author writes in sympathy with the people whose life he describes, and thus his book possesses the interest which belongs only to an inside view. The details are graphic and accurate. They show keen observation, and even careful study. A queer cosmopolitan metropolis is Constantinople, and the pictures of its life are full of quaint and curious interest.—*The Abode of Snow*, reprinted from *Blackwood's Magazine* (G. P. Putnam's Sons), carries the reader on a romantic tour from Chinese Thibet to the Indian Caucasus, through the upper valleys of the Himalayas. The writer has the advantage of writing concerning a region about which comparatively little is known; his book of travels is thus, in a sense, original; his descriptions are graphic and even pictorial—so much so that the reader feels a sense of disappointment that such opportunities for art should be wholly lost, for there are no illustrations. A valuable map accompanies the volume.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—During September numerous astronomical publications have been received from Europe, most prominent among which are the sixth volume of the magnificent series of the Pulkova observations and the valuable special memoirs that issue from that imperial institution. Of these latter, Dollen's second paper on the use of the transit instrument in the vertical of the pole-star should be in the hands of every American geographer, geodesist, or astronomer.

Dr. Doberck, of the Markree Observatory, Ireland, has published the results of his work upon the orbits of the binary stars *Zeta* Aquarii and *Gamma* Leonis. The former of these was measured by Sir William Herschel in 1781, and it is only by virtue of this old observation that we are enabled to obtain a good approximation to the time of revolution of this binary, which is about 1500 years. *Gamma* Leonis has a much more rapid motion, as it completes a revolution in 402 years. Dr. Doberck's elements agree very closely with observation during the entire period 1800–65, the average discordance between the distance as measured and the distance as computed being less than a quarter of a second of arc.

Mr. Alvan Clark, of Cambridge, calls attention to the rapid change of position of the binary star *Mu* Herculis. Appearances seem to indicate that this binary has a shorter period than any known double star except, perhaps, *Delta* Equulei, and this fact, as well as the intrinsic interest of this pair (originally discovered by Mr. Clark), should recommend it as an object for observation to those who possess telescopes of sufficient power (twelve inches aperture and above). The observations at the Naval Observatory indicate a change of about 15° in position-angle in the past year.

In our last month's Record we had occasion to notice the beautiful series of drawings of planets and nebulæ published by the Harvard College Observatory under the direction of the late Professor Winlock. Mr. L. Trouvelot, the artist to whom the making of these drawings was confided, has prepared, from late observations with his own telescope (six and a quarter inches aperture) and with the Harvard refractor (fifteen inches), a set of pastel drawings, on a large scale, of Saturn, the nebula of Andromeda, sun spots, and others. The Harvard College drawings were about eight by ten inches in size, while Mr. Trouvelot's are about twenty-four by thirty-six inches, and they are of great fidelity and beauty. M. Terby, of Brussels, has undertaken a new discussion of drawings of Mars, and in order to make his data as complete as possible, requests that any person having drawings of Mars of any date may send them to him at 124 Rue des Bogards, Louvain, Belgium.

Dr. Fuhg has published a discussion of all the observations of the sun's diameter made at Greenwich from 1836 to 1870, with the particular object of discovering the difference, if any, between the polar and equatorial diameters. He finds that no proof of any such difference can be drawn from these Greenwich observations, and from the whole number (6827) made between 1836 and 1870 he concludes the mean apparent solar diameter to be 32′ 2.99″. Airy previously found, from the observations of 1836–47, 32′ 3.64″, and this value is adopted in the English *Nautical Almanac*.

It is known that the experiments of Foucault on the velocity of light, when combined with the value of the constant of aberration of Struve, give a value of the solar parallax (8.86″) which is very close to the best recent determinations, and which will not be far from the results from the recent transit of Venus. The recent experiments of Cornu on the velocity of light, combined with this value of the solar parallax, indicate, however, that the value of the constant of aberration deduced from Bradley's observations by Bessel is the true one, and this value differs from Struve's by 0.2″. Villarceau has examined the question of the proper value of the constant of aberration under the supposition that the whole solar system has a proper motion, and he gives the outline of a plan for determining both the true constant of aberration and the direction of the solar motion. This plan requires simultaneous observations to be made at points in each hemisphere where the latitude is 35° 16′. The expense of such expeditions would not be large, and important results might be expected from the carrying out of this project.

M. Flammarion has, during 1874 and 1875, observed the changes of brightness of the 4th satellite of Jupiter with a view to determine its period of rotation. His principal conclusions are, first, the 4th satellite varies between the sixth and the tenth magnitude; second, there is a probability (but not a certainty) that it turns on its axis like our own moon, so as to always present the same face to Jupiter; third, this hypothesis will not account for all the variations of brightness observed. Its reflecting power (*albedo*) is, on the whole, inferior to that of the three other satellites.

M. Tisserand, of Toulouse, has made an interesting discussion of his observations of the shooting-stars of the 9th, 10th, and 11th August, 1875.

The tracks of eighty-eight meteors were carefully mapped, and as there seemed to be a preponderance of meteors in certain azimuths, these were united so as to give fourteen distinct trajectories, each of which was the result of three or four individual observations. These fourteen were then treated as deserving great confidence, and from them the place of the radiant point was sought. The principal radiant was in right ascension 46° 41′, declination 56° 7′; while two secondary radiants were found, one of them in right ascension 57° 20′, and declination 51° 40′; and the other in right ascension 64° 0′, and declination 63° 0′. These values satisfy the original observations very exactly, and this multiplicity of radiant points is a fact of great interest in the theory of shooting-stars.

The little-known subject of the zodiacal light has been studied for many years by Schmidt at Athens, and Heis at Münster, the latter of whom has just published in full his own observations made in the course of the past thirty years. It is to be hoped that the observations made at Quito by the Rev. George Jones, of the United States navy, may some day also be published.

The erection of the magnificent solar observatory at Potsdam, near Berlin, is being steadily carried forward. This establishment will embrace more than twelve different buildings, six of which are observing domes, and one a fine physical laboratory; the magnetic and meteorological observatory and the Zollners horizontal pendulum will be also specially provided for.

The erection of an observatory at Trieste has been determined upon by the Austrian government. A large telescope by Alvan Clark, of Cambridge, will be its principal instrument.

A very important work in theoretical astronomy has just been terminated by M. Leverrier in his investigations into the theories of the major planets, a work which he began with his researches into the perturbations of Uranus. The tables of the motion of Saturn are now completed, and theory and observation have been compared from 1751 to 1869, with a very gratifying accordance, except for the period 1839–44, during which time the discordances, though not large, are yet more serious than any from modern observations. M. Leverrier says that the theory is not to be charged with these discrepancies, and seeks for an explanation of them in personal peculiarities in observing an object so complex in figure as Saturn.

Sir William Thomson has re-examined Laplace's theory of the tides, as developed in the "Mécanique Céleste," and comes to the conclusion that the objections which Airy brought against some of Laplace's analytical processes, and the interpretation of them in numbers, in his "Tides and Waves," are not well taken, and that the method of Laplace, although quite obscure, was nevertheless essentially correct.

The pamphlet of Mr. John N. Stockwell, of Cleveland, on the *Theory of the Moon's Motion*, will be likely to give rise to controversy, as it is a further extension of previous papers which we have noticed. Mr. Stockwell, after referring to the fact which has already called forth reply, that the present lunar tables do not satisfactorily represent the moon's place, finds the explanation of this in the very outset of the lunar theory itself, where he claims that a fundamental error has been made, and in this work lays the foundation for a lunar theory on what he considers correct bases.

In the sudden death (September 13, aged sixty-four, by heart-disease) of Professor I. A. Lapham, of Milwaukee, American science has lost one of its warmest friends and supporters. To Mr. Lapham more than to any other one person the country owes the establishment of the Weather Bureau at Washington. He was also intrumental in securing for Wisconsin its State survey.

In *Physics*, the month has been characterized by the appearance of some valuable papers. De Luynes and Feil—the former well known from his researches on the Prince Rupert's drop—have made some experiments on the hardened glass of M. De la Bastie. They find that this glass presents many points of analogy with the Prince Rupert's drop, as well in the mode of production as of fracture. Though it is not ordinarily possible to cut a piece of this glass with a saw, a drill, or a file without its flying in pieces, yet in some cases it may be done. A disk, for example, may be drilled through its centre without fracture, though not elsewhere. A square plate of St. Gobain glass thus hardened showed in polarized light a black cross, the lines of which were parallel to the sides. It is always possible to saw such a plate along these lines without fracture, though beyond them, either parallel or transverse to them, any attempt to cut the plate fractures it. If the two fragments of a plate thus cut be examined in polarized light, the arrangement of the dark bands and colored fringes shows the molecular state to have altered by the division. Placing the one plate directly upon the other in the original position, both bands and fringes disappear; while if reversed and superposed, the effect is increased, being that due to a plate of double thickness; hence the tension in the plate is symmetrical with reference to the saw cut. We may conclude, therefore, that while hardened glass is in a state of tension, it may always be cut in certain directions when the resulting pieces can take a condition of stable equilibrium. This is easily determined by examination with polarized light. In the case of fracture the fragments are always symmetrically arranged with relation to the point where the equilibrium was first destroyed. The authors have also examined into the cause of the bubbles so generally seen in hardened glass. They find them to be produced at the moment of hardening, and to disappear, or nearly so, when the glass is annealed. They hence conclude that they are due to the imprisoning of minute masses of gas in the glass, these masses becoming enormously dilated when the glass is hardened; this dilatation, which is actually 1700 or 1800 times the original volume, being caused by the contraction of the surrounding glass produced in the process of hardening.

Pfaff has made some experiments upon the plasticity of ice, in order to throw additional light upon glacier motion. In none of the hitherto recorded observations is any mention made of the amount of pressure necessary to change the form of ice, though Moseley observed that to pull apart an ice cylinder a weight of 5½ to 9 atmospheres was required to the square inch, and to fracture it a pressure of 7½ to 9 atmospheres. Pfaff has sought to determine the minimum press-

ure at which ice yields, and has proved that even the slightest pressure is sufficient if it act continuously, and if the temperature of the ice and of its surroundings be near the melting-point. In one experiment a hollow iron cylinder 11.5 millimeters in diameter sunk into the ice 3 millimeters in two hours, it being surrounded with snow, the temperature varying from −1° to 0.5°. When the temperature rose above the melting-point, it sank 3 centimeters in one hour! scarcely a trace of water resulting. A steel rod a square centimeter in section, when pressed with one-third of an atmosphere, sank into the ice 14 millimeters in three hours, the temperature being 2.5°. The flexibility of ice was shown by placing a parallelopiped 52 centimeters long, 2.5 centimeters broad, and 1.3 centimeters thick upon wooden supports placed near its ends. From February 8 to 15, the temperature varying from −12° to −3.5°, the middle portion sank only 11.5 millimeters. But the succeeding twenty-four hours the temperature was higher, and the middle of the bar sank 9 millimeters. From 8 A.M. to 2 P.M. the increase was 3 millimeters, when the bar broke, the temperature being +3°. The whole bending was 23.5 millimeters. Similar experiments were made upon the ductility of ice; it elongated by traction. From these results it is easily seen why a glacier's motion increases with the temperature.

Decharme has communicated an additional paper on the sonorous flames previously described by him, in which he gives experimental reasons for believing that the air which is blown against the flame, and which he supposed to act solely mechanically, plays also a chemical part. He finds that using a Bunsen burner, the sound is extremely feeble unless the air openings be closed and the flame be luminous. Moreover, neither carbon dioxide nor nitrogen gases will produce the sound unless oxygen be mixed with it. The author hence believes that the sound results from the small explosions which are incessantly produced by the combination of the oxygen of the air with the carbon and hydrogen of the flame when the combustion of this is already incomplete. That the sound should be well pronounced, therefore, the presence of air or of oxygen mixed with some inert gas is necessary.

Bresina has described a simple method of comparing the rates of vibration of two sounding air columns by means of oscillating flames. To the jets supplying two ordinary singing tubes are affixed lateral branches, by which the gas from each may also be supplied to a second burner supported on a convenient lateral stand. When the flames in the tubes sing, those outside vibrate in unison with them; and by means of a revolving mirror the ratio of the two may easily be ascertained by counting. If the two singing flames are connected to the same exterior flame, the combined vibration is seen in the mirror.

Lesueur recommends strongly the use of zinc to prevent the formation of incrustations in steam-boilers. His attention was called to the subject by observing that the brass stays of a surface condenser in a steam-vessel were reduced, after a few years of service, to a mass of spongy copper, the zinc having entirely disappeared. This having occurred repeatedly, the constructors of these condensers placed zinc in the condensers, and observed that not only was the brass no longer attacked, but the boilers supplied from these condensers were entirely free from incrustation. Direct experiments of the author's have confirmed this fact. The explanation of it he finds either in the electric current thus generated in the boiler, the zinc being positive and the iron negative, or more probably in the hydrogen continually set free in minute quantity on the iron surface, thus preventing the adherence of scale. (The author does not seem to be aware that this same device is not new, having been employed for this purpose for many years in the United States.)

Mayer has proposed a simple mode of obtaining thermographs of the isothermals of the solar disk by the use of Meusel's double iodide. Thin paper, smoked on one side, is covered on the other with the iodide, and is exposed to the sun's image, formed by a telescopic object-glass, the aperture being at first only that necessary to give the smallest area of blackened iodide with a sharp contour. This he calls the area of maximum temperature. On enlarging the aperture, the black area gradually extends, forming a series of new isothermal lines with the successive enlargements. Some interesting conclusions have already been reached, and it is the author's intention to make a thorough investigation of the vast field thus opened.

Troost and Hautefeuille have made a calorimetrical investigation on iron and manganese silicides. They conclude, first, that silicon in combining with manganese evolves considerable heat, and hence that the compound thus formed is very stable—a fact already proved for carbon. Second, that the similarity of these two substances, carbon and silicon, appears also when their action on iron is considered; they both act as if they were dissolved in the metal.

Lundquist has given the results of his calculations to determine the distribution of heat in the normal sun spectrum, founded on certain measurements of Lamansky's. He represents the intensity of this heat graphically, and gives curves in which the ordinates represent intensities, and the abscissas wave lengths. It appears from these curves "that in the normal spectrum of the sun the maximum of heat is situated about in the middle of the luminous spectrum, and diminishes on both sides of this point," thus confirming entirely the experimental results obtained by Dr. John W. Draper in 1872. In the electric spectrum, however, assuming Tyndall's results as data, calculation gives a curve in which the maximum of heat is near the line A. In this case the distribution of heat is not equal in both halves of the visible spectrum.

Rayet has published a paper on the conical solar dials of the ancients, particularly that of Heracleus of Latmos, with a view to bring to light the amount of knowledge possessed by their constructors. The interior surface of these dials constitutes a cone, the section of which by the upper horizontal surface being a curve of the second degree, either an ellipse (dials of Heracleus and at Naples), a hyperbola (dial at Athens), or a parabola (Phenician dial). The latter curve requires that one of the generatrices of the cone should be rigorously horizontal, and has been only once observed. But the dials were not made in this way; the cone was traced with any

convenient proportions, subject only to the condition that its summit should be on a perpendicular from the centre of the base.

Bunsen has given an account of some new methods in spectrum analysis, in which he has sought to render the use of the spark for obtaining spectra as easy and as general as that of the gas flame. The first portion of his paper is devoted to a description of the battery coil and spark apparatus required; the second gives the results of his investigations in this way, particularly with the rarer elements. The memoir is accompanied by three spectrum plates, uncolored, showing the spectra of thirty elements and compounds.

Watts has described a new form of micrometer for use with the spectroscope, in which one of the lines of the spectrum itself is substituted for the cross wires. This line may be the sodium line, which is almost always present in gas-flame spectra, a hydrogen line with vacua tubes, or a Fraunhofer line in solar work. This standard line is displaced by a micrometer screw, by which the amount of motion necessary to move it from one point of a spectrum to another may be ascertained. The micrometer screw is attached to the upper half of a divided lens placed between the prism and the observing telescope, and moves this half over the lower, which is fixed.

Adams has devised a new polariscope for examining the rings of crystals, the objects had in view being (1) to obtain a large field, (2) to secure the means of measuring both the rings and the axial angles, and (3) to be able to immerse the crystal in liquid. The peculiarity of the optical arrangement is that the crystal section is placed at the common centre of curvature of two nearly hemispherical lenses, so that its relation to these is unchanged when the crystal and lenses are rotated about any axis parallel to its surfaces and passing through this centre.

In *General Chemistry* a few important additions have been made to our knowledge. Delachanal and Mermet have prepared a compound of platinum, tin, and oxygen analogous to the gold compound known as the purple of Cassius. When the brown liquid which is obtained when a solution of platinic chloride is mixed with one of stannous chloride is diluted with water and boiled, a brown substance is precipitated which, when well washed with hot water, contains no chlorine, but only oxygen, tin, and platinum. The authors have also prepared the same substance by placing a strip of tin in platinic chloride. Its composition somewhat varies with its mode of preparation.

Friedel has produced a direct union of methyl oxide and hydrogen chloride—a body which, since both of its constituents can exist free, must be classed with the molecular compounds of Kekulé. But Friedel shows that this body is not decomposed when converted into vapor, and hence argues that the ordinary rules of chemical union should be extended to it. This can only be done by supposing its oxygen to act as a tetrad or its chlorine a triad. Since hydrogen chloride and methyl chloride do not unite even at $-18°$ to $-20°$, the author inclines to the former view, and supports it by other cases, such as water of crystallization—a view of the matter which was taken some years ago by Wolcott Gibbs.

Ramsay has examined the properties of ethyl-thiosulphate of sodium prepared by the action of ethyl bromide on sodium thiosulphate. He finds that it is exceedingly unstable, decomposing spontaneously in a few weeks. The precipitates produced in its solutions by silver, lead, or barium nitrates are even more rapidly decomposed, only a few hours being required. When distilled with phosphoric chloride a complex reaction takes place, ethyl disulphide being one of the products.

Deering has noted some points worthy of notice in examining waters by the ammonia method. He observes that the tint after the addition of the Nessler solution increases constantly in depth; hence he makes a caramel solution after ten minutes to imitate the distillate, and uses that for comparison. He also notes that distilled water contains ammonia; that potable waters yield ammonia in the second, third, and fourth fractions; that commercial stick potash gives ammonia when distilled with water; and that an aqueous extract of peat gives much ammonia when distilled with sodium carbonate.

Griffin describes his new form of portable gas furnace, in which a pound of cast iron can be melted in thirty-five minutes, and the new method of supporting crucibles in it.

In *Organic Chemistry*, Prevost has given a new and simple method of preparing epichlorhydrin, which consists in warming dichlorhydrin in a capacious retort attached to a receiver, and adding pulverized sodium hydrate to it in the proportion of 250 grams to 550 cubic centimeters of dichlorhydrin, the temperature being kept below 130°. Almost pure epichlorhydrin distills over.

Stenhouse and Groves have shown that by the prolonged action of chlorine upon pyrogallol, two new bodies are formed, which they call respectively mairogallol and leucogallol. The former is produced by a long-continued action of the gas, and crystallizes from boiling glacial acetic acid, or from mixed ether and glacial acid, in brilliant orthorhombic prisms. Leucogallol forms crystalline crusts composed of minute colorless needles.

