimate. The numeral system is decimal, and ends with *tapitrisa* (ended are the numbers), the word for a million. There are two moods of the verb,— the indicative and the imperative. There are two classes of personal pronouns,— the inclusive of the speaker, and the exclusive. Other peculiarities in grammar are pointed out by Dr. Parker in an exhaustive dictionary of fourteen dialects, which unite the Malagasy with the Malay stock-language. To account for this anomaly of race and language, Dr. Hildebrand supposes the Hovas to have first settled the island, and to have been overpowered by African marauders, who killed most of the Hova men, and married their wives. The children, learning their language from the mothers, perpetuated at the same time their African blood and their Malay language. But Dr. Parker seriously objects to this explanation. Mr. Keane is of the opinion that the Africans were introduced as slaves, who, while gradually corrupting the blood, would have little effect upon the language. Dr. G. Oppert also commented upon the paper. — (*Journ. anthrop. inst.*, xii. 478.) J. W. P. [38

The flora of ancient Egypt. — The student of anthropology is repeatedly charmed and surprised by the varied and brilliant illumination thrown upon his subject by sister sciences. He is not less pleased to know that quite frequently the light proceeds in the other direction, and that human custom preserves for other sciences their sibylline leaves. In 1881 Emil Brugsch Bey discovered in the vault of a king of the twentieth dynasty a large number of plants contained in the funeral offerings, repasts, and wreaths of the dead. Among these are several species not known to have belonged to ancient Egypt. Mr. G. Schweinfurth, deputed by M. Maspero, has studied these plants, and classified them in the Egyptological museum of Boulak, according to the high personages for whom they were intended. A very extended and interesting account of these labors was communicated to Sir Joseph D. Hooker, together with a set of the wreaths, flowers, etc., described. Excellent illustrations accompany the paper of Mr. Schweinfurth. These objects were exhibited at the annual *soirée* of the Royal society on the 25th of May, and are now on view at the Royal gardens, Kew. — (*Nature*, May 31.) J. W. P. [39

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

STATE INSTITUTIONS.

Missouri weather service, St. Louis.

Weather report for May. — The average temperature for May at the central station has been 63.4°, which is 2.8° below the normal temperature, and 3.5° above the temperature of May, 1882. Since 1837 the May temperature has fallen below that of last month five times. The extremes during last month at the central station were 38.0° and 88.4°; although, in the suburbs of St. Louis, the temperature fell to 36.0° on the evening of the 21st. In 1851 Dr. Engelmann observed a temperature of 29.0° in May, but it was in the early part of the month. The lowest minimum temperatures reported were, 29.5° at Centreville; 31.0°, at Big Creek, Warren county; 32.0°, at Steelville; all other stations reporting over 34.0°. The highest minimum temperatures are reported from Glasgow, 45.0°, and Harrisonville, 47.0°. The highest maximum temperatures reported were, Corring, 91.0°; Miami, 98.0°; Harrisonville and Big Creek, 90.0°. The highest average temperatures reported were, Cairo, Ill., 65.2°; Mascoutah, Ill., 65.0°; Harrisonville, 64.0°: the lowest being at Keokuk, Io., 59.9°; Macon, 60.4°; Louisiana, 60.5°.

The rainfall at the central station was 2.61 inches, which is 2.2 inches below the normal May rainfall at St. Louis. In western Missouri, however, from Harrisonville northward along the Missouri valley, the rainfall has been over seven inches; and a small maximum of over seven inches occurs in the region around Ironton. An area of minimum rainfall of between two and three inches occurs in south-west Missouri, around Greenfield and Lamar, and another occurs along the lower Missouri below Chamois, extending along the Mississippi as far south as Cairo.

On the 13th, tornadoes occurred at various points in Missouri and Kansas, as follows: the town of Oronogo, Jasper county, was destroyed at about 7.40 P.M., two persons being killed, and forty injured. This tornado is probably the one which passed about two miles north of Carthage. Hailstones as large as hen's eggs fell at Springfield at about 10 P.M. Another storm passed two miles south-east of Pattonsville, Davies county, on the same evening. Two tornadoes passed through Kansas City at 5 o'clock, one passing a few minutes later than the other. Several persons were killed, and a great deal of damage was done to property. These whirls were slender whip-like vortices, the diameter at the surface of the earth being only a few feet, although the destructive path was about seventy feet. These storms originated apparently in Wyandotte county, Kan., where they caused great damage. A later development of this storm passed through Macon City, one hundred and twenty miles east-north-east from Kansas City, where a tornado occurred about 8.30 P.M. The track was from one-fourth to three-eighths of a mile wide. Three persons were killed at Macon.

On the 18th, tornadoes occurred in Missouri, Illinois, and Wisconsin. At 7 P.M. a tornado did considerable damage at Berger, Gasconade county, Mo. At about 8.20 P.M. a tornado passed through Wentzville from the south-west, causing great destruction to property, and loss of life, as far as St. Paul, Mo. At about the same time a storm passed from Cottle-