Müntz and Ramspacher propose to determine tannin in its solutions by filtering these, under pressure if necessary, through a piece of fresh hide. This combines with the tannin, and the filtrate is entirely free from this substance. A section of the skin afterward shows a line in the middle, above which the skin has thus been converted into leather.

Microscopy.—We find in the August number of the Journal of the Quekett Microscopical Club the description of an ingenious arrangement for cleaning very thin covers without breaking them. It consists of a small tube of brass or steel, about an inch in diameter, and the same in height, into which fits loosely a weighted plug. To the lower end of this plug is cemented a piece of chamois leather. Another piece of leather is stretched upon a flat piece of wood or plate glass to form a pad, which completes the apparatus. The tube being placed upon the pad, the moistened thin cover is dropped into it, and the weighted plug placed on it; holding the tube well down on the pad, one can rub as much as necessary without any danger of breaking, the weight of the plug giving sufficient pressure to clean the

glass. The manipulation is quite easy, and it is difficult to break the glass.

In the same number of the journal is an interesting paper, by Mr. W. F. Woods, on the relation of *Bucephalus* to the cockle. He states that, in contradistinction to the opinion of M. Lacaze-Duthiers, who has described it as a cercarian form of some unknown *Distoma*, that either, *first*, the *Bucephalus* is the larva of the cockle (and if not, it remains an interesting question for solution what is), or, *second*, the *Bucephalus* is a parasite; but if so, it does not render the cockle sterile, as asserted by Lacaze-Duthiers, and, *third*, the connection of the tube with the ovisacs, as established by presence of eggs in both, proves that it is not an independent sporocyst, but an organ of the cockle, while, *fourth*, if this connection be denied, the *Bucephalus* must still be developed from eggs seen in the tube.

In contradiction of a third assertion by Lacaze-Duthiers, Dr. Wallich writes as follows in the *Lancet* (June 12) on the subject of nutrition of the protozoan. He states that for fifteen years he has stood alone in maintaining that the law of nutrition which prevails in the case of the higher orders of the animal kingdom, and constitutes the fundamental distinction between it and the vegetable kingdom, fails in the case of the simplest and humblest creatures; and he expresses a belief that the lower rhizopods provide for their nutrition and growth by eliminating from the medium in which they live the *inorganic* elements that enter into the composition of their protoplasm, and that there is no hard-and-fast line between the two extremes of the two great kingdoms, but a gradual transition and overlapping from both sides. The results of deep-sea explorations, and especially the examination of the *Tuscarora* soundings, do not confirm this view; the vegetable growths, even at extremest depths, proceed *pari passu* into the animal, and we see as yet no reason why the same provision that holds good in the case of the higher and terrestrial organisms should not be extended to the humblest marine or aqueous forms.

We learn from a contemporary that in order to facilitate the microscopical examination of the eye in cases of disease, M. Monoyer has contrived a modification of Siebel's ophthalmoscope, so arranged that three persons can make simultaneous observations. In the *Monthly Microscopical Journal* for September, 1875, is an interesting paper by Worthington G. Smith on the resting spores of the potato fungus, or the "new" potato disease, as it has been called, and he shows that it is no other than the old enemy in disguise, *Peronospora infestans*, in an unusual and excited condition. The article is well illustrated, and worthy the attention of microscopists interested in the study of these parasitic organisms. In the same journal is the conclusion of Dr. Bastian's address on the microscopic germ theory of disease, in which he insists that the facts already known abundantly suffice to displace the narrow and exclusive vital theory, and to re-establish a broader physico-chemical theory of fermentation, and that the original notion, borrowed from the vital theory of fermentation, that all the organisms met with in a fermenting mixture are strictly lineal descendants of those originally introduced as ferments, must disappear with the vital theory itself, and with it the old explanation of the mode of increase of contagium within the body.

While connected for a few weeks with Hayden's United States Survey of the Territories, Dr. A. S. Packard, Jun., discovered on the shores of Great Salt Lake a new cave-insect fauna analogous to that of Mammoth Cave. A new blind white thousand-legs, a myriapodous insect, and a singular harvest-man, a spider-like form, both new to science, were discovered in a cave about two hundred feet above the present level of the lake, on the bottom of which were fossil fresh-water shells. We now know that this cave was made during the pliocene-tertiary period, and we have some data in ascertaining the length of time necessary for the origination of these peculiar cave forms. This discovery throws light on the probable geological age of the cave fauna of Mammoth, Wyandotte, Weyer's, and other caves in the Atlantic States.

Dr. Packard also studied the fauna of Great Salt Lake, finding a new insect larva living in the brine. He also studied the development of the brine shrimps (*Artemia*), discovering the larva. The entire history of the *Ephydra* fly, so abundant in the lake, was also ascertained.

Among injurious insects, the *Caloptenus spretus* has been found on the grounds of the State Agricultural College at Amherst, Massachusetts. On comparing specimens with some received from California through Mr. Henry Edwards, of San Francisco, no differences in size of body or wings were discovered on careful comparisons made by Dr. Packard.

The phylloxera has also occurred for the first time in the vineyard of the Amherst Agricultural College, while the Colorado potato beetle is abundant and destructive within eighteen miles of Boston, and in other parts of Massachusetts as well as Connecticut.

The *American Naturalist* for September contains an illustrated article on the crocodile of Florida, by Mr. W. T. Hornaday. Much information concerning the habits of this animal, which was first discovered in 1870 by the late Professor Wyman, is given in the present article.

Professor G. Brown Goode notices in the *American Naturalist* the occurrence of an albino haddock and an albino eel, and it seems that specimens of albinos of both of these fishes occur in the museum of the Peabody Academy of Science at Salem.

Botany.—The lover of trees will welcome the report on the trees and shrubs growing naturally in the forests of Massachusetts, by Mr. George B. Emerson, which is enriched with a number of finely executed plates by Mr. Isaac Sprague. A new feature consists in colored views of the leaves of the different species as they appear in the fall. We learn that the much-wished-for *Flora of California*, by Professor W. H. Brewer, is fast approaching completion, and will be given to the public probably during the coming winter.

In the *Journal of Botany* Mr. J. Cosmo Melville describes some new algæ found by him at Key West. De Bary, in the *Botanische Zeitung*, gives an account of the formation of the prothallus in *Chara*, with some interesting remarks on partheno-genesis in *Chara crinita*.

Under the head of *Agricultural Science* we have previously reported the results of observations by Fautrat, in France, on the influence

of forests upon rain-fall. From these it appeared that the air above a forest is more nearly saturated with moisture than at the same elevation above cleared land, and, further, that the fall of rain was greater in the former than in the latter situation. Fautrat has since shown, however, that the amount of rain actually received by the soil is less under the cover of the forest than on the open land. Of the rain-water received a part is evaporated, and only the remainder contributes to the supply of streams. By comparative observations Fautrat finds the evaporation only one-tenth as great from the soil of the forest as from that of open land. So the forest soil is actually much more moist, and furnishes to springs and streams more water from rain than the same area of cleared land.

Again, there is more moisture above forests, to be carried over cultivated land and deposited as dew upon the cooled earth at night. Forests are therefore in a double sense useful as retainers and furnishers of moisture to the earth.

Simon claims to have settled the vexed question whether humic acid contains nitrogen or not by showing that when first prepared from non-nitrogenous bodies it is free from nitrogen, but that it takes on nitrogen from the air, at the same time becoming soluble in water. He states that humic acid kept out of contact with air, and especially nitrogen, is insoluble in water, and remains so. On exposure to air, however, it absorbs nitrogen with evolution of carbonic acid and formation of humate of ammonia, which is soluble in water. In this view, peat and muck are valuable not only as amendments and for the fertilizing material they contain, but also as purveyors of atmospheric nitrogen to the soil.

Some time ago Grandeau propounded the novel theory that the fertility of soils depends not upon the absolute amount of their mineral plant-food, but chiefly upon the amount which was combined with organic substances, and cited a number of experiments with a very fertile Russian black earth soil in defense of his view. Simon has lately sought a confirmation of this theory in the artificial preparation of organo-mineral compounds such as are assumed by Grandeau to exist in nature. He has succeeded in obtaining several quite strongly marked compounds of phosphoric acid with organic matter from humic acid. It is probable that by such investigations very valuable light may be thrown upon the action of humus in vegetable nutrition.

The fact has become universally recognized that in many superphosphates the phosphoric acid which has been rendered soluble by addition of sulphuric (or hydrochloric) acid to tribasic phosphate of lime "reverts" after a time to an insoluble or less soluble form. This process of reversion of phosphoric acid has been variously explained. Most commonly, however, it is regarded as a formation of either dibasic (neutral) phosphate of lime with the lime or of phosphate of iron or alumina with the sesquioxides of iron and alumina present. Millot has published in the *Comptes Rendus* some accounts of investigations which lead him to infer that in superphosphates in which enough sulphuric acid has been added to unite with the whole of the lime this reversion is not to be sought in the formation of a dibasic phosphate of lime, but rather in that of phosphates of iron and alumina.

The reversion of soluble phosphoric acid of superphosphates when applied to calcareous soils has been studied by Ritthausen. He concludes that the process is more or less rapid in proportion as the calcareous material is more or less loose and finely divided; that the final product of the reaction of the phosphoric acid and the lime is neutral or dibasic phosphate; and finally that the actual loss from the reversion of the phosphoric acid to this dicalcic phosphate is not so great as might at first seem, since the latter is not wholly insoluble in pure water, and is quite soluble in water containing carbonic acid.

An interesting contribution to our knowledge of the composition of such roots as beets and turnips has been made by Schultze and Urich in investigations on field beets. (*Runkelrüben, Beta rapacea alba?*) In the analysis of fodder materials it has been customary to assume that all the organic nitrogen occurs in the form of albuminoids. Schultze and Urich found, however, that only 21.6 to 38.9 per cent. of the nitrogenous material of their beets was present in the form of albuminoids, and that 34.0 to 45.7 per cent. existed in the form of amides. Asaparagin was not detected, but betain was found in considerable quantities in the beets.

Clin has given a method for the preparation of crystallized monobromcamphor, being camphor in which an atom of bromine has replaced one of hydrogen by the direct action, at 100° C., of bromine upon camphor. The specimens shown to the French Academy were magnificently crystallized.

Bourneville finds that monobromcamphor (1) lessens the number of beats of the heart, (2) lessens the number of inspirations, (3) lowers the temperature of the body, (4) possesses powerful sedative properties, and (5) produces ordinarily no disturbance of the digestive organs. It has been used with good effect in nervous affections, even in cases of long standing.

Engineering.—The board of engineers convened by Captain Eads to examine and pass judgment upon his plans for the improvement of the mouth of the Mississippi has, after a careful consideration of the subject in all its details, emphatically indorsed the feasibility of this great work. With respect to details, a number of minor modifications to the plan proposed are recommended. Of these perhaps the most important is the recommendation that the proper line for the eastward jetty shall begin about 6380 feet from the "Land's End," and about 1080 feet beyond the mattress laid September 1, and on the line submitted by Captain Eads. A slight modification of its curvature is likewise suggested, so as to render the action of the current more effective, and secure greater solidity, and also that this jetty should overlap the end of the west jetty by at least 300 feet. As to the proper width between the jetties at their outer ends, the board recommends that it remain as designed by Captain Eads, at 1000 feet at the water surface at ordinary high tide. Upon the question of priority of construction of different parts of the work, it is recommended that the foundation of the east jetty be secured out to a depth of thirty feet, and of the west jetty to twenty feet, and that the east jetty be carried up to the water-line before raising the mattress wall of the west jetty to the same level, leaving the construction details of the pier-heads for future consideration. Upon the gen-

eral features of the improvement plan the board reports as follows: "After attentive examination of the plan of construction, consisting of a combination of willow mattresses and stone, now in execution by Mr. Eads, the board finds it to be a modification of methods long in use in Holland and elsewhere. It is essentially the same as that applied to the jetties of the mouth of the Oder, and also to the jetties at the new mouth of the Maas, so satisfactorily as to draw from the legislative body of Holland the expression that 'their complete success has removed all doubts as to the possibility of making piers at sea on our coast.' It is, moreover, the same essentially as that adopted by the recent commission [1874] for these works."

The government works at Hallett's Point having for their purpose the removal of the Hell Gate obstructions to the navigation of New York Harbor are now very near completion. The work of excavation is completed, and comprises a surface of two and a quarter acres. At the intersection of the headings and galleries columns or piers are left standing, and by these, which number 172, the roof of rock, some ten feet in thickness, is supported. Some ten or fifteen holes of two and three inches diameter are now being bored by steam-drills in each of the columns, and three-inch holes, about five feet apart, in the roof. These holes will contain eight and ten pound charges of nitro-glycerine, and will be all connected together by gas-pipe filled with the same explosive. These borings are about half completed, and will be finished in a month or two. When all is ready, the water will be let into the excavation and the whole series of charges exploded simultaneously by electricity. It is calculated that if only half the charges are exploded, the work will be effectually accomplished. The filling of the holes will occupy some time during the coming winter, and the firing of the mine is looked for about June or July next.

The new work at Flood Rock is now in progress, and a shaft has been sunk to the depth of fifty feet in the solid rock. The same system will be pursued here as at Hallett's Point, save that the excavations will be much greater in extent; and the time occupied in their completion will depend chiefly upon the appropriations made by Congress. The removal of the reef at Hallett's Point will materially lessen the dangers of the Hell Gate passage, and will prove of permanent advantage to commerce.

The laying of the direct United States cable was completed on September 5.

From a paper read before the British Association at its late meeting it appears that work upon the Severn Tunnel, a project undertaken by the Great Western Railway Company to connect their system at Bristol with that in South Wales, is being pushed forward. The tunnel will be about four and a half miles in length, one-half of which will be under the river Severn. It will connect in the most direct manner the populous districts of South Wales with the south of England, and when completed will form the express route between London and South Wales. At the same meeting the Channel Tunnel scheme was the subject of considerable discussion, which was in general favorable to its feasibility.

A sum of 8000 florins has been voted by the States-General of the Netherlands for re-examining into the possibility of draining the Zuyder-Zee, and for soundings to determine the character of the soil at its bottom.

It is proposed to establish a subterranean pneumatic postal service between Versailles and Paris, in order to facilitate communication between the seat of the government at the former and the general service of the government departments at the latter place. The line proposed will be double, permitting the carriage of twenty kilos of dispatches an hour in both directions.

From the annual report of the Secretary of the American Iron and Steel Association, which has just appeared, we learn that the total production of rolled iron in the United States in 1874, including Bessemer steel rails, was 1,839,560 net tons, as compared with 1,966,445 tons in 1873, a decrease of only 126,885 tons. This decrease was all in rails. The home production of Bessemer steel rails in 1874, from the same authority, was 144,944 net tons, against 129,015 tons in 1873, a gain of 15,929 tons. The production of Bessemer rails in this country since the inauguration of the industry in 1867 has been as follows in net tons:

1867	2,250	1871	38,250
1868	7,225	1872	94,070
1869	9,650	1873	129,015
1870	34,000	1874	144,944

The *Railroad Gazette* places the extent of new railroad constructed in the United States in 1875, up to September 25, at 746 miles, against 1025 miles reported for the same period in 1874, 2507 miles in 1873, and 4623 in 1872.

In our monthly record of *Mechanical* novelties we may note that the ponderous 81-ton gun has just been completed at the royal gun factories at Woolwich. Its length is thirty-three feet, and its diameter varies from two feet at the muzzle to about six feet at the breech; while internally the bore measures twenty-seven feet, and will just admit a projectile of fourteen and a half inches diameter.

A lately invented street rail for horse-cars is designed to do away with the battering of the rail ends and the jolting of passengers. The novelty consists in its having the head and the flange separate, and in the fact that the upper and lower pieces are laid down in such a manner as to break joints. This novel combination, it is claimed, gives a smooth, continuous rail line, having unusual rigidity. The lower piece, or flange, is so designed that it may be reversed when worn, thus offering a new surface for wear.

At the last meeting of the Franklin Institute a resolution was adopted appointing a committee to test the strength of irons and steels employed in the construction of boilers and bridges, and appropriating $1000 for the expenses of conducting the tests; also a resolution indorsing the proposition for the establishment of a Museum of Industrial Art in the city of Philadelphia. The plan proposes a museum similar to the South Kensington Museum of London, to develop art industry of every kind by the best examples, free lectures on technical subjects, and schools. The projectors of this important enterprise are desirous of securing the Memorial Building of the Centennial Exhibition for this purpose after the close of the Exhibition. The enterprise has the indorsement of all the Philadelphia scientific societies.

more healthful than much of our modern American child literature. For very little folks are the *Blue-beard Picture Book*, with thirty-two pages of unique colored pictures; *Buttercups and Daisies*, a volume of rhymes and pictures—the former not embodying any remarkable poetic merit, the latter decidedly bright and pretty; *Happy Child Life*, with real sparkle in the rhymes, and with colored pictures very attractive. —Oscar Pletsch has a remarkable genius for portraying children and child life.—The *Golden Harp Album*, *Little Wide-Awake*, and *Every Boy's Annual* are collections of prose, poetry, and pictures, rather too miscellaneous to take first rank in children's literature.—*The Young Ladies' Book* is a very useful manual of amusements, exercises, studies, and pursuits. Its object is to teach young ladies something to do, both in useful employment and in recreation; it begins with nursing the sick, it ends with directions for a picnic.—Another book very full of useful information is *Discoveries and Inventions of the Nineteenth Century*, by Robert Routledge. It is almost a cyclopedia of inventions, contains over 300 illustrations, and covers a wide scope. It gives more credit to American inventors than many of the foreign works on kindred subjects are accustomed to do.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

OUR *Astronomical* record for October begins with the notice of two new asteroids, No. 149, discovered on the 6th inst. by Perrotin at Toulouse, and No. 150, discovered on the 18th by Watson at Ann Arbor.

In the mathematical department of astronomy we should not fail to note the memoir by G. W. Hill, of Nyack, on the development of the perturbative function in periodic series. Mr. Hill occupies himself with that method of developing the perturbative function in which all the elements are left indeterminate, whereby a literal development is obtained possessing as much generality as possible. This method has been invested with additional interest, he states, on account of certain investigations arising from Jacobi's treatment of dynamical equations, and Delaunay's method in the lunar theory.

The Analyst, the pages of which are enriched by Mr. Hill's memoir, is a journal devoted to pure and applied mathematics, edited by J. E. Hendricks, of Des Moines, Iowa. This is the only purely mathematical journal at present sustained in America, and it is believed that it is doing a good work in encouraging the study among us of that which lies at the foundation of all progress in the physical sciences.

In publishing some observations on the planets as made at the observatory at Paris, Leverrier states that the observations of Mercury are represented by the tables of the movements of that planet with very great precision; but in the construction of these tables it has been necessary to assume that the perihelion of Mercury's orbit moves in such a manner as corresponds to the existence of one or more intramercurial planets. These planets, as is well known, have never yet been satisfactorily observed, nor is it known whether they are of the nature of asteroids or meteoric dust, nor whether, perhaps, the zodiacal light and the solar corona may not contain sufficient material to cause by their attractions the movements observed in Mercury.

Secchi contributes to the Paris Academy of Sciences the full details of his observations of the solar protuberances and spots since April, 1871. This period covers fifty-five rotations of the sun around its axis.

Professor Heis has published the complete details of his observations of the zodiacal light. These observations extend from the year 1847 to 1875, and their complete publication constitutes a very important contribution toward the solution of the questions bearing on the true nature and the cosmic relations of the phenomenon. A large number of the best modern observers of the zodiacal light have been stimulated to their exertions by Professor Heis's interest in the work. Among these we note Weber, whose observations have been made at Peckelot, about twenty miles east of Münster; Goldschmidt, whose observations were made in Paris; Tromholdt, in Denmark; Groneman, in Groningen; Eylert, whose observations were made during an ocean voyage from Hamburg to Buenos Ayres. The observations made by Schmidt, Jones, Neumayer, Serpieri, and others are also made use of by Heis; and, according to the careful comparison of modern and ancient observations, it would appear that there is reason to suspect little or no change in the general features of the zodiacal light during the past two hundred years.

Progress is reported in the construction of the new physical observatories being erected, the one at Paris, under Janssen, and the other at Potsdam, under Sporer, Vogel, and others.

A school of practical astronomy has been established by Mouchez at Montsouris. It will be open to all who have any desire to study astronomy. Special attention will be given to spectral analysis and celestial photography.

In *Meteorology*, we take pleasure in calling the attention of both theorists and observers to the methods adopted at the observatory at Montsouris for studying what is there called the physics of the atmosphere, by which, however, is more especially meant the study of the *rôle* played by the moisture both in its invisible and in its visible state. The complete investigation of this subject is provided for by Marie Davy, the director of the observatory, by the use, first, of a large achromatic with a silvered objective and achromatic ocular, by means of which the brightness of any portion of the sky is determined. Second, a similar apparatus with unsilvered objective for determining the relative brightness of the diffused light of the sky, and the actual brightness of the solar rays; and the same apparatus is employed also for a similar object at night, to determine the transparency of the sky. Third, a modified form of Desain's thermo-electric actinometer, whence an indication as to the total quantity of the vapor of wa-

ter contained in any portion of the atmosphere is obtained. Fourth, Arago's cyanometer, and side by side with it Arago's polarimeter, to which the modifications suggested by Rubenson are to be applied. The important works of Desain are fully appreciated by Marie Davy, who follows very closely in the route pursued by him, in that he insists on the preponderating influence of aqueous vapor upon the variable diathermancy of the atmosphere: aqueous vapor, in fact, plays a double part, both as an invisible gas and as a visible cloud or haze.

In reference to the relation between the solar radiation or solar spots and terrestrial meteorology, Blanford, of Calcutta, remarks that in India, in general and in detail, in the annual changes as well as in the daily, the temperature of the air and its humidity always vary in opposite directions. This is easily explained by considering that the greater the humidity of the air, so much the greater is the quantity of cloud and the quantity of rain. Therefore it follows that under these conditions a less amount of solar heat reaches the surface of the earth, which is consequently cooled down by the evaporation of the falling rain-water. It would seem, therefore, that on the average throughout the world, since there is more water than land, the principal effect of an increase in the temperature of the sun would be to increase the quantity of moisture in the atmosphere, and to diminish the temperature of the air at the immediate surface of the earth.

Professor Wild, of St. Petersburg, announces that the Central Physical Observatory in that city is to be enriched by the erection of an auxiliary observatory at Pavlovsk, some fifteen miles to the southeast of the present institution. In this new building numerous researches will be carried on that are quite impossible in the old one, where there is now experienced much disturbance from the traffic in the city. The income of the auxiliary observatory will be about one-half that of the central institution.

Mr. Hellmann has investigated the peculiarities of the atmosphere as observed by the Army Signal-office at Mount Washington in May, 1872. He finds a decided connection between the difference of the temperatures at the top and bottom of the mountain, on the one hand, and the direction in which the wind is blowing and the state of the cloudiness of the sky, on the other.

We understand that the Japanese government has taken up in earnest the matter of meteorological observations, partly, it is said, in consequence of representations made by the Americans and English residing in Japan. The first step has been taken by the Kai-Ta-Kui-Shi, or the department for the colonization and development of Jesso. This department has determined to establish eight stations on that island and one at its head-quarters in Tokio. The instruction of the observers and the organization of the whole system seem to have been intrusted to G. J. Rockwell, Professor of Chemistry at the Imperial College at Tokio, whose name will be familiar to many of our American readers.

Professor Rowland has begun the publication of his studies on magnetic distribution. He states that his investigations made in 1870 cover a portion of the ground recently treated of by Jamin. His own observations were conducted in reference to the confirmation of his mathematical investigations, which are represented by very general formulæ. The most novel feature of Rowland's experiments consists in the method adopted to measure the intensity of the magnetism, for which purpose he uses a small coil of wire sliding along the magnet.

Professor J. L. Smith, in a note on the Dixon County (Tennessee) meteorite of 1835, states that this is the most interesting specimen of pure meteoric iron yet known. Its surface was not melted, although evidently highly heated in its passage through the atmosphere. The Widmannstättian figures are developed with exquisite beauty. It contains 71 per cent. of hydrogen.

Among the *Physical* papers of the month may be mentioned Marey's valuable memoir on the movements of liquid waves in elastic tubes, in which is given the results of experiments made to elucidate the circulation of the blood, particularly with reference to the character of the pulse as determined with the author's well-known sphygmograph. By means of a very ingenious little apparatus called an explorator, several of which are placed along the length of the tube through which the wave moves, compressed air is made to move a style at the instant the wave passes. This style records the movement, both in time and in form, upon a blackened cylinder, whose surface moves twenty-eight centimeters per second. The author's conclusions from these experiments have a high physiological importance. Romilly has studied the action of a current of air or steam in drawing into its course the surrounding air, using for this purpose various forms of openings and ajutages. The same results were obtained with air and steam, the maximum pressure in the receiver being obtained when the receiving cone has an angle of 5° to 7°, the base directed away from the jet. This latter is placed at a distance from it determined by making the jet the apex and the opening of the receiving tube the base of a cone of 15°. Then the quantity of air drawn in is directly as the diameter of the two openings (of the jet and receiving cone); the velocity is in the inverse ratio; the pressure is inversely as the section of the receiving tube, the absolute pressure varying according as the receiver is open or closed.

Parish has described a simple form of balance for taking specific gravities of solids, constructed somewhat like a common form of letter scale, with unequal arms, the substance being placed in a pan (which can be immersed in water) at the end of the shorter arm, while the longer is graduated directly to give the specific gravity.

Schott has examined the character of the crystallizations which are produced in common glass under various conditions, with a view to elucidate the chemical character of glass itself.

Nipher has published a paper on the variation in the strength of a muscle, in which he calls attention to the fact that after the relation of the strength of a muscle to the dynamical work of exhaustion has been determined, its strength at any time is easily found by measuring the dynamical work of exhaustion. He also finds that the co-efficient of power of a muscle per square centimeter of its section is very variable; so

that the work a muscle can do depends not alone upon its size, but also upon its quality.

Victor Meyer has devised a simple and very effective method of determining the solubility of salts in solvents, which is rapid and accurate, whatever be the temperature at which the solubility is taken.

Schüller and Wartha have proposed some modifications in the ice-calorimeter of Bunsen, with a view of adapting it to more general use. The freshly fallen snow is replaced by ice, and the measurements are made by weighing the mercury expelled.

Naumann finds in the recent results of Kundt and Warburg upon the specific heat of mercury vapor a complete confirmation of the opinion which he, on purely theoretical grounds, expressed eight years ago, that mercury and cadmium molecules are diatomic. Moreover, he shows, in accordance with the dynamic theory of gases, that the heat of the atomic motion is to the heat of the molecular motion, and to the heat of expansion as $n : 3 : 2$, in which n is the number of atoms in the molecule. The specific heats of gases, including that of mercury vapor, calculated on this hypothesis, agree well with those experimentally determined by Regnault and others.

Abney has investigated the conditions of photographic irradiation—which causes the photographic image of a luminous body in front of a dark background to appear larger than it is—and concludes that the current theory that it is due to reflection from the back of the plate can only be true when the incident rays make an angle with the normal to the surface. This he conceives to be the fact, the particles of silver bromiodide scattered through the collodion film acting to reflect the light thus obliquely. The experimental results given accord well with those calculated on this theory.

Terquem and Trannin have described a new method for determining rapidly the index of refraction of a liquid, which, like Wollaston's, depends upon the angle of total reflection, but which does not require a special apparatus. By means of two plane parallel plates of glass, having a film of air between them, which are immersed in the liquid to be examined, the critical angle is determined, and so the index.

Hagenbach has called attention to the fact that unannealed or imperfectly annealed glass, which is in a state of tension from too rapid cooling, is very likely to break either from a blow or from sudden changes of temperature. As this tension renders the glass doubly refracting, he proposes to examine glass articles with polarized light in order to detect any imperfection in the annealing.

Sandoz has examined four of the new Jamin permanent magnets of laminated steel with a view to ascertain whether their force varied with time whether the armature was attached or not, and also whether sudden rupture diminished the portative force. The magnet employed weighed 411 grams, and its armature 69 grams. Its maximum lifting power was 9.3 kilograms, or nearly twenty-three times its own weight. He finds that these magnets gain rather than lose by time, and that whether they are kept armed or not; and sudden rupture rather increases their power to receive charges.

Camacho has described a new form of electro-magnet, in which, instead of a bar of iron, the core is made up of a number of concentric tubes of iron, around each of which a coil of wire is wound. In one experiment such a magnet, charged with the same battery, lifted five times the weight which was raised by a precisely similar magnet constructed on the old plan. In a subsequent paper Du Moncel has communicated to the Academy some results he obtained with this magnet, which are analogous to those made by him in 1862. He shows that the increased power obtained in these magnets is due to a superposition of the magnetic effects by the enveloping cores.

Jamin has re-observed and extended the curious fact stated by Haldat that iron filings, inclosed in a brass tube and compressed, retain their magnetism permanently. Tubes thus made were shown the Academy, eight or ten centimeters long and three in diameter, which attracted iron filings at least as strongly as steel bars of good quality of the same size. Filings of pure soft iron showed the same result, as also did iron reduced by hydrogen.

Deprez has made some experiments on the velocity of magnetization and demagnetization of iron, and finds that soft iron, ordinary iron, malleable cast iron, and chilled steel all required one-and-a-half-thousandths of a second for magnetization, and one-four-thousandth for demagnetization. Gray cast iron was magnetized in one-thousandth.

Rowland has published the results of his studies on magnetic distribution, giving the results of experiments made in 1870–71.

Fuchs has devised a simple means of detecting the presence of an induced current by means of a gold-leaf electroscope.

Oberbeck has experimentally determined the resistance which the air offers to an induction spark. He shows that it is a function of the strength of the currents, and that hence its numerical value may be calculated in the same way as that of solid or liquid conductors.

Bauermann communicates a method of showing the conductivity of the various forms of carbon, due to Dr. Von Kobell, of Munich. A fragment of the carbon to be tested is held in a pair of zinc tongs (a simple strip bent on itself) and immersed in copper sulphate solution. The proportion of copper deposited on the carbon indicates its conducting power.

Lippmann notes the curious experiment of putting a mass of water contained in a glass vessel in communication with the earth, and then bringing near it an excited rod of resin; oxygen is evolved at the wire. On removing it the hydrogen is disengaged. But before removing the rod, where was the hydrogen? The author says it is neither in combination nor solution, but is retained upon the surface of the water.

Buff has made an extended investigation into the changes of temperature which are produced when an electric current passes from one metal to another. The evolution of heat is proportional to the quantity of electricity passing in a unit of time multiplied by the electro-motive force of the battery.

In *General Chemistry*, Cayley communicated to the Chemical Section of the British Association a paper on the analytical figures which are called trees in mathematics, and on their appli-

cation to the theory of chemical compounds. His purpose was to determine the theoretical number of hydrocarbons of the formula C_nH_{2n+2}, and his results agree with those of experiment so far as the latter have been developed. He shows, for example, that 799 isomers are possible, having the formula $C_{13}H_{28}$. Berthelot has continued his studies in thermo-chemistry, and has published two papers. In the first of these he treats of the thermal changes connected with the oxides of nitrogen; in the second, of the thermic formation of barium dioxide and hydrogen dioxide.

E. Dumas has written upon the touch-stone, giving an extended historical sketch of the subject, and furnishing an analysis of a stone which has been used from very ancient times in the Paris assay office. It proved to be a piece of fossil wood, of an unknown genus and species, however, to which, on microscopic data, Renault assigns the generic name *Obrussaxylon*, meaning wood used for assaying gold.

Behrend has described a new method of preparing sulphuryl chloride, which consists in heating sulphuric chlorhydrin in sealed tubes to 170°–180° for ten to fourteen hours. The yield is satisfactory.

Frerichs has devised a new form of balance, in which the beam is made of aluminum alloyed with five per cent. of silver. The beam is very short, and yet the balance is not at all deficient in delicacy. The use of riders is dispensed with, the small weights being determined by the torsion of a wire ingeniously arranged.

Arzberger proposes the use of an air-damping apparatus for chemical balances, to diminish their oscillations. To the stirrup a gilded brass plate is hung, which moves in a short cylinder, a trifle larger in diameter, supported on the case.

Precht and Kraut have investigated at length the question of the dissociation of salts which contain water, and have obtained some valuable results.

Langley has proposed, in determining carbon in iron and steel, to burn the carbon without first separating it from the copper, as is the usual method.

In *Organic Chemistry*, Prescott has given the results of his determinations of the solubilities of the alkaloids in the crystalline, amorphous, and nascent conditions in ether, chloroform, amyl alcohol, and benzine respectively, these solvents having been washed with water before use.

De la Harpe and Van Dorp have examined the hydrocarbon fluorene discovered by Berthelot. They find that when fluorene is distilled over moderately heated lead oxide a semi-solid reddish product is obtained, which is a condensation product containing double the number of carbon atoms in its molecule.

Liebermann and Fischer have further examined chrysophanic acid, the active principle of rhubarb. They find it to stand to emodin, its associate, precisely as alizarin stands to purpurin, only both the former are homologous with the latter, being derivatives of methyl-anthracene. Chrysophanic acid is dioxymethylanthraquinone.

Tiemann and Haarmann have described a method for the accurate determination of vanillin in vanilla, and have shown that the price of the commercial varieties is not always in accord with their content in vanillin.

Latour and Cazeneuve have separated from mahogany an astringent substance containing carbon, oxygen, and hydrogen, which is crystalline, and identical with catechin.

In *Physiological Chemistry*, Schutzenberger has continued his valuable researches on albumin and the albuminates.

Gautier and his pupil Scolosuboff have made an extended examination on arsenic in the tissues, and have shown that it principally localizes itself in the nervous tissues. They also describe an improved method of separating it from organic matters.

Mineralogy.—Dr. Moore has recently described a new mineral from the zinc mines at Stirling, New Jersey. It occurs in small hexagonal crystals, and in drosses of indistinct crystals. It has perfect basal cleavage, and a metallic lustre; color, bluish-black. The hardness is 2.5, and specific gravity 3.91. An analysis showed that it was a hydrous oxide of zinc and manganese, it being closely related to psilomelane. When ignited, it assumes a copper-red color, and it is in allusion to this that the name chalcophanite is given.

Professor Secchi has recently published at Naples an elaborate memoir upon the eruption of Vesuvius in the spring of 1872, it being the continuation of a work commenced by him a year since. He enumerates a long list of minerals found as sublimation products, and among these the following new species: *Atelite*, which is a compound of oxide and chloride of copper, containing water; it is produced by the action of hydrochloric acid upon melaconite. *Cryptohalite*, a fluo-silicate of ammonia. *Chlorallumínite*, a hydrous chloride of alumina. *Chlorotionite*, found in crusts of an azure-blue color, and being a sulphate of potash and copper. *Pseudocotunnite*, found in acicular yellow crystals, which are without lustre; it is supposed to be a compound of chloride of lead and chloride of potash. *Hydrofluorite*, hydrofluoric acid and *Proidonite*, fluoride of silicon.

Des Cloizeaux has continued his valuable optical studies of the feldspars, and now describes a more simple method of distinguishing between them than that already given.

Professor Cox, at the meeting of the American Association in Detroit, describes a new porcelain clay, which he calls *Indianaite*. In composition it is quite near kaolin. It is found in Spice Valley township, Lawrence County, Indiana, in considerable deposits, and is already used in the porcelain potteries of Cincinnati.

Microscopy.—The *Academy* (May 8) says that a microscopic examination of the dust which fell in parts of Sweden and Norway on the night of March 29–30, 1871, has led M. Daubrée to believe that it proceeded from a volcanic eruption in Iceland. The dust was found to be composed of fragmentary transparent grains, some colorless, others more or less brownish-yellow. Minute crystals of feldspar and pyroxene were recognized. There are many instances of dust being conveyed by air currents to great distances. Thus in February, 1863, sand apparently from Sahara fell in the western parts of the Canaries, and, more recently, ashes from the Chicago fire reached the Azores in four days, accompanied with an empyreumatic odor, which made the inhabitants suppose that a great forest was in conflagration.

Dr. C. Johnson gives the following as the

method adopted by him in preparing sections of coal, in the Cincinnati *Medical News*, July, 1875: 1. Macerate suitable pieces one-quarter or one-half inch thick in liquor potassa until they swell or soften. 2. Soak for a few hours in pure water, and drain. 3. Macerate in nitric acid until the color changes from black to brown. 4. Soak for a few hours in water, and drain. 5. Put in alcohol for a few days. 6. Fasten in a cutter with paraffine, and make sections, the sections to be mounted in balsam after successive immersions in absolute alcohol and oil of cloves.

In the *Monthly Microscopical Journal* for October, 1875, is an interesting paper on *Cephalosiphon* and a new infusorian, by Dr. C. T. Hudson. He concludes that the *Cephalosiphon* is a genuine Melicertan, forming its tube from early youth, and is not a temporarily incased *Philodine*, as had been supposed, from having only one antenna. The new infusorian is named *Archimedea remex*, so called from its frequently assumed corkscrew shape, and from its rows of cilia used as banks of oars. The full-grown *Archimedea* is about $\frac{1}{50}$ inch in length, with a tube of $\frac{1}{25}$ inch, more or less, in length. It was found attached to *Anacharis alsinastrum*. The tubes are exceedingly slender, and readily deserted upon the least disturbance. They are, of course, far too long for its inhabitant, which, as a rule, lives in the top of it, though occasionally it backs down nearly to the bottom. In the same journal is an excellent paper, by G. J. Allman, on "Recent Progress in our Knowledge of the Ciliate Infusoria," being the anniversary address to the Linnæan Society. We will notice it more at length hereafter.

The subject of *Anthropology* has been very closely studied of late through the medium of idiots, imbeciles, and microcephales. The labors of Marshall (*Phil. Trans.*, 1864, vol. cliv., p. 501), of Bradley (*Journ. of Anat. and Phys.*, 2 ser., vol. vi., 1871, p. 65), of Broadbent (*ibid.*, 2 ser., vol. iii., 1870, p. 218), of Jensen (*Archiv für Anth.*, Bd. iv.), of Vogt (*Mém. de l'Inst. Genèv.*, tom. xi.), of Schule (*Archiv*, 1872, Bd. v., 437), of Aeby (*Archiv*, 1874?), and finally, of Dr. Pozzi (*Rev. d'Anthropologie*, 1875, num. 2), show how much interest attaches to this branch of the investigation. The last-named author, from a review of the subject, comes to the following conclusions: 1. The weight of the brain has only a relative value in determining the degree of intelligence. 2. On the contrary, the morphology of the convolutions is a factor of far greater importance. 3. The obtuseness of intelligence is correlated in the case under examination, and in most of its analogues, with a great simplicity of brain convolution. 4. This appears to result from an arrest of development, generally corresponding to positive characters among the anthropoid apes. 5. Certain morphological phenomena can not be thus interpreted: alongside of anomalies reversive by arrest of development are found also anomalies due to deviation of development.

Among the interesting papers read at the American Association a few were devoted to ethnology. We call attention to Professor C. V. Riley's paper on locusts as food for man; Professor R. J. Farquharson's, upon Indian mounds; Professor L. H. Morgan's, on ethnological development; and to the communications of Mr. Henry Gilman on the ancient men of the great lakes; of Professors E. A. Strong and W. L. Coffenberry, on mound explorations in Kent County, Michigan; of Professor E. D. Cope, on the archæology of New Mexico; of Dr. Sternberg, on Indian mounds and shell heaps near Pensacola, Florida; and of Mr. Lorenzo G. Yates, on the aboriginal money of California.

An entirely new feature in the history of ethnology is the Congress of Americanists held at Nancy from the 19th to the 22d of July. The first session was devoted to the discussion of the relations of America to the Old World before Christopher Columbus. The Northmen, the Phenicians, the lost Atlantis, the lost tribes of Israel, were all treated to a discussion; but the conservative spirit of the Congress decided to require greater light upon these theories before accepting them. The second session was devoted to American anthropology proper. The discussions were conducted by MM. Broca, Petitot, Barten de Metz, Professor Hynes, and Professor Joly. The third session was devoted to American languages. Papers were read by M. Pacheco on the Quichua language; by Leon de Rosny on the decipherment of the Maya inscriptions; by M. Petitot on the Déné-Dindjies of the Mackenzie River; by Jules Vinson on the pretended analogies between the Basque and some of the languages of the New World. The fourth session was devoted to American culture. Oscar Comettant's paper on American music was especially noteworthy. The stone age was discussed by M. Reboux, M. Chel, and Francis Allen. Waldemar Schmidt presented a manuscript with sketches made by the natives of Greenland.

Part xvi. of *Reliquiæ Aquitanicæ* appeared in May last. Chapters xxiii. and xxiv. are devoted to classified lists of birds and stone implements found in the caves of the Dordogne Valley. Chapter xxv. is on "Fossil Man from La Madelaine and Laugerie Basse," by E. T. Hâmy.

The Geographical Congress and Exposition at Paris were exceedingly rich in ethnological material. The papers read at the Congress were of the most thorough and interesting character. We can do no more than indicate their titles. M. Venioukoff made an important communication upon the races of Asiatic Russia. In a very interesting communication upon the Negritos of India, Dr. Hâmy showed the presence of this race of oceanic negroes of short stature on the Gangetic peninsula. M. De Hujfalvy spoke of the migrations of the Turanian races. Upon motion it was resolved to adopt the name Uralo-altaic for Turanian. At the Exposition, archæological and ethnological geography was a prominent feature. Russia sent the works of Saveluff, Ouvaroff, Europäus, Koppen, and others upon the various peoples of that vast empire. Sweden, Norway, Denmark, England, the Netherlands, Germany, Austria, Belgium, Spain, and the United States were more or less largely represented. Of course the best showing was by France. The most ancient times were represented by two cases containing a part of the rich collection of M. Reboux from the quaternary alluvium of Paris, Clichy, Levallois, Neuilly, Grenelle, etc. Next to these were four glass cases containing a splendid series of objects from the Pyrenees, grottoes of Gourdon, Arndt, and Lorther, the product of the labors of M. Piette. Charts of France during all of its ar-

chæological eras were both plentiful and beautifully executed. In all respects the Congress and the Exposition attained the most satisfactory results in anthropology, ethnology, and protohistory.

M. Prunières having sent to the Society of Anthropology a fragment of a human skull bearing traces of small circles in the interior, M. Mortillet, following the conjecture of M. Lequay, that they were made by a circular die, had a series of experiments made with iron and bronze dies of different patterns, and confirmed M. Lequay's theories. M. Broca, however, did not agree with his colleagues, but endeavored to prove that the effect was produced with a pointed tool directed by the hand.

M. Topinard having presented to the Society of Anthropology of Paris the two microcephales, Maximo and Bartola, who have been exhibited in both hemispheres as Aztecs since 1854, and who have been thoroughly examined and accurately described by many anthropologists, beginning with Richard Owen, a long and interesting discussion of the whole subject of microcephaly was excited.

M. Sanson, in the Bulletin of the same society, describes the methods of artificial skull perforations among the South Sea Islanders.

In the general meeting of the German Anthropological Society, at Munich, Dr. Ecker announced that in the hard coal near Metzikon, occurring between two glacial epochs in that region, Dr. Schleuerman had discovered a number of pointed sticks carbonized (probably of *Abies excelsa*), which gave the strongest evidence that they were the work of man. These were sent to Professor Rutimeyer, who describes them fully in *Gaea*, 1875, 575. This is probably the oldest relic of humanity ever found in Germany or Switzerland, and perhaps in all Europe. In the same coal are remains of *Elephas antiquus*, *Rhinoceros murkii*, and *Bos primigenius*.

In *Zoology*, some important papers have appeared. Professor Hyatt's "Revision of the North American Poriferæ," a group of sponges, is the first installment of a series of papers on our native sponges, comprising considerable work done under the auspices of the United States Fish Commission, as well as on specimens from the different museums of the country. It is accompanied by a plate drawn on stone, and contains remarks on foreign species.

Some four years ago the Rev. Mr. Dalliger and Dr. Drysdale began to publish a series of papers, which have attracted much notice, on the life history of monads. The last is now published. The authors remark that simple conditions of season and temperature may account for their successive appearance in the fluid, without supposing that one form was developed out of another. "On the contrary, the life cycle of a monad is as rigidly circumscribed within defined limits as that of a mollusk or a bird." In no instance was the continuance of the species maintained without the introduction of a sexual process, a blending of what were shown in the sequel to be genetic elements. The experiments as to the effect of heat on the monads and their spores uniformly established an important fact, viz., that the spores resist heat much better than the adults. A temperature of 150° F. was always found to destroy utterly all the adult forms, while the spores resulting from sexual generation have a power of resistance to heat which is greater than this in the proportion of eleven to six on the average. "This appears to us," they say, "to be the very essence of the question of biogenesis *versus* abiogenesis. In some, at least, of the septic organisms spores are demonstrably produced, and these spores can resist a temperature nearly double that of adults on the average; that which some can resist is 88° F. above the boiling-point of water." This, adds the *Quarterly Journal of Microscopical Science*, is in harmony with the experiments of Roberts and the later ones of Huizinga.

Heretofore the earliest indubitable remains of dragon-flies have come from the lias formation, but lately, in some fragments of carboniferous shale from Cape Breton, Mr. S. H. Scudder has detected "well-preserved remains of the abdomen of a larval dragon-fly," thus carrying back the existence of these insects into the paleozoic age.

Some facts regarding the habits in confinement of the blind craw-fish of Mammoth Cave and the restoration of lost parts are given by Mr. F. W. Putnam in the Proceedings of the Boston Society of Natural History.

In the Proceedings of the same society is a lengthy enumeration of North American Neuroptera, by Dr. Hagen.

Under the head of *Agricultural Science* we note the observation by De Luca that the earth of the Solfatara (areas where sulphur vapors escape and sulphurous incrustations are deposited) of Puzzuoli, near Naples, absorbs ammonia from the atmosphere. This De Luca believes to be due to the sulphur and arsenic present, which, under the influence of air and moisture, become converted into acids, and then combine with ammonia. His suggestion that this fact may be of importance in agriculture is not without plausibility in view of the fact that organic compounds containing sulphur exist and undergo decomposition in every fertile soil.

Tissandier has examined the dust gathered from the air and brought to the earth by snow. Snow which fell in the city of Paris and in the country was melted and evaporated to dryness. The residue on analysis yielded from 53 to 61 per cent. of ash and from 47 to 39 per cent. of organic matter. It was found to contain, besides considerable quantities of iron, silica, carbonate of lime, alumina, chlorides and sulphates, and likewise nitrate of ammonia. The residue was an impalpable grayish powder. The earlier snows of the season brought more, and the later less, the quantities varying from 16 to 212 parts in 1,000,000 of snow-water. Material so rich in organic substance and in nitrogen must be very effective in fertilizing the soil. The atmospheric dust in snow is quite similar to that obtained from air in other ways, as is shown by extended researches by the same author. The iron universally present he believes to be of meteoric origin.

The guanos of the islands Enderbury and Raza, which belong to the same group with Baker Island, have been investigated by Schumann and Heiden, and shown to be similar and fully equal if not superior to the Baker guano. They are very rich in phosphate of lime—80 to 90 per cent.—and contain but little carbonate of lime. They contain only traces of fluoride and chloride of calcium, which fact shows that they are not

phosphorites. In the absence of chlorine compounds, a dry product is obtained on treating with sulphuric acid, while not enough iron and alumina are present to cause any appreciable reversion of the superphosphate to an insoluble form. On the whole, these two guanos are pronounced the best crude materials for the manufacture of superphosphates which are brought into the German market.

In *Engineering*, we may record that the New York Rapid Transit Commissioners have announced their conclusions with regard to the kinds of structures that will be built in that city. After specifying the several forms and modifications of elevated railroad that will be required upon streets of different widths, the report, which is quite lengthy, prescribes numerous details of construction and appointment, designed to render the operation of the roads safe and satisfactory.

Concerning the Flood Rock excavations, upon which work was commenced last June, we learn that a shaft ten feet by twenty feet in plan, and sixty feet deep, has already been sunk, from the bottom of which two tunnels have been started, which are in about twenty feet and thirty feet respectively. One of these runs across toward the New York shore, and the other in the direction of Hallett's Point. The work of excavation here will necessarily be delayed until after the great blast at Hallett's Point, referred to in our last month's summary. The works are under the superintendence of Captain William H. Heuer, United States Engineers.

The tunneling of the Detroit River is still being mooted, despite the misfortune which attended the work inaugurated in 1871, and abandoned, in the face of great difficulties, several years later. Soundings have lately been taken, in the interest of the Canada Southern Railroad, at a different point in the river, and with what is reported to be a very favorable result. Here the bed of the river is principally of limestone, and the tunnel proper will require to be only half a mile long. Estimates have been presented, likewise, showing that a double-track tunnel can be constructed at this point at an expense not quite half as great as the estimated cost of the abandoned project.

In accordance with the recommendation of the Senate Committee on Transportation, a government survey has just been completed for a railroad from the Tennessee River to the Atlantic. The line surveyed begins at Guntersville, Alabama, on the big bend of the Tennessee River, and terminates at the harbor of Brunswick. The line passes through four counties in Alabama and sixteen in Georgia, including the richest portions of these States. Its length is 412 miles, and the line diverges nowhere more than five miles from an air line. The railroad is proposed as an outlet for the grain and other produce of the Mississippi Valley. Our contemporary the *Railroad Gazette* expresses an unfavorable opinion concerning its utility.

From abroad we learn that the St. Gothard Tunnel, according to latest reports, has been bored on the side of Switzerland to the depth of 2500 meters, and on the side of Italy 2000 meters, leaving 10,500 meters yet to be penetrated. At the present rate of progress, the work will probably be finished about the year 1880.

In order to facilitate increasing traffic, a proposition to widen London Bridge has been referred to a committee of experts by the municipal authorities of that city.

The soundings for the submarine tunnel between England and France are being carried on actively. At the time of this writing the operations are directed to the part of the strait a few miles from the English coast, and report has it that the engineers charged with the important duty are well satisfied with the results obtained.

The English papers comment upon the curious coincidence that at the recent celebration of the fiftieth anniversary of the opening of the Stockton and Darlington Railroad, the first public railroad worked by steam, the announcement should have been made at the close of the banquet of the signing, on the very day of the celebration, of a contract for the construction of the first Chinese railway.

The *Railroad Gazette* has information up to the 30th of October of the construction of 920 miles of new railroad in the United States in 1875, as compared with 1242 miles reported for the same period in 1874, 2955 in 1873, and 5312 in 1872.

The accompanying figures, compiled from the *American Manufacturer's* recently published reports, show the number of iron furnaces in and out of blast in nearly every section of the country on the 1st of September, 1875, as compared with those which made similar reports to the same paper on the 1st of September, 1874. The returns for 1874 were from 82 per cent. of the whole number of furnaces, and those of 1875 are from 95 per cent., the latter being so nearly complete as to afford a very correct idea of the present condition of the pig-iron industry. The number of furnaces reporting is as follows: in 1874, 575 stacks; in 1875, 664 stacks. Of these there were in blast, in 1874, 348 stacks, with a weekly capacity of 51,439 tons; 1875, 289 stacks, capacity, 47,008 tons. Out of blast, 1874, 227 stacks, capacity weekly, 39,089 tons; 1875, 375 stacks, capacity, 53,803 tons. The whole number of stacks in the country is now about 700.

At Phœnixville, Pennsylvania, an experimental trial was lately made of a single-track elevated railroad in the presence of a number of engineers and other invited guests. The trial is said to have resulted very favorably. Both the road and engine contain features of novelty, which would require an elaborate description to be comprehended.

In *Technology*, we may allude to the frequent paragraphs in the daily press noting the increasing employment of natural gas in the manufacturing works of Western Pennsylvania.

The Lowe petroleum water-gas system for illuminating gas has been adopted by and introduced into the city of Utica, New York.

A new system of signaling with the electric light, in which the clouds are made use of as the screen upon which the image is cast, is being at present experimented with in Berlin, with the view of its adoption for military purposes if found successful.

Cuir-liége is the name of a new fabric, exhibited for the first time at the late Paris Maritime Exhibition. It consists of thin sheets of cork coated on both sides with rubber, with some textile fabric outside, the whole forming one coherent tissue. It is designed as a substitute for

leather, and possesses great strength and elasticity, besides being extremely light and quite impermeable to moisture.

An enameled water-pipe is a novelty introduced by the National Tube-works Company.

M. Lecoq, a French chemist, is reported to have discovered, with the aid of the spectroscope, a new metal closely allied to zinc and cadmium. The discoverer has named the new substance gallium, in honor of France.

Editor's Historical Record.

POLITICAL.

OUR Record is closed on the 22d of November. Elections were held, November 2, in New York, New Jersey, Pennsylvania, Maryland, Massachusetts, Wisconsin, Kansas, Minnesota, and Mississippi. In New York, John Bigelow, the Democratic candidate, was elected Secretary of State by a majority of 14,902. The Democratic majority in 1874 was over 50,000. The next New York Legislature has a Republican majority of 8 in the Senate and 14 in the Assembly.—The election in New Jersey was not for State officers; 8 State Senators and 60 Assemblymen were chosen. As a result of the election, the Legislature has a Republican majority in both branches.—In Pennsylvania, Governor Hartranft was re-elected by a plurality of 12,030.—In Massachusetts, Alexander H. Rice, the Republican candidate, was elected Governor by a majority of 4979 over Gaston. The Democratic majority in 1874 was 7000. The Legislature has a Republican majority in both branches.—In Maryland, John Lee Carroll, the Democratic candidate, was elected Governor by a majority of from 8000 to 10,000.—In Wisconsin, Harrison Ludington, the Republican candidate, was elected Governor by a majority of 843. In the Legislature the Republicans have a small majority in both branches.—The Democrats carried Mississippi, where a State Treasurer was chosen, by a majority of about 10,000.—In Minnesota, J. S. Pillsbury, the Republican candidate, was elected Governor by a majority of about 12,000. The Legislature is two-thirds Republican.—As a result of the election in Kansas, the Republicans carried all but three of the seventy-two counties in the State.

In New York city, the entire anti-Tammany ticket was elected.

In Nebraska, the Republican candidates for Supreme Judges were elected. The new Constitution was carried by a majority of nearly 25,000.

Joseph Guibord was buried in the Catholic cemetery, Côte des Neiges, in Montreal, November 16. The coffin was laid in a bed of cement, to preclude the possibility of its removal. Guibord died in 1869. He was a printer, and, as a member of the Institut Canadien, had been excommunicated from the Church. His remains were refused admission to consecrated ground. His wife applied to the Superior Court for an order to compel the Church to allow his burial in his own lot in the cemetery above named. The order was granted finally by the Queen's Privy Council, November 28, 1874. On the 2d of last September an attempt to execute the order occasioned a riot, and the burial was postponed.

The Prince of Wales, who is visiting India in royal state, was accorded a magnificent reception on his landing at Bombay, November 8. Over 200,000 spectators witnessed the procession escorting him to the Government House, and the city was splendidly decorated.

The German Parliament was opened October 27. The Emperor was absent, on account of indisposition, and his speech was read by the Minister of State. The Emperor's speech declares that peace is now more assured than at any time during the twenty years preceding the reconstruction of the empire.

The French Assembly re-assembled November 4. One of its first acts was the adoption of M. Buffet's motion to discuss the Electoral Bill on the 8th. The debate was accordingly opened on that day, and is still continued. On the 11th the ministerial party gained a triumph in the vote relating to the method of voting. Gambetta unsuccessfully urged the adoption of universal suffrage. The clause passed provided for elections by districts instead of on a general ticket.

DISASTERS.

October 26.—Great fire in Virginia City, Nevada. The business portion of the city completely destroyed. Estimated loss, $4,000,000.

November 4.—The steam-ship *Pacific* foundered between San Francisco and Portland. Nearly two hundred lives lost.

November 9.—The steam-ship *City of Waco* burned off Galveston Bar. Nearly seventy lives lost.

October 21–23.—Severe gales off the Scottish coast. Five vessels lost, with their crews.

November 7.—Wreck of the British ship *Calcutta*, from Quebec to Liverpool, on Grosse Isle. Twenty-three lives lost.

November 11.—Explosion of fire-damp in a Belgian colliery. Over forty lives lost.

November 15.—News in London of the wreck of the British ship *Astrida*, near Boulogne, France. Nine persons drowned.

November 18.—Railway disaster between Stockholm and Malmo, Denmark. Sixty passengers killed or severely injured.

OBITUARY.

October 27.—At Newtonville, New York, the Rev. Dr. William Arthur, author of a work on *Family Names*, aged seventy-nine years.

October 29.—In North Brookfield, Massachusetts, the Hon. Amasa Walker, the well-known publicist, aged seventy-six years.

November 4.—At Cumberland, Rhode Island, the Hon. Thomas A. Jenckes, author of the Civil Service Bill, aged fifty-seven years.—In New York city, William T. Blodgett, a prominent merchant and art collector, aged fifty-two years.

November 21.—In Norwalk, Connecticut, the Hon. Orris S. Ferry, United States Senator from that State, aged fifty-two years.

November 22.—In Washington city, Vice-President Henry Wilson, in his sixty-fourth year.

to the latter class of novels. No such combination of events ever did or could have happened to human beings. After we once get away from the shell-house of Amos Beecroft, Mariner, and into the full current of the story, we give up looking for probabilities, and curiosity usurps the place of sympathy. The adventures are too improbable for human credulity; and we read of the shipwreck without horror, and of the death and burial of poor little Bob without a tear. Of course all ends well: how could a Christmas story end otherwise?

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—Our astronomical summary for November begins with the enumeration of four asteroids discovered during the month, as follows: No. 151, on November 1, by Palisa, at Pola; No. 152, by Paul Henry, on November 2, at Paris; No. 153, by Palisa, at Pola, November 2; and No. 154, by Prosper Henry, at Paris, on November 6.

Meteorology and Terrestrial Physics.—The government of the Dutch provinces in India has published the magnetic and meteorological observations made by Dr. Bergsma at Batavia from 1866 to 1870. Dr. Bergsma was assisted by seven Japanese students, and maintained a series of hourly observations on all phenomena relating to these subjects.

Dr. Hinrichs, of Iowa City, has undertaken to establish a system of State meteorological reports, in which attention is especially paid to the rain-fall. He has begun to publish a monthly, entitled *The Iowa Weather Review*, for the purpose of disseminating promptly the results of the observations made by his correspondents.

The meteorological observations made at Berne, in Switzerland, in 1873 and 1874 have been published in full by Professor Forster, of that city, from which it would appear that a special meteorological observatory is now being erected in Berne, thereby filling out the plan of distribution of physical observatories in Switzerland, since there is already projected a physical astronomical observatory at Basle. The three purely astronomical institutions at Zurich, Neufchatel, and Geneva have long been well known. Professor Forster will attend especially to the relations of meteorology to agriculture, forestry, and health. Solar and terrestrial radiation are included in his plan of work, as also terrestrial magnetism.

The meteorological commissions of the various departments of France have always paid especial attention to the work of collecting data relating to thunder-storms. Lagrene states that in the Department of Haute Marne the average annual number of thunder-storms is eighty-seven, of which twenty-five occur in July, twenty in May, and fourteen in June. From October to March only six occur on the average.

In a recent analysis of observations of ozone, made at Lansing, Michigan, Professor Kedzie recommends that such observations be continued, and gives directions for their proper execution.

The hourly observations made by the Army Signal-office at stations at the summit and base of Mount Washington in May, 1872, have seemed to Dr. Helmann worthy of a special study, and he has deduced from them certain interesting results. He says that in the morning hours we have at any point on the earth the greatest heat, and an ascending current of air to the eastward of the place of observation, while in the afternoon it is to the westward. If, therefore, there were no prevailing wind in the neighborhood, we should, in the morning hours, experience at the upper station a west wind, and in the afternoon an east wind; if, however, a prevailing west wind exists, then we should experience merely an increase of its intensity in the morning hours, but an enfeebling of its intensity in the afternoon. These views he finds confirmed by some observations made in Switzerland, and expresses the hope that the necessary anemometric observations may at some time be made and published for Mount Washington. In reference to the case, which frequently occurs, of a high wind at the summit of the mountain while a feeble wind or calm prevails below, Dr. Helmann suggests that we need instruments which shall measure both the vertical and the horizontal components of the motion of the wind.

In a note on the formation of hail, Planté states that he has observed certain effects which go to show that the formation of hail is due to an electric discharge of low tension, accompanied by a gyratory movement of the electrified particles of ice.

Groneman, whose theory of the nature and origin of the auroral light has attracted considerable attention of late years, has published a short article giving new confirmations of its truth. According to him, the cause of the well-known peculiar geographical distribution of the aurora borealis in an oval belt lying between the parallels of 50° and 70° can be explained by two considerations: first, the position of the earth's axis in connection with the daily variation of the aurora, or with the elongations of the orbits of the cosmic dust to which the aurora owes its existence; second, the encounter between the earth and this ring of dust, and the consequent slow distribution of the dust in different latitudes. Groneman appears inclined to believe in the actual existence of periodical auroras, one of which may possibly recur annually on the 4th of February—an idea that was apparently first thrown out by Arago, and which is quite in accordance with Groneman's theory of the origin and nature of the aurora.

Fritz has compared the observations of auroras found in his great catalogue with the observations of the sun spots as given by Wolf. He finds that the great majority of important auroras agree accurately with the maxima of sun spots, and that the great aurora period of fifty-five and a half years also agrees with five of Wolf's sun-spot periods. He even goes further, and states that it is very probable that a still longer period of 222 years may be detected in the records of the auroras.

The observations of earthquakes that have been made in Italy by means of the pendulum

seismometers under the direction of Serpieri have been subjected by him to a detailed study, from which he concludes that this delicate instrument can be of use in predicting the approach of an earthquake shock. The intimate nature of the connection between the slightest earthquakes in Italy and the mountain ranges shows that these all may be considered as elastic waves of compression, emanating from a central region, in which the geological strata are, on a large scale, breaking down along lines of faults and fissures, and filling up the hollow caverns beneath. According to Alexis Perry, Serpieri's memoir on this subject is one of the most important that has appeared in recent times.

In *Physics*, but a few papers of note have appeared. Penaud has presented to the French Academy an important memoir on aviation, in which he describes his new apparatuses for mechanical flight. He divides the systems of aviation already proposed into three classes: helicopters, aeroplanes, and orthopters. In the first, screw-propellers with nearly vertical axes constitute the sustaining power; in the second, the surfaces are nearly plane, inclined slightly to the horizon, and the apparatus is propelled by screws; the third are furnished with organs whose surfaces have nearly vertical and alternating movements. In 1870 a variety of helicopters was constructed which would rise to a height of fifteen meters and remain in the air for twenty seconds. In 1871 an aeroplane was presented to the Society of Aerial Navigation, which was most successful. But a year later a mechanical bird was produced which essentially solved the problem.

Moreau has made a series of experiments to determine the precise function of the swimming bladder of fishes. He shows very ingeniously that fishes which possess such a bladder undergo variations of internal pressure, and hence that they do not, as is generally stated, make use of muscular power to preserve their density unaltered when this pressure changes. The function of the swimming bladder, then, in Moreau's opinion, is to enable the fish to adapt itself to all depths, not by a mechanical action exerted upon this by means of its muscles, but solely by changing the quantity of air which is contained in this organ.

May has published a memoir on hydrodiffusion, or the diffusion of a heavier liquid into water, in which he gives experimental and mathematical evidence to sustain the hypothesis of Fick—or a modification of it—that the passage of a dissolved substance from one solvent to a second proceeds according to the theorem which Fourier established for the passage of heat along a conductor.

Guthrie has investigated the conditions of production of stationary liquid waves in both circular and rectangular troughs, intending therefrom to deduce the velocity of wave progression from the frequency of the recurrence of a given phase in the same place. With circular troughs he noticed that with binodal motion—*i. e.*, motion produced by oscillations at the centre—the number of vibrations is independent of the amplitude and of the temperature; that the normal rate of pulsation is not reached unless there is a depth of at least six inches; that the chemical nature of the liquid is without effect on the rapidity of oscillation; that the rapidity of progression of such waves varies directly as the square root of the wave length; and that the nodal line of such circular waves is one-sixth of the diameter from the circumference. Hence it follows that a wave a meter long would travel 83.07 meters a minute, or a little more than three miles an hour.

Lescœur has studied the influence of chemical character upon the gyratory motions which are observed whenever certain substances, such as camphor, for example, are placed on the surface of pure water. He has obtained the result with the acids belonging to the fatty series and with many of their acid salts, though only in a slight degree with normal salts. A fragment of glacial acetic acid, for example, moves very actively on water and dilute acetic acid, but not on the concentrated acid or on mercury. So also of propionic, butyric, and valeric acids.

Müller has experimented to determine the pitch of the notes given by transversely vibrating rods of gypsum when dry and when moistened with various liquids. His results show (1) that the changes in tone produced by the absorption of liquids are also accompanied by a variation—actually a decrease—in the co-efficient of elasticity; this effect is most marked with water, less with alcohol, and still less with oil; and (2) the variations of tone of the various rods when wet, in comparison with a dry rod, follow a definite law, a comparison of the condition of such a rod when it has taken up a liquid showing a change in its modulus which is quite definite in amount, and depends only on the liquid employed.

Bosanquet has communicated to the Musical Association a second paper on temperament, or the proper division of the octave, in which he considers carefully all that has been done in the subject, and suggests a plan of his own for the purpose. To test the question, he has had a harmonium constructed with a compass of only four and a half octaves; but as each octave has fifty-three keys (!), the number of notes is quite sufficient. A previous instrument had eighty-four keys in each octave.

Cailletet has published in full his paper on the influence exerted by pressure on combustion. His experiments were made with a hollow iron cylinder which would stand a pressure of 300 atmospheres, into which air could be compressed by pumps. The flame to be examined was placed in this tube, glasses being inserted in the sides through which it could be seen. A candle flame becomes at first brighter as the pressure increases, but soon smokes, the combustion being incomplete. In general, however, the author concludes that the temperature of combustion increases with the pressure.

Sauer has experimented upon the visibility of the ultra-violet rays of the spectrum. He used for this purpose light emitted by zinc in the electric arc, which he observed was particularly rich in these rays. He thinks there would be no great difficulty in using this method for obtaining a photograph of this portion of the spectrum.

Vogel has given the results of his examination of the spectra of various coloring matters, with especial reference to their use for detecting these substances when used for adulterations, especially in wines. These substances are very numerous, not less than 482 having been mentioned for this purpose at the recent Wine Congress in Colmar. Vogel uses a common pocket spectroscope, a few test tubes, and some simple reagents. Upon a

horizontal line as the axis of abscissas he erects perpendiculars at the positions of the Fraunhofer lines, and then, by means of ordinates proportional to the intensity of color at different points, he obtains a simple intensity curve by which the results may be very readily compared. Figures of many of these curves are given in the paper.

Schaack has given in a recent memoir his views upon the construction of lightning-arresters at present used for telegraph lines. He proposes to replace these by a simple trough of water, made of metal and connected to earth, through which the wire (a fine spiral of silk-wound German silver wire covered with a thin coating of rubber) which connects the register with the line passes. The earth connection from the register is made to the metal of this trough. A discharge of lightning would melt the small wire and escape to earth, leaving the instruments uninjured.

Bichat has published an interesting memoir upon induction, in which he shows that as a current of high electro-motive force may be developed from one of low by means of the so-called induction coil, so, by passing a current of high tension from a Holtz machine through the outer coil, a current is generated in the inner coil capable of producing magnetic effects and of decomposing water, precisely as does the direct current from a battery. He also suggests an important modification in the Foucault interrupter, by which the intermittent current is interrupted more uniformly.

Weber has communicated an extended paper on the theory of the galvanometer, in which he discusses the whole subject mathematically.

Bunsen has given some results obtained in his laboratory by Hillebrand and Norton on the electrolytic preparation of the metals contained in the mineral cerite. About forty grams of the elements cerium, lanthanum, and didymium were obtained in this way.

In *Inorganic Chemistry*, the month has produced but few important papers. Gladstone and Tribe have shown that water may be decomposed by the joint action of aluminum and aluminum iodide, bromide, or chloride. They suggest as probable that the reaction takes place in two stages. In the first the aluminum of the iodide is oxidized, and in the second it is regenerated, setting free hydrogen.

Gautier has given an improved method of quantitative testing for arsenic in cases of poisoning. The organic matter is destroyed by alternate treatment with strong nitric and strong sulphuric acids, the sulphide precipitated as usual, converted into oxide, and placed in a modified form of Marsh apparatus, by which the whole is collected in a tube and weighed.

Mineralogy.—A new mineral resin has been called schraufite by Von Schröckinger, in honor of Professor Schrauf, of Vienna. It has been found in considerable abundance in the sandstone at Bukowina. It resembles amber somewhat, but differs from it in chemical composition. It is quite soft, and has a conchoidal fracture. Its color is a deep red, which grows darker on heating; the temperature at which it melts is unusually high for resins of this class.

Some recent observations on a few well-known species may be of sufficient interest to be added here. Perofskite has been carefully investigated by the Russian mineralogist Kokscharow. It has always been a somewhat uncertain mineral, having the form of an isometric crystal, and yet showing the phenomena of double refraction, which belong only to crystals which are optically biaxial. Kokscharow shows that both these facts are strictly true, and, further, that most of the Russian crystals are penetration twins. The abnormal optical character is due to the peculiar internal structure of the mineral, it being far from homogeneous in structure.

The same mineralogist has shown that titanic iron is not in form so closely related to hematite as has been supposed, but that it is really tetartohedral.

Vom Rath has proved that the supposed new mineral, seebachite, introduced by Bauer into the science a year or two ago, is really identical with phacolite. The mineral in question is found at Richmond, in Victoria. It belongs to the rhombohedral system, although Von Lang attempted to show that it was biaxial, that is, orthorhombic. In composition it is very near chabazite, of which mineral phacolite has sometimes been considered a variety.

Mr. Ward has recently discussed before the Royal Geological Society the question of the comparative structure of ancient and modern volcanic rocks—a subject which has received much attention in England, and been treated more broadly there than by the lithologists on the Continent. The conclusion reached tends to show the unimportance of the age of rocks taken by itself. Of a certain ancient series of volcanic rocks he says, "They may with as much reason be called lavas as any of the modern flows of Vesuvius." The author describes a considerable series of more or less altered volcanic rocks from Cumberland, and affirms that in lower Silurian times there existed in Cumberland volcanoes of sufficient magnitude to accumulate a thickness of at least 12,000 feet of volcanic products. Most of the eruptions were subaerial. The volcanic rocks, though once true lavas, are now in many cases much changed and metamorphosed. The period when the metamorphism chiefly took place was that of the close of the upper Silurian or earlier part of the Devonian.

Microscopy.—Messrs. Dallinger and Drysdale, whose excellent researches on the life history of a monad we have already noticed, have recently taken up the study of *Bacteria*. Using the new immersion $\frac{1}{25}$th of Powell and Lealand, an objective capable of resolving the striæ of *Amphipleura pellucida* into beads, as also the fine striæ of *Surirella gemma*, they find that *B. termo* is furnished at both ends with a flagellum exquisitely delicate, and only to be discovered when in the proper position in regard to the light. Their paper is published in the *Monthly Microscopical Journal* for September, 1875.

In the *Quarterly Journal of the Microscopical Science* for April, 1875, is a very full account of modern researches into the nature of yeast, by A. W. Bennett, M.A., illustrated with many figures. We can only refer to this article, which is too long and important to be abridged within the space allowed here.

Dr. Carpenter, at the Bristol meeting of the British Association, questioned the theory of Dr. Wyville Thompson on the origin of the red clay universally found in the deepest sea soundings. Dr. Thompson supposed it the residue, after the calcareous portion of the shell had been dissolved

by the excess of carbonic acid, the mineral matter not calcareous left behind being a red silicate of iron; and in support of this view Dr. Thompson stated he had obtained a similar deposit of "red ash," as he terms it, from the ordinary foraminiferous ooze, after removing the calcareous portion by dilute acid. Dr. Carpenter, referring to the discovery of casts of the foraminifera in the green sands, and especially as noted by the late Professor Bailey, considers that the red clay, instead of being the ash from the foraminiferous shells, was but the higher oxidization of the iron of the internal casts, and the disintegration of them by the action of carbonic acid. The casts are formed by the decomposition of the animal, when the silicates precipitated from sea-water take the place of the animal substances, particle by particle, filling completely the cavities of these minute shells with green or ochry silicates.

Ethnology.—M. Baudrimont has found, in the Dolmen de Font-Rial (Aveyron), a fragment of the lower part of a right tibia, exhibiting an exostosis produced by a flint arrow-head driven into the bone, not by the point, but by the barb. The difficulty of conceiving how the wound could have been produced by a bow-shot induces the learned author to suppose this an instance of primitive surgery.

In the second number of *Le Musée Archéologique*, a popular quarterly recently started in Paris, with M. Caix de St. Aymour for editor, M. Roban has an article on a number of gold bells found in a Zapotic tomb, which were presented to the Emperor Maximilian, which disappeared after his execution, and were discovered at a goldsmith's in Washington.

M. Jules Ballet, of Guadeloupe, read a paper at the Congrés des Americanistes, at Nancy, on the Caribs of the Antilles.

Letters have been received at Berlin from Professor A. Bastian, commissioned by the German government to visit Central and South America on an archæological expedition. He had visited Chili and Peru, and was on his way to Ecuador and Colombia.

Dr. Daniel Wilson is the author of a paper in the *Canadian Journal* entitled "Hybridity and Absorption in Relation to the Red Indian Race." He accounts partly for the disappearance of the aborigines by intermarriage with the whites. The predominance of half-breeds and the characteristic "Brother Jonathan" face are attributed to a like source.

At a meeting of the Anthropological Society of Stockholm, October 16, G. de Vlyder, the African traveler, gave a description of the four great South African races—the Bushmen proper, the Namaquas, the Hereros, and the Ovambos, exhibiting arms, dresses, ornaments, and musical instruments. He claimed for the Hereros superiority in race, political power, language, etc. The *Cape Monthly* for September contains an article of Dr. Bleek's on the Bushmen. In addition to published accounts, we have information upon their skill in drawing and painting, reminding us of the modern Esquimaux and the ancient cave-dwellers of Perigord.

Dr. Georg von Gabelenz, of Dresden, is engaged in preparing a thorough treatise on the Papuan languages, using therefor, in addition to other materials, the collected manuscripts of Mr. Miklucho-Maclay and Dr. A. B. Meyer.

The recent work of W. Stanley Jevons, F.R.S., on *Money and the Mechanism of Exchange* has an interesting chapter on the "early history of money," showing how alterations in the medium of exchange have been connected with the principal steps of human progress.

Mr. Francis Galton read two papers before the Anthropological Institute, November 9, one entitled "Short Notes on Heredity, etc., in Twins," and the other "A Theory of Heredity."

Mr. F. W. Rudler read a report on anthropology at Bristol.

Dr. Smart read a paper recently before the British Archæological Association on the ancient worship of springs.

Dr. Alexander Ecker has an interesting article in *Archiv für Anthropologie* (viii. 67) on the fluctuating character of the human hand. The author draws attention especially to the comparative length of the fore and the ring fingers in ancient statuary, in different modern races of men, as well as in apes.

Zoology.—The Jena *Journal of Science* has just been received, containing Dr. E. Bessels's description of the large sand foraminifer dredged by the United States Fish Commission off the coast of New England. This is a star-like, gigantic foraminifer, which sends out "pseudopodia," or protoplasmic threads, much as in the shell-like calcareous foraminifera. It is named *Haeckelina gigantea*.

The same number contains an account by Dr. Rabl of the embryological development of certain pond snails belonging to the genera *Lymnæus*, *Physa*, *Planorbis*, and *Ancylus*. These investigations are of interest from the clearness with which the "gastrula" stage is presented in *Lymnæus ovatus*, the same phase ("*imaginati gastrula*") being much more obscurely marked in *Lymnæus stagnalis*, as observed by Ray Lankester. It appears that all the fresh-water pulmonates whose development has thus far been observed have the same general mode of growth.

The mode of development of the garden snails of Europe (*Helix pomatia* and *H. nemoralis*) is discussed in an elaborate manner in the same journal by Dr. Hermann von Jehring, so that now we have tolerably full knowledge of the mode of growth of the land and fresh-water snails.

Microscopists will be interested in an account by Hertwig of a new acinetan infusorian (*Podophrya gemmipara*), which appears in the new German *Journal of Anatomy and Embryology*, edited by Gegenbaur. After a review of the structure of acinetæ generally, the author speculates on the origin of these interesting forms, and believes that the original ancestral form from which the acinetæ and infusoria sprang was a one-celled organism covered with cilia.

A general account of the mode of development, in the egg, of insects and crustaceans is given by Dr. Packard in the *American Naturalist*, being part of a series of papers entitled "Life Histories of Animals," which have at intervals appeared during the past year.

The embryo of the white ant (*Calotermes*) has for the first time been figured by Fritz Müller in the Jena *Journal of Science*. From this single figure it would seem that the white ant is similar in its mode of development to other insects, especially the dragon-flies, as described by Packard in the Memoirs of the Peabody Academy of Science.

The relation of bees to flowers is discussed by Hermann Müller in a paper translated in *Nature*. He calls attention to the interesting facts presented by various groups of *Hymenoptera*, in which occur a series of forms presenting more and more complex life relations, accompanied by a higher and higher mental organization. The consideration of these gradations is calculated to throw much light on the question, "How has the honey-bee acquired its remarkable instincts?"—a question which the study of that species alone would, in his opinion, do little to solve, but on which the habits and organization of the lower group throw much light. Dr. Müller, after giving the evolutional history of the sting of the wasp, tracing it up from the ovipositor of the ichneumon-fly and sand-fly, thinks that the various acts by which the solitary wasps protect their young must have at first been arrived at with a consciousness of the object to be effected, but that they have gradually become instinctive, and are now unconsciously inherited from generation to generation. "Still it is," he observes, "impossible to watch a wasp at work without feeling that, with these inherited customs or so-called instinct, much individual effort also comes into play."

The tongue of a European salamander, *Geotriton fuscus*, is found to differ from all other *Amphibia*, and to recall that of the chameleon, woodpeckers, and ant-eaters in being extremely long, and, in the present instance, ending in a disk.

A certain amount of speculation seems now inevitable in the scientific essays of German naturalists, of which time alone will show the usefulness. As an example are the following remarks of Dr. Rosenberg, which flow out from his studies on the vertebral column and the *os centrali carpi* of man. How man may have developed from the mammals he endeavors to show by stating the differences existing in the vertebral column of the monkeys and apes as compared with that of man. For instance, in two genera, *Troglodytes* and *Hylobates*, there are thirteen dorsal vertebræ, while in the orang and man there are only twelve. But Dr. Rosenberg has discovered in more than one human embryo an actual rib-rudiment on the thirteenth dorsal vertebra, so that the homology of the thirteenth dorsal in man and *Troglodytes* is established. Other similar cases are adduced by the author in this recent field of research and speculation.

Agriculture and Rural Economy.—The agricultural science of the present day includes, as one of its most important branches, the investigation of the laws of the nutrition of domestic animals. Under this general subject the special one of the digestibility of fodder materials has during the last eighteen, and especially during the last ten, years been studied by feeding trials with horses, oxen, cows, sheep, goats, and swine. These digestion experiments have been made almost exclusively at the German Agricultural Experiment stations, where over one thousand, each occupying the labor of several men for days, weeks, or even months, have already been executed, and others are continually in progress. That so enormous an amount of work should have been accomplished is explained by the fact that thirteen of the German stations, each employing from two to five chemists, are devoted especially to researches in animal nutrition.

We have just received reports of some feeding trials with sheep, carried on by Schulze and Märcker at the station at Weende, in Hanover, which are of interest as confirming some of the very important deductions from previous experiments of this class. It has been found that a certain portion of the woody fibre of plant food is digestible and nutritious, from forty to nearly seventy per cent. of the fibre in hay, clover, and straw being digested by cattle and sheep, and a smaller proportion by horses. This crude fibre consists of cellulose (which has the same composition as starch) and other materials richer in carbon. It is believed that the cellulose constitutes the digestible part of the fibre. This view finds a remarkable confirmation in experiments referred to, in which the composition of the digested portion of the fibre coincided almost exactly with that of cellulose. Results identical with this have been found in numerous other experiments at Weende and elsewhere.

It is a familiar fact that all ordinary fodder materials consist of water, mineral matters, and two classes of organic substances—the albuminoids (gluten, fibrin, etc.), which contain nitrogen, and the carbo-hydrates (sugar, starch, cellulose, etc.) and fats, which contain no nitrogen. One of the important principles brought out by the German experiments is that unless foods, especially mixed rations, contain a sufficient proportion of albuminoids, they are not economically digested. When carbo-hydrates, as sugar or starch, or materials rich in these, as potatoes, are fed in considerable quantities with hay and straw, less of the latter is digested than when they are fed alone. On the other hand, nitrogenous substances, as gluten, and likewise foods rich in albuminoids, as oil-cake, cotton-seed meal, beans, pease, and bran, when fed even in considerable quantities with hay and straw, do not decrease the digestion. Thus, in the experiments of Schulze and Märcker, large quantities of gluten of wheat, and of bean meal as well, caused no depression in the digestion of hay or aftermath, while the addition of starch and sugar to the ration decreased the digestion of the whole organic substance of the former by nine per cent., that of the albuminoids by fifteen per cent., and that of the crude fibre by eight per cent.

Quite in accordance with the above are the results of late experiments by Dr. Stohmann, director of the station at Leipsic, on lupines (seeds) as food for sheep. The lupines proved almost completely digestible, and (being highly nitrogenous) exerted a very favorable influence upon the digestion of the hay. From twenty to thirty-nine per cent. more of the crude fibre was digested from the hay fed with lupines than from the same hay when fed alone. To the bitter taste, which renders lupines unpalatable to cattle, sheep do not seem to object. As a rich food for fattening sheep, Dr. Stohmann says that lupines rightly used can hardly be too warmly recommended.

The already well-established fact that forage crops grown on well-manured soil are richer in albuminoids, which constitute the most valuable portion of the food, than those grown with scantier fertilizing is well illustrated in some late experiments by Wagner. On a poor sandy soil in Westphalia, which was rendered fertile by irrigation, the effect of manuring grass with superphosphates was tested. Not only was a much greater yield obtained, but the manured grass contained

a much larger percentage of albuminoids. The albuminoids were also more soluble in water, and hence probably more digestible. The manured grass was likewise much richer in phosphoric acid.

This experiment, with those previously mentioned, sets forth a general principle which, though little understood, is of vast consequence to the agriculture of the United States. Taken as a whole, our fodder materials have not a sufficient amount of nitrogen to secure their most economical utilization. This evil may be corrected, first, by cultivating nitrogenous crops, as clover, lucerne, beans, pease, and lupines; second, by making more use of nitrogenous waste products, as oil-cake, cotton-seed meal, malt sprouts, bran, etc.; third, and most especially, by heavier manuring, which brings crops not only larger, but richer in nitrogen.

The question of the formation of sugar in fruits has been studied by Mercadante in investigations on the plum. It appeared that in the first period of development, while the fruit, like the leaves, takes up carbonic acid and gives off oxygen, the sugar was, in presence of malic acid, formed from gummy substances, sugar and acid increasing simultaneously. In the second or ripening stage, in which oxygen is absorbed and carbonic acid given off, acidity of the fruit diminished, while the sugar increased, in consequence of a conversion of malic acid into sugar.

The chemistry of malted and unmalted barley has been investigated by Kühnemann, who finds dextrine in neither and sugar in both.

In the province of *Engineering* we may record that at the different sessions held during the past month by the Interoceanic Canal Commission (composed of General A. A. Humphreys, Chief of Engineers, Captain C. P. Patterson, Superintendent of Coast Survey, and Commodore D. Ammen, Chief of Bureau of Navigation), appointed two years ago by the President, the reports of surveys by Commander Shufeldt of the (1) Tehuantepec route, Commodore E. P. Lull of the (2) Nicaragua and (3) Panama routes, Commander Selfridge on the (4) Darien and (5) Atrato routes, and by Lieutenant Collins on the (6) Atrato route, were fully discussed. The deliberations of the Commission were likewise materially assisted by the consideration of a highly valuable report on similar engineering works abroad, prepared by Professor J. E. Nourse, of the United States Naval Observatory, from observations made and information collected during a recent official visit abroad. After a full examination of all the surveys on file in the departments, noting the evidence in favor of each case, the Commission closed its sessions, and presented to the President a report in which the Nicaragua route is approved as the most feasible one. It is the only route where the climatic conditions are healthful, and where a uniform and constant supply of water is to be found. The cost of the projected canal by this route is estimated at $65,722,147.

Concerning the progress of the bridge over the East River, we glean that the tower on the Brooklyn side was finished some two months ago, and that work on the New York tower was suspended for the winter on December 1. It is likewise stated that the structure will be so far completed as to permit of the throwing over of a temporary bridge early in the summer of next year. On this temporary structure the workmen will weave the wires into the permanent supporting cables. The bridge will probably be completed by July, 1879. Thus far, about $5,800,000 have been expended upon it.

During the past month a railway convention was held in St. Louis for the purpose of furthering the completion of the Texas and Pacific Railroad. The convention was largely attended by friends and advocates of the enterprise, and resolutions were adopted looking to the resumption of work thereon under certain guarantees of assistance from the general government.

Further railway postal facilities have been provided for the West. Cincinnati, Indianapolis, and St. Louis, and intermediate cities, are about to be supplied with fast mail-trains.

The Junction Railroad, connecting the Savannah and Charleston road with the Atlantic and Gulf road, was completed during the past month, and opened for traffic.

The *Railroad Gazette* has information up to November 27 of the construction of 1150 miles of new railroad in the United States in 1875, against 1664 miles reported for the same period of 1874, 3276 miles reported in 1873, and 6202 miles in 1872.

The leading commercial journals abroad are agitating the construction of an important water cut-off, namely, a ship-canal from Bayonne, in the Bay of Biscay, through Toulouse to Ayde, on the Mediterranean. This improvement is urged on the ground that it would make almost a beeline from Plymouth, England, to Malta, and save the long run down the coasts of Portugal and Spain, which amounts to some hundreds of miles.

The enterprise of leading the product of the great Butler County gas well to the iron-works at Pittsburg (a maximum distance of nineteen and a half miles) has proved completely successful. The new fuel is easily managed, quite economical, and produces a quality of iron thought to be superior to that made from the same material with ordinary fuel.

The Bessemer Steel-works of the Lackawanna Iron and Coal Company, at Scranton, Pennsylvania, went into operation on the 23d of October last.

The Hatch process for making steel from refuse scrap-iron is said to be in successful operation at the works of the Pittsburg Refining Company.

The petroleum-water-gas process of Lowe, lately introduced at Utica, New York, has just been very favorably reported upon by Professor Wurtz.

The *Kölnische Zeitung* reports that Krupp is making preparations for the construction of a 124-ton gun.

M. Mouchot lately exhibited before the French Academy a solar engine of simple construction, from which he claimed to have obtained considerable utilizable energy, and to have produced, after three-quarters of an hour's exposure to the sun, a boiler pressure of sixty pounds of steam.

In some recent high-speed brake trials in England it was found that at a speed of about fifty miles, with the most approved devices, and the employment of all available means of stoppage, including the reversing of the engine, a train can not be stopped within a shorter distance than half a mile.

A justifying type-setting machine is a recent American invention.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

THE *Astronomical* activity during December has flagged slightly, if we may judge from the fact that but one new asteroid has been reported during the month, that, namely, which has received the number 157, and was discovered by Borelly at Marseilles on the 1st of the month.

In *Meteorology*, some valuable and suggestive papers have appeared, first among which we notice one by Professor Langley, of the observatory at Alleghany City, Pennsylvania. This gentleman has for some eight years given special attention to the phenomena observed in the solar atmosphere, and in his latest communication he gives a general review of his determination of the absorption of the solar heat and light that takes place in the sun's atmosphere itself. This absorption takes place, he thinks, principally in a shallow layer at the base of the chromosphere, and nearly coinciding with the "reversing layer" observed by Secchi and Young, and amounts, so far as the heat is concerned, to about one-half of the whole original energy. The slightest change in the thickness or other condition of the solar atmosphere has an appreciable effect on the absorption, so that we have here at hand a sufficient cause for those variations in solar heat that geological observations seem to demand. The absorption is also selective, so that the sun tends to have a bluish tinge when the absorbing layer is thin, but to have a reddish tinge at other times, affording us thus some rational hypothesis whereby to explain the phenomena of variable stars.

Professor Loomis communicates to the National Academy of Science his fourth paper on the results of the study of the daily weather maps of our Army Weather Bureau. Besides a number of miscellaneous subjects, Professor Loomis treats of the movements of areas of high barometric pressure, showing that they move southeastward —a point, however, that can scarcely be called new, inasmuch as it is renewedly shown in the monthly reviews of the Signal-office. It was first announced in 1871 by Mr. Abbe, and was even predicted by Professor Ferrel so long ago as 1859. By studying the published paths of storms over America, the Atlantic, and Europe, Professor Loomis is led to the conclusion that about one-tenth of those that originate in America reach Great Britain. In their progress over the ocean their rate of movement is sensibly slower than over the land.

In a communication by Mr. Scott, of London, to the Meteorological Society he gives some observations showing that on the average the French "Thermomètre Fronde" is not a very decided improvement upon the ordinary thermometer fixed in a properly sheltered place.

But few papers will be more welcome to the meteorologist than that by Bosanquet on the polarization of the light of the sky. This obscure subject, first systematically investigated by Brewster, Arago, and Babinet, received a new interest when Tyndall observed the delicate blue colors and polarized light of clouds of finely divided vapors. His observations have, however, remained unused until now that Bosanquet has shown how far they go in explaining what little we know of the polarization of the light of the sky. The first portion of Bosanquet's memoir shows that the formulæ charts and explanations given by Brewster do not agree sufficiently well with his own and other observations, but shows how they may be so modified as to afford a pretty correct general view of the phenomena. In general, Bosanquet substitutes neutral rings for the neutral points, ordinarily so called since the publications of Arago, Brewster, etc. He then shows that the experiments of Tyndall justify the conclusion that the proportion of polarized light observed normally to the illuminating beam that falls upon and is reflected from fine particles, whether of vapors or dust, diminishes with the increasing size of the particles, and with the increase of the neutral angle up to ninety degrees, which latter extreme occurred in the case of heavy vapors of resin and water.

Applying these ideas to the atmosphere, it results that the diminution of the maximum polarization from zenith to horizon may be regarded as due to a small increase in the mean size of the particles, whether these be of vapor or dust, etc. Except in so far as modified by this circumstance, the phenomena observed in the sky should be arranged symmetrically about an axis drawn to the sun, and the neutral points of Brewster and Babinet become merely special points in a neutral circle about the sun, while the neutral point of Arago belongs to a neutral circle about the anti-solar point. Within these small circles the polarization is negative except at their centres, which ought, theoretically, to be neutral, and to be the only neutral points in the sky.

The observations made in 1874 by Professor Pickering, of Boston, seem to have been unknown to Bosanquet, but will, in connection with this new theory, be of service in advancing our knowledge of this subject, which now at last will, it is hoped, receive the attention from meteorologists that it demands.

The absorptive and radiative powers of the aqueous vapor of the atmosphere were some years ago, as is well known, the subject of a very animated discussion between Tyndall and Magnus, the latter of whom maintained that this vapor had not the remarkable properties attributed to it by Tyndall. The subject was consequently examined by Wild and others, who gave their adherence to Tyndall's views; but these have been but slowly and partially received in Germany. Lately Hoorweg has, however, by a renewed system of observations, conclusively shown the general correctness of Tyndall's results; according to whom it is to the presence of a small percentage of vapor in the atmosphere that we owe the moderation of terrestrial climates, which, without it, would present only a daily recurring succession of intense heat and cold.

Mineralogy and Geology.—At a recent meeting of the Connecticut Academy, Mr. G. W. Hawes presented some interesting facts derived from the study of a series of rocks from the so-called "chloritic formation" near New Haven. The rocks in question are unquestionably of metamorphic origin, belonging to the range of crystalline rocks extending to the west of New Haven. The results of chemical analysis show that they are identical in composition with the well-known

igneous trap-rocks of the Connecticut Valley. Moreover, as among these igneous rocks there are two varieties constantly occurring, so here among those of metamorphic origin there are two kinds —the *anhydrous*, for which the name metadolerite is proposed, and the *hydrous*, which is called metadiabase. It is in general customary to draw the line so sharply between igneous rocks and those derived from altered sedimentary strata that it is interesting to find that in some cases no important distinction exists, either chemically or mineralogically.

The study of rocks by aid of the microscope is still being prosecuted with much energy, and the many facts accumulated are serving to throw light upon a subject which has been but imperfectly understood. The examination of a considerable series of fragmental rocks by Auger shows that crystalline minerals are rarely absent in them, though often not visible to the naked eye; thus mica, calcite, tourmaline, and hematite are generally present. The serpentines of the Vosges Mountains have been studied by Weigand. The subject is of some interest, since it has been shown that many serpentines have the microscopic structure of the original chrysolite from which they were derived. The investigations of Weigand show, further, that not only chrysolite, but also other magnesia silicates, as bronzite and amphibole, are capable of producing serpentine on a large scale by their alteration.

The existence of metallic zinc in the native state has always been somewhat uncertain, the reported cases of its discovery not being altogether reliable. Quite recently, however (*American Journal*), Mr. Marks has reported its occurrence on the southern edge of Tennessee and the adjoining parts of the States of Georgia and Alabama. It was first found in loose fragments in a small cave in Sand Mountain, under circumstances which seemed to point to its having come originally from the adjoining rock, a blue limestone. Later search has shown that the metal, though still in loose fragments, occurs in crevices in the rocks of Raccoon Mountains and in Sand Mountain, along a distance of thirty miles.

In this connection it may be worth noting that Kokscharow mentions the recent discovery of native lead in grains and flattened fragments in the hornstone of the Kirghese Steppes, Russia. It is accompanied by gold, magnetite, and hematite. Native lead was also reported a few years ago by Dr. Gurth as having been found with native iron in the bed-rock of the gold placers at Camp Creek, Montana.

Achrematite is a new molybdo-arsenate of lead from the mine of Guanaceré, State of Chihuahua, Mexico, described by Professor Mallet, of Virginia. In general appearance it is compact, but showing something of crystalline structure; the examination in polarized light suggests that it may belong to the tetragonal or hexagonal systems. Its color is a sort of liver-brown, though in individual grains it is of pale sulphur-yellow; the streak is a pale cinnamon-brown, and the lustre between resinous and adamantine; on thin edges it is translucent. The specific gravity is 5.965 for solid fragments, 6.178 for the fine powder, and its hardness a little greater than that of calcite. The chemical examination makes the mineral, as stated, a molybdo-arsenate of lead. Its name has reference to the fact that it contains no precious metal, though it was given to the describer as an ore of silver.

Geography.—Since our last report of geographical movements, much has been done to extend our knowledge of the physical and natural history of various portions of the globe.

In America the parties under the direction of Major Powell, Lieutenant Wheeler, and Professor Hayden have all returned from the field, and are engaged in preparing their reports upon the labors of the past summer. The general average of past years has been fully maintained in reference to the number of square miles investigated and the miscellaneous information gathered.

In the Old World, Professor Nordenskjöld has completed his very remarkable expedition to Northern Siberia, his vessel, the *Proven*, having returned to its starting-point. The professor himself, with a portion of his party, returned homeward *via* St. Petersburg. His vessel succeeded in accomplishing what has been attempted in vain for three hundred years, thereby clearing up some interesting problems in Northern geography. The natural history collections made were also of very great scientific interest.

As was to have been expected, nothing has been heard recently of the British arctic expedition, which, it is presumed, is now well advanced toward the north, and in comfortable winter-quarters. It is expected that an auxiliary expedition will set out early in the coming summer, for the purpose of communicating with the first vessels, and extending to them any succor that may be necessary.

The more recent discoveries in Africa have been extremely interesting, especially the work accomplished by Mr. H. M. Stanley in the survey of the Nyanza Lake, which he shows to be a very large body of water, and not of the restricted dimensions claimed for it by some recent writers. Lieutenant Cameron, also, by crossing the continent of Africa from Zanzibar to Loanda, and by his establishing the true relations of Lake Tanganyika to the Lualaba and Congo, has secured his due meed of fame.

The return to Australia of the vessel fitted out by Mr. Maclay for exploration in New Guinea, without having accomplished its object, is matter to be regretted. The difficulty appears to have been partly due to the unfitness of the ship for her purposes from her too great draught of water, and partly to want of harmony in the party.

The *Challenger*, which has occupied a prominent place in the history of science during the past three years, is now on her way back to England, where she is expected in the course of the coming spring. The last advices reported from her were of her arrival at Valparaiso on the 19th of November.

Ethnology.—The first article in the third number of *Revue d'Anthropologie* for 1875 is a long and able paper upon the Roumanians of Macedonia. The author states that while many labors have been consecrated to the Roumanians of Wallachia and Moldavia, scarcely any mention has been made of the trans-Danubian members of the same family.

In the tenth number of *Matériaux* for 1875 Valdemar Schmidt's paper on "Funereal Rites in Scandinavia and other Parts of the World" is fully reported, together with the discussions which it evoked. In the same number is a report of M.

G. de Mortillet's theory of the East Indian origin of bronze implements, of M. Prunière's note on "Working in Bone and Teeth in the Neolithic Age," and of M. Paul Broca's "On the Inhabitants of the Isle of Batz."

The committee of the International Congress of Anthropology and Prehistoric Archæology, appointed to report upon a universal system for signs upon charts, have made their report. The whole subject is discussed in a supplement to the eleventh number of *Matériaux*, and a full description of the signs given.

The editors of *Matériaux* propose to publish a complete index of the first ten volumes of that work.

The seventeenth and last number of *Reliquiæ Aquitanicæ* has been received. It contains the conclusion of Milne-Edwards's paper in a former number, a few supplementary notes, and complete indexes to the whole work.

Papers upon the following interesting subjects were read at the meeting of the German Scientific and Medical Association in August last: "On Sclavian Legends," by Professor Mullner; "On Diluvial Man," by Count Wurmbrand; "On the Natural Law of the Formation of States," by L. Gumplowicz; "On Protohistoric Measures," by R. von Luschlin; "On Celtic Warfare," by Dr. Weiss.

Miss L. C. Lloyd, who was for a long time Dr. Bleek's chief assistant in his studies, makes an appeal for aid to carry on his researches into the folk-lore and speech of the Bushmen, Hottentots, and Caffres.

The *Academy* for November 20, 1875, copies in full the text of Dr. Goldschmidt's "Report on the Inscriptions in the North Central Province of Ceylon." They are all in Simhalese. The same alphabet having been in use for 2100 years, by comparing the modern Simhalese with the old Indian, he was enabled to decipher descriptions of all ages.

The Rev. A. H. Sayce, in looking over the results of cuneiform decipherment, has arrived at the conclusion that the Sabbath was of Chaldean origin; that seven was a sacred number among them; that their lunar month was divided into sevens; that the 7th, 14th, 21st, and 28th of the month were called *sulum*—rest. Even the word *sabbatu* occurs in the inscriptions, and is rendered by Mr. Smith "a day of rest for the heart."

Dr. A. Morice contributes to the third number of *Revue d'Anthropologie* for 1875 an elaborate treatise on the pathology of the indigenes of Lower Cochin China, and especially of the Anamites. In the same number is a note upon the discovery of nigritos in Southwest India.

The ravages of the measles among the Feejeeans have greatly reduced their numbers, and render the possession of relics from those islands exceedingly precious to the ethnologist.

The appointment of Professor F. W. Putnam on the Wheeler survey as archæologist is a wise measure. The professor will shortly issue an illustrated report of the archæological results of the explorations.

Microscopical Science.—Herr Husert, of Eisenach, advertises a new microscopical objective, said to magnify 2000 to 3000 diameters, and requiring no corrections for covering glasses of different thickness (!), and he states that the markings of *Amphipleura pellucida* can be seen by direct light (!). There must be some grave mistake here. The *Amphipleura* is often furnished with a semi-siliceous outer investment, that becomes rugose and pitted by turning, and very often when the diatom is thus prepared it is apparently easily resoluble. The same is true with the so-called *Frustulia saxonica*, which is only another name for *Colletonema vulgare* and *Navicula crassinervis*, varying simply in size or outline. The true *N. crassinervis*, from specimens of De Brebisson, who first described it, is a small *Navicula rhomboides*.

To the *Monthly Microscopical Journal* for December, Mr. Sorby contributes an important paper upon a new method of measuring the position of the bands in spectra. The apparatus employed is somewhat difficult to make. A plate of quartz one and a half inches in thickness is cut so that the light will pass along the line of the principal axis, and is interposed between two Nicol prisms. The whole visible spectrum is thus apparently divided into eight spaces by seven well-defined bands at equal intervals, and with this peculiarity, that on rotating the polarizer or analyzer (the upper prism is furnished with a graduated ivory circle) these black bands will move over the spectrum, occupying the original positions on completion of each half revolution. Each band gradually passes from the red end to the blue, in moving from zero to zero, over a semicircle. Of course it becomes comparatively easy to construct a table of wave lengths, in millionths of a millimeter, corresponding to each one-tenth division between the bands. The zero point is determined by causing the upper Nicol to rotate until the centre of the second dark band from the red end of the spectrum exactly coincides with the sodium line, or solar line D.

In the same journal, Dr. Woodward, U.S.A., has an article upon the markings of *Frustulia saxonica*, illustrated by copies from photographs, and correcting some misstatements and misapprehensions in a previous communication by Mr. Hickie. It will be read with interest by all those engaged in testing objectives by means of the *diatomaceæ*. As to the resolubility of this diatom as furnished by Möller, it is so much easier than *Amphipleura* as really to fall within the limits of Spencer's one-sixth student objective, with which we have seen it very well.

Professor Wyville Thompson, in a letter to Mr. Huxley, extracts from which will be found in *Nature*, August 19, states that the best efforts of the staff of the *Challenger* have failed to discover *Bathybius* in a fresh condition; and Professor Huxley states that it is seriously suspected that the thing to which he gave this name is little more than sulphate of lime precipitated in a flocculent state from the sea-water by the strong alcohol. It is much more likely that what Professor Huxley observed was the gelatinous secretion of *diatomaceæ*, which is produced in immense abundance in the ocean depths, and which behaves, under chemical reagents, very much like the so-called *Bathybius*.

In *Zoological Science* the month's record shows the usual progress. Several papers on subjects in descriptive zoology have appeared, among them Theodore Lyman's second paper on the sand-stars, etc. (*Ophiuridæ* and *Astrophytidæ*), collected by the late Professor Agassiz on the *Hassler* expedition, also including those dredged by the late Dr. Stimpson. The memoir is illustrated by three excellent plates drawn on stone.

A singular animal has been discovered, at the depth of fifty fathoms, by Mr. Tycho Tullberg among the islands and fiords of the western coast of Sweden. After giving a lengthy review of its external appearance and anatomy, the author hesitates at present to offer any opinion as to the systematic position of the animal, though he ventures the remark that the type of mollusca and that of vermes seem both to claim *Neomenia* as a distant relation, the latter, perhaps, with more right than the former. *Neomenia*, however, presents considerable deviations from both, in the absence of a radula, in the structure of the alimentary canal and of the nervous system, as also in other respects, as the form of the body and the spines on the skin. Excellent plates accompany the article, which is written in the English language.

The reproductive organs of the decapod *crustacea* have been studied afresh by M. Brocchi, who concludes that neither the position nor the form of the genital orifices can furnish characters for classifying the macrourous forms (lobsters and shrimps), while in the crabs they, with the external organs, are of value for distinguishing families and species. Reference is made to works on this subject by the American naturalists Stimpson and Ordway.

A small collection of spiders made in Labrador by Dr. A. S. Packard, Jun., has been described by Dr. Thorell, of Upsala. They were collected on the northern shores of Labrador. About fifteen species were collected, of which only ten were well enough preserved to be identified and described. One *Lycoza* is common in Southern and Western Greenland, two species are found in Europe, while a larger number are indigenous than one would have supposed, though almost nothing is known of the spider fauna of boreal and arctic America, Greenland excepted.

The canker-worm and moths have been distinguished by Mr. Riley as not only embracing two species, but two separate genera, from differences founded on the egg, larva, chrysalis, and the moth itself, the moths being thought to differ generically. For the spring canker-worm moth the generic name *Paleacrita* is proposed, the other being *Anisopteryx pometaria*.

The same number of the Transactions of the St. Louis Academy of Sciences contains notes on the natural history of the grape *Phylloxera* by the same author. He concludes that it is no use to endeavor to destroy the eggs or nidus for the eggs.

It appears by a note quoted in the *American Naturalist* for January that in certain Australian moths, different species of *Ophideres*, the end of the tongue is stiff and barbed, so that the insect is capable of perforating the skin of oranges. This tongue is, as usual, capable of being rolled up between the palpi, but the tip ends in two triangular points, furnished each with two barbs. They then swell out, and present on the lower surface three parts of the thread of a screw, while their sides on the upper surface are covered with short spines springing from a depression with sharp hard sides. These spines tear open the cells and pulp of the oranges, as a rasp opens those of beet-root to extract the sugar. This is an entirely novel feature in the *Lepidoptera*, and, says M. Künckel, reminds one of the mouth parts of the *Hemiptera* and *Diptera*, which have maxillæ adapted to pierce tissues.

The fishes still engage the attention of the Dutch ichthyologist Bleeker, who published a beautifully illustrated revision of the species of East Indian synanceoids.

A check list of the North American batrachians and reptiles has been lately prepared by Professor Cope, and published as the first Bulletin of the United States National Museum, under the direction of the Smithsonian Institution. It is divided into three parts, the third containing an essay on the geographical distribution of these animals.

An important paper by Professor Weismann on the transformation of the Mexican axolopl into an *Amblystoma* appears in Siebold and Kölliker's *Zeitschrift*.

The *American Naturalist* contains a lively account of the habits of the common *Anolis* of Florida, by Rev. Dr. S. Lockwood, while M. Bert has prepared a memoir on the mechanism and the causes of change of color in the chameleon. After speaking of the contractile corpuscles of different colors which exist in the skin of the chameleon, after showing the influence exerted on the color of the animal by cutting the mixed nerves, the spinal marrow, the removal of one or both cerebral hemispheres and of the eyes, the author concludes, first, that the different colors and hues that the chameleon assumes are due to a change of place of the colored corpuscles; second, the movements of these color corpuscles are controlled by two kinds of nerves; third, the light rays belonging to the blue-violet region of the solar spectrum act directly on the contractile matter of the corpuscles; fourth, each cerebral hemisphere regulates, through the reflex centres, the nerves of coloration of the two sides of the body. An abstract of the memoir, presented to the French Academy, is in the *Revue Scientifique*.

The *American Naturalist* contains several ornithological notes of interest, among them an article on the proper specific name of the song-sparrow, by Mr. David Scott; on the availability of certain names for birds used by Bartram, by Mr. J. A. Allen; with a note by the same author on the extinction of the great auk in Newfoundland, and notes by Drs. Coues and Cooper, with a notice of the occurrence of the European tree-sparrow in this country, by Dr. Merritt.

The second Bulletin of the United States National Museum contains an interesting report on the birds of Kerguelen Island, by Dr. Kidder, naturalist to the transit of Venus expedition to that island. It appears that there are no land birds or mammals, strictly speaking, indigenous to the island, and but a single shore bird (*Chionis minor*). The report refers to the albatross, gulls, and penguins. The species are determined by Dr. E. Coues, who adds synonymical and other notes.

A fossil sirenian animal allied to, but smaller than, the manatee has been discovered in Jamaica, and described by Professor Owen, from a skull and atlas bone, under the name of *Prorastomus sirenoides*.

In a paper on the origin of the deep-water fauna of the Lake of Geneva, M. Forel thinks the entire fauna of the Swiss lakes is descended from forms which have migrated up the rivers since the melting of the glaciers, and have afterward been differentiated.

Agriculture.—Seyfart gives in the *Landwirthschaftlichen Versuchs-Stationen* an account of the

newly opened guano deposits in Southern Peru. The total deposits are estimated by the government engineers at upward of seven and a half million cubic meters, or about seven million tons. Of thirty-three samples analyzed, fourteen are quite rich in soluble matter, containing, on the average, 9.52 per cent. of soluble phosphoric acid, 15.31 per cent. total phosphoric acid, and 10.82 per cent. ammonia; thirteen are more insoluble, averaging 3.51 per cent. soluble and 19.37 per cent. total phosphoric acid, and 2.96 per cent. ammonia; five of the remaining samples were guano-like earths of comparatively little commercial value; and the other a fresh guano.

The existence of unexhausted stores of guano of such great extent and so superior quality must be most important for the agriculture of both the United States and Europe. There is, however, one drawback in the form of reports of parties other than the Peruvian engineers, which represent the estimates of the latter as considerably above the actual truth.

It is well known that immense numbers of cattle are slaughtered annually for the preparation of Liebig's meat extract at Fray-Bentos, in Uruguay. Of late, the portions of the carcass from which the meat extract has been taken have been utilized, the bone being made into bone-meal and the flesh into a flesh-meal. Both of these are valuable fertilizers, the former being especially rich in phosphoric acid and the latter in nitrogen. The flesh-meal has been used also as food for sheep with moderate, and for swine with considerable, success. A mixture of these two materials has been lately offered as a fertilizer in the German market, under the name of Fray-Bentos guano. It is a very fine, dry, yellowish powder, with a glue-like odor, and contains, as the average of several analyses, 20.3 per cent. of phosphoric acid and 4.6 per cent. of nitrogen. It is sold at nine and three-quarter marks per centner, or not far from $42 50, gold, per ton. It is, at this rate, a cheap and excellent fertilizer.

The composition of sewage matter collected by the system of Liernur at the barracks at Prague has been lately investigated by Wilk. This system, invented by Captain Liernur—who, by-the-way, is a native of Holland, and figured for a time as an officer in the Confederate service in our late war—has been introduced in several European cities. It consists in collecting the solid and liquid excrements, by aid of atmospheric exhaustion and pressure, in large cisterns, whence they are removed from time to time and used for manure. The whole matter deposited, both solid and liquid, is thus saved, and forms a fertilizer rich in both nitrogen and phosphoric acid, the more so because the urine, which contains a relatively large proportion of these ingredients, and is ordinarily lost, is here preserved. The use of this system will, however, notwithstanding this great advantage, not be likely to extend to England and the United States, since it excludes the use of water, which is essential to Anglo-Saxon ideas of cleanliness.

What with the plans of a liberal government and the work of agricultural experiment stations in Italy, there seems to be hope that the Roman Campagna may be reclaimed, and made not only healthy, but very productive. Sestini, director of the station at Rome, and Marro report analyses of a number of fodder plants from the Campagna. Eight specimens of meadow hay were analyzed, and found to be remarkably rich in albuminoids, the most valuable ingredients of food, the percentages in six ranging from 10.9 to 17.9, while in the other two, which contained 7.1 and 8.6 per cent., the decrease was probably due to bad harvesting. The percentage of phosphoric acid in the ash was high, and that of potash particularly so. This was probably due to the fact that the soil of the Campagna is formed almost exclusively from volcanic rocks, which are rich in these ingredients.

That the soil of the Campagna is also suited to the growth of sugar-beets is shown by experiments of Sestini, Marro, and Del Torre, in which the roots were found to contain at the beginning of August sufficient sugar for profitable extraction.

The influence of size on the composition of mangels has been studied at the laboratory of Messrs. Lawes and Gilbert, at Rothamsted, England. Eighteen roots were examined, and the total weights and proportions of dry matter and ash of each determined. The weights varied from 1.5 to 13.5 pounds. The proportion of dry matter varied from 7.6 to 16.4 per cent., and the ash in the fresh roots from 0.69 to 1.61 per cent. These variations were closely connected with the size of the roots, which, as a rule, become more watery and more saline as they increase in bulk. The largest mangels had but little feeding value. The best ones were those weighing from three to four and a half pounds.

As usual, the subject of *Pisciculture* and the *Fisheries* continues to occupy a large share of the public attention, in view of the popularity of the measures taken looking toward the increase in the supply of fresh-water fishes and the proper utilization of the products of the waters generally.

Of the various State Commissions, those of Virginia, California, and Maine have lately published their reports of satisfactory work.

The varied enterprises in which the United States has been engaged during the autumn have been successfully prosecuted, the United States hatching establishment on the Sacramento River, under the charge of Mr. Livingston Stone, having obtained nine millions of eggs, in bulk amounting to eighty bushels. Some two millions of the young were hatched out and placed in the Sacramento for the purpose of keeping up its supply, and the remainder of the eggs were sent East, for the most part to the State Commissioners of Fisheries. The introduction of the young fish into suitable waters was prosecuted mainly during the months of December and January, and nearly all the waters of the United States east of the Missouri River have received their share. A very large number were planted in the head waters of the Ohio, the Mississippi, and other streams in the central portion of the United States, as well as in the waters tributary to the Great Lakes, and those of the East, from Maine to Georgia. It is not too much to hope that in a few years most satisfactory results from the experiment will be experienced. Mr. Atkins has also continued his work in collecting and developing the eggs of the Eastern salmon at Bucksport, Maine, and has secured between three and four millions. These, as being taken later in the year, and of slower development, will be distributed in March or April. In addition to his labors with the sea salmon, Mr. Atkins has also secured a large number of eggs

of the landlocked salmon from the Grand Lake Stream, in Eastern Maine, some nine hundred thousand eggs in all having been placed in the hatching boxes. In the course of its labors during the summer of 1875, having reference to the shad, about twelve millions of young were hatched out and distributed in various waters by the United States Fish Commission.

A very important enterprise of the same general character is that which is now in progress under the direction of the Fish Commissioners of Michigan, Ohio, and Canada. The Michigan Commissioners are now hatching about seven millions of white-fish eggs, those of Canada having almost as many. The Ohio Commissioners were unable to complete their establishments in time for extensive operations this season, but they have at their four hatching stations a considerable number of the eggs of the white-fish, partly furnished to them by the Commissioners of Michigan.

An important movement has been made on the Hudson River by Seth Green, under the direction of the Fish Commissioners of New York, in the multiplication of sturgeon. The economical value of this fish is only beginning to be appreciated in this country, although in Europe it has long ranked among those of most importance. But already a large business in the manufacture of isinglass and caviar, as well as in supplying this fish for consumption, both fresh and smoked, has been prosecuted for some time. The Hudson River formerly abounded in sturgeon, which have become scarce, and the object of Mr. Green's work has been to increase the number. An incidental benefit resulting from the multiplying of these fish, it is expected, will be the destruction by them of the stake nets which at present do so much to prevent the natural increase of shad in that river, the nets being too weak to resist so powerful a fish as the sturgeon.

The prominence of the turbot and sole among the more expensive fishes of Europe has suggested the idea of introducing them into American waters; and at the request of Mr. J. S. Kidder, of Boston, the United States Fish Commissioner is now engaged in making preparations for transferring a sufficient number of young fish from the British coast to that of Massachusetts to make a satisfactory experiment, the expenses to be borne by Mr. Kidder.

In *Engineering*, we may record the completion, by the Pennsylvania Railroad Company, of a substantial timber structure in the place of the old bridge across the Schuylkill at Market Street, Philadelphia, the destruction of which by fire we recorded in our last. The bridge is a Howe truss, well constructed of white pine, with a flooring of oak. Its length is 540 feet, the two end spans being each 162 feet and the centre span 216 feet in length; height of truss, 25 feet in the clear; width of bridge, 48 feet, including sidewalk 10 feet wide. The celerity of the company in erecting this structure has been most favorably commented upon, the work of construction having been done in three hours less than twenty-one days from the signing of the contract.

Lieutenant-Colonel Kurtz, the government engineer in charge of the river and harbor works of the Delaware River and its tributaries and Delaware Bay, reports the improvements in immediate contemplation to be the lengthening of the Lewes pier head twenty-one feet, the completion of the new ice pier at Newcastle, the removal of 23,000 cubic yards of mud and gravel and of seventy-five feet of rock from the channel at Wilmington, the finishing of the work at Marcus Hook, the repairing of the ice piers at Chester, the deepening of the channel of the Schuylkill at its mouth, the widening of the channel at Fort Mifflin bar to 1500 feet, the lowering of the Bulkhead Shoals to twenty-one feet, and the widening and deepening of the channel of Cohansey Creek.

The project of constructing a direct line of railroad between Boston (*via* the Hoosac Tunnel) and the coal-fields of Pennsylvania, to which a brief allusion has already appeared in our monthly Record, has just received a fresh impulse from a meeting of influential citizens interested therein, which was lately held in New York. The plan favored at this meeting was to connect North Adams with Albany by a direct road through the tunnel, and then, by the construction of short connecting lines, inviting railroads already in existence to form a direct line from the coal-fields of Pennsylvania, by way of Carbondale, Hancock, Marketville, Mooreville, Middleburg, Albany, North Adams, Greenfield, Fitchburg, etc., to Boston.

The *Railroad Gazette* records up to December 25 the construction of 1264 miles of new railroad in the United States in 1875, against 1808 reported for the same period in 1874, 3606 in 1873, and 7065 in 1872.

From abroad, we have intelligence that the Italian authorities have under favorable consideration a plan for the improvement of the Tiber, which will be in all probability carried out, with the effect of reducing the danger of future inundations. The plan in question, proposed by a commission of engineers, contemplates shifting the bed of the river, removing the bridges which impede its flow, and straightening its course below the city of Rome. The cost of these improvements is estimated at $2,000,000. This scheme makes the fifth that has been proposed for the purpose.

M. De Lesseps, of Suez Canal fame, has lately made a very favorable presentation of the Channel Tunnel project before the French Academy of Sciences, in which the results of the recent survey are reviewed. These results are, concisely stated, as follows: The sinkings at both extremities of the proposed cutting brought to light a dense stratum of chalk at a convenient depth, and the formation was carefully traced from the French to within a short distance of the English shore, when further operations were discontinued, owing to the severity of the weather. This work was to be finished at the beginning of the present year, and if, as was confidently expected, no insuperable difficulty presented itself, the horizontal boring will be commenced. M. De Lesseps affirmed that the commercial was the only unsolved problem in connection with the project, and of its satisfactory solution he expresses his entire confidence. He estimates that the number of passengers who may be expected to travel annually between Paris and London will reach at least a million, which number, at only eight shillings per fare, would yield a yearly revenue of £400,000 from passenger traffic alone.

At the time of this writing, the Machinery Hall and the Horticultural Building of the International Exhibition at Philadelphia are announced as finished and ready for the reception of exhib-

its. The main building will be ready in a few days more.

The industrial exhibitions at Santiago, Chili, and at Melbourne, Australia, are both in progress, and, report says, most successfully. Many of their exhibits will find their way to Philadelphia.

The *Société Industrielle de Mulhouse* will celebrate the fiftieth anniversary of its existence, next May, by holding an exhibition of the industrial resources of Alsace.

The German government has decided upon opening an exhibition of arts and manufactures at Berlin in 1878. This exhibition will be strictly national in character.

The Inman Company has decided to establish a regular line of steam-ships between Philadelphia and Liverpool. The steam-ship *City of Limerick* arrived at the first-named port a few days ago.

The *Engineering and Mining Journal* gives the following approximate figures of the production of anthracite coal for the year 1875, as compared with 1874, to wit:

Region.	1874.	1875. (Approx.)
Wyoming (tons of 2240 pounds)..	10,204,764	11,550,000
Lehigh " " ..	4,712,280	3,475,000
Schuylkill " " ..	6,715,074	6,400,000
Sullivan " " ..	36,268	16,000
Total.....	21,668,386	21,441,000

It is yet too early to give a reliable review of the coal trade of the United States for the year 1875, but our contemporary affirms the indications to be "that the aggregate production of coal has increased, notwithstanding the continuance of an unparalleled depression in every branch of business during the entire year."

The Western Union and Atlantic and Pacific telegraph companies are introducing the system of pneumatic tubes from their offices in Broadway, New York, to their branch offices, which are expected to be ready for working at an early date.

A disastrous explosion of fire-damp, attended with loss of life, has just occurred in one of the numerous coal mines in the neighborhood of Wilkesbarre.

We glean from foreign exchanges that steam street engines of improved patterns have lately been experimented upon in Brussels and Paris, with promising results.

A locomotive operated by compressed air has lately been invented, which is described as being applicable where steam or gases under pressure are employed to produce motive power.

The recently published report of the Light-house Board shows that extensive and careful experiments have been made with regard to the merits of the mineral oils of the United States for the purpose of light-house illumination, as likewise elaborate experiments with regard to sound as applied to the system of warning signals for mariners in foggy weather. The report affirms that even at this stage of the experiments the results obtained have been gratifying, and by pursuing these inquiries the Board hopes to arrive at conclusions not only valuable to science, but of inestimable practical value to the mariner.

At the meeting of the French Academy, held December 6, M. Wurtz submitted a specimen of the newly discovered metal, gallium, in the metallic form. It is described as a beautiful metal, possessing a lustre intermediate between platinum and silver. It was obtained by electrolysis of the aqueous solution of its ammoniacal sulphate, the precipitate being submitted to the burnisher. The new substance appears to stand between zinc and aluminum. It is so closely allied to the former that its separation is effected with extreme difficulty, and its analogy to the latter is indicated by the fact that the sulphate of gallium unites with alkaline sulphates to form an alum which crystallizes in cubes.

Deaths.—Numerous deaths among scientific men have been reported since our last necrological summary, the details of which have been published in *Harper's Weekly*. Among these we may mention, for the United States, Professor Samuel D. Tillman, Dr. L. Bradley, and Captain James Long, the discoverer of Wrangell's Land; for Great Britain, Sir Charles Wheatstone, Mr. C. B. Vignoles, R. C. Carrington, T. E. Edwards, and Commander Goodenough, R.N.; for France, Professor G. P. Deshayes; and for Germany, Dr. O. Peschel, Dr. Karl T. Andree, Dr. Carl Scheerer, and Professor Reslhuber.

Editor's Historical Record.

POLITICAL.

OUR Record is closed on the 28th of January. —Congress re-assembled, after the holiday recess, January 5. In the House, the bill for universal amnesty introduced by Mr. Randall was the subject of an exciting debate. Mr. Blaine offered a substitute excepting Mr. Jefferson Davis. The bill was finally rejected, January 10, failing to receive a two-thirds vote.

The Pension Bill, appropriating $29,533,500, was passed by the House, January 14.—The Centennial Bill, appropriating $1,500,000, was passed by the House (146 to 130), January 25. An amendment to the bill provides that the money appropriated shall be repaid into the United States Treasury before any dividends are made to stockholders.

Several financial bills have been introduced in the House. One of these, brought forward by Mr. Morrison, of Illinois, provides that the Secretary of the Treasury shall retain, for the redemption of United States notes, the coin received from all sources in excess of the requirements of the public debt, until it shall amount to thirty per cent. of the United States notes; and that until that time the act for the resumption of specie payments shall be suspended. The bill also provides for the accumulation in the national banks of coin equal to thirty per cent. of their circulation for the redemption of their notes.—All measures looking to the absolute repeal of the act of 1875 for the resumption of specie payments January 1, 1879, have failed.

On January 26 the House repealed the law passed during the last hours of the last session increasing the postage on third-class mail matter.

Eulogies on the late President Johnson were

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

IN *Astronomy* we have to record the detection during January of two new asteroids—158, discovered by Knorre, and 159, discovered by Henry, of Paris. The first was found during a search for Siwa (140), and is of the 11th-12th magnitude, the second is of the 12.5 magnitude.

One of the most important astronomical events of the month has been the publication of the first part of a work in three volumes which is to be a summary of all the important astronomical writings of Bessel. The first part contains a portrait of Bessel, copied from Mandel's noble engraving, and two lithograph plates of the appearances of Halley's comet, as well as twenty-three memoirs on the theory of the motions of the bodies of the solar system, and fifty-one on different points of spherical astronomy. The editor is Dr. R. Engelmann, late of the Leipsic Observatory. It is to be hoped that this may lead some competent person to undertake a similar compilation of the works of Sir William Herschel, which is so much needed.

Dr. Vogel, lately of the private observatory of Councilor Von Bülow, at Bothkamp, claims to have seen and observed the fainter satellites of Uranus in 1871 with the fine Schröder equatorial (twelve inches aperture) belonging to the observatory. These have so far only been certainly observed with instruments of the largest class. It will be remembered that in 1873 Struve announced the discovery of a minute companion to the bright star Procyon, the existence of this companion having been suspected from observed irregularities in the proper motion of Procyon. This was again seen and measured by Struve in 1874, but we believe he has failed to find it during 1875. This companion has not been seen with the 26-inch telescope of the United States Naval Observatory by any of the observers, in spite of assiduous search, but we learn that three small companions have lately been seen and measured, none of which correspond to the companion announced by Struve. This is of importance as affecting the question of the practicability of accurately predicting the motions of an unknown satellite from variations in the proper motion of a large star, the proper motion itself depending upon the ordinary meridian observations. It may be mentioned in this connection that the companion of Sirius is even now not in its theoretical place, probably owing to the comparative rudeness of the observations on which the determination of the proper motion of Sirius depends, especially those of N. P. D.

The report of the Board of Visitors to the Melbourne Observatory for 1875 records the evidences of activity. A new photo-heliograph and two new equatorials (of eight and four and one-half inches aperture) have been added to the equipment, already good. The great four-foot reflector has been used for the purpose of delineating nebulæ, and ten already figured by Sir John Herschel in 1834 have been redrawn. The only drawings of this kind published as yet are two of the nebula 30 (B) Doradûs, drawn in 1870, at an interval of less than one year, by M. Le Sueur and Mr. M'George, and these show marked changes, to establish which further observations will be indispensable. The great nebula near Eta Argûs has not changed in the course of the year. The meridian circle was employed on the usual objects of observation. The previous work of this instrument was embodied in a catalogue of 1227 stars, which was printed in time to be distributed to the various transit of Venus parties in the southern hemisphere, to whom it was of great service. Magnetic and meteorological observations are carried on, and much extra work has been done, in connection with the late transit of Venus. American astronomers connected with the transit of Venus expeditions bear witness to the courtesy with which their plans were aided by the officers of this and other southern observatories.

The third volume of the Bothkamp observations has just been published by Dr. Löhse, and we learn that the issue of a fourth is contemplated. The present volume of this important series is principally devoted to observations upon the sun. Part I. deals with investigations upon the physical condition of the sun's surface, Part II. with the photographic registration of solar spots, and Part III. with an important series of meteorological observations. It is to be regretted that, owing to the promotion of both Drs. Vogel and Löhse to other important duties in connection with the new "Astrophysikalischen Institut," now building at Potsdam, this fine observatory, which was the first of its kind in Germany, is for the present unoccupied with scientific work.

The Austro-Hungarian government has authorized the building of a national observatory on a grand scale, which will probably be completed in 1877. It will be equipped in the most complete manner with meridian instruments, a 12-inch equatorial by Alvan Clark and Sons, and a 26-inch equatorial by Grubb, of Dublin, besides portable instruments. The great activity in the direction of physico-astronomical observations may also be judged of by the news which reaches us of the completion of the new observatory of the University of Oxford, which will be devoted to celestial physics. This observatory possesses a 12¼-inch achromatic by Grubb, Mr. De la Rue's reflecting telescope, and smaller instruments, meridional and extra-meridional.

In connection with the news of the founding of so many observatories may be mentioned the important scheme which has just been proposed by Tacchini, of Palermo, and adopted by the Italian government. By its provisions the astronomical work to be done is divided among the various observatories of Italy, according to their means, so that no waste of effort may occur, and the governmental grants of money are also so divided as to produce the best results. According to it, the observatories of Naples, Florence, Palermo, and Milan are declared to be institutions of the first class, to the maintenance of which the principal care of the government will be given; those of Parma, Modena, and Bologna are to be physico-meteorological observatories, belonging to their respective universities; and those of Rome, Campidoglio, Turin, and Padua are to be university observatories (astronomical). The increasing demands of science require, or will soon require, similar organization on the part of the observatories of every country.

The reduction of the observations made by the American transit of Venus parties is progressing steadily, Professors Watson, Peters, Hall, and Harkness (chiefs of parties) having undertaken to reduce their own observations, the others being reduced under the direction of Professor Newcomb.

In *Meteorology*, there have been during January several interesting papers. Mr. Ericsson communicates to *Nature* some account of his experiments on a generous scale toward the elucidation of the subject of the amount of heat transmitted to the earth by the sun. As nearly all this heat is consumed in producing meteorological results, it is evident that meteorologists can not be insensible to the importance of his conclusion that the heat radiated from an incandescent plane is not of equal energy in all directions, but is proportionate to the sine of the angle of inclination to the plane.

The Meteorological Commission appointed by the Italian government has made an elaborate investigation and report, recommending certain governmental instructions which will secure almost perfect uniformity in the Italian observations and publications relating to meteorology.

The Imperial Meteorological Observatory at Tokio, Japan, under the direction of Mr. M'Vean, government surveyor, has begun its activity by the publication of five-day means and reports.

The peculiarities of the upper strata of air are being systematically investigated in France, not only by balloon voyages, but by permanent mountain stations, of which three are now occupied—Mont Louis, by Falguere; Pic du Midi, by Nansouty; and the Puy de Dôme, by Alluard.

Mr. S. A. King, of Boston, proposes by means of a captive balloon to also contribute much to the study of the atmosphere.

Lemstrom has developed, in the Geneva *Archives*, his views on the nature and origin of the aurora. His theory regards this as mainly a terrestrial phenomenon, due to electric discharges through the upper regions of thin air (similar to the discharges through a Geissler tube), and also between this air and the earth; according to him, the upper stratum of air forms a great conductor, which is nearer the earth in the polar than in the equatorial regions.

From the detailed study, by Hildebrandsson, of the tornado of August 18, 1875, in Sweden, it is evident that this closely resembled in its details and its surroundings those that so frequently occur in the United States.

The rapid spread of intelligent interest in meteorology is shown by the fact that the Paris papers have followed the lead of those of London, and daily publish reduced copies of the morning weather maps.

Professor Reynolds has made a further communication to the Royal Society on the refraction of sound by the atmosphere, fully confirming the positions previously advanced by himself and by Professor Henry. Interesting relations seem to exist between these phenomena and the state of the atmosphere before or during storms, etc.

With the second part of the 164th volume of the Transactions of the Royal Society of London, we receive the complete memoir of Mr. Blanford on the winds of Northern India. This elaborate work is one of the finest examples of inductive reasoning that have graced the recent progress of meteorology. Mr. Blanford has based his studies principally upon the observations made under his direction in Bengal, under Dr. Thomson in the northwestern provinces, under Dr. Townshend in the central provinces, and by Mr. Elliott of Roorkee. His object has been to describe and to trace out the origin and causes of the normal wind currents of Northern India and their annual variations, in so far as these can be discovered in the local physical changes in the atmosphere. For this kind of inquiry India offers many peculiar advantages. Among other results, Blanford partially confirms for India some of the laws deduced by Hann for Carinthia, *e. g.*, that the decrease of temperature with altitude is greater with north and northeast than with south and southwest winds; it is greater in storms; it is greater in the higher than in the lower strata during calm clear weather. The cause of these variations is the variable quantity of moisture diffused through and ascending in the atmosphere, there being at the Himalayan stations a certain inverse ratio between the relative humidity and the decrease of temperature. Mr. Blanford discusses the rain-fall in its connection with the winds, as also the temperature and barometric pressure. His tables and charts, showing for each month the distribution of these elements in India, are by far the most perfect that we have. The upper currents over areas of high pressure are shown by him to move inward, as is now known to be the case in Europe and America, and in general there is in India a system of upper currents opposed to every observed system of lower winds. Mr. Blanford's work has a direct bearing on the subject of the cyclones of the Bay of Bengal, and the conclusion he deduces as to their origin is apparently that which accords best with all that we know of similar storms elsewhere. Cyclones are rare in the Bay of Bengal, except from the middle of May to June, and in October and November. "They form in a region of calms or variable winds; an area of barometric depression and rising temperature is formed several days before the cyclone is generated; currents of air set in converging toward this area; finally, if among these currents there rushes in a strong southwest or west-southwest current of air saturated with moisture," this furnishes the required abundance of vapor, whose rapid condensation gives out the heat required to form and maintain a cyclone, instead of the small tornadoes that would otherwise be the only result.

Mr. Roscoe urges upon meteorologists the importance of maintaining a record of the intensity of the chemical action of sky light, and describes a convenient self-recording apparatus that he has himself used during the past three years.

The important report of the English Royal Science Committee will, it is said, probably result in soon terminating the anomalous and embarrassing position that the London Meteorological Office has long occupied in reference to the government. Dr. Hooker hopes to secure the extension of the English net-work of telegraphic reporting stations, so as to include all the principal cities of the globe.

The Iowa State system of weather reports, under Professor Hinrichs, continues to increase in popularity and efficiency.

In *Physics*, Romilly has published the second part of his memoir on the effect of a jet of air

or vapor in drawing the surrounding air into its course. He has observed that, using a receiver with thin walls, if the jet be removed only a few millimeters from it, and directed not into the opening of this receiver, but just outside of it, and upon the wall itself, a maximum of pressure is produced more than double of that obtained when the jet enters the orifice. Using a jet provided, like the receiver, with lateral walls, there is no longer a pressure, but an aspiration produced, even at considerable distances.

Meunier has observed a quartzose sandstone from the vicinity of Orsay, Department of Seine-et-Oise, France, perforated through and through by the roots of trees. The grains of quartz are held together by a calcareous cement, which is the material upon which the carbonic gas exhaled by the roots has exerted its solvent action. These roots were those of the elm, and were of all sizes, from a centimeter and more to less than a millimeter in diameter. The author thinks that possibly in this way roots may insinuate themselves into rocks far anterior in age, and thus be regarded as much older than they really are in fact.

Duclaux has observed and investigated the curious fact that a homogeneous liquid mixture may, by a change of temperature or by certain additions, become separated into two layers. For instance, a mixture of 15 cubic centimeters of amyl alcohol, 20 cubic centimeters of ordinary alcohol, and 32.9 cubic centimeters of water is homogeneous above 20°; but the least lowering of temperature below this, even by one-tenth of a degree, causes the division of the liquid into two nearly equal layers. The author proposes to use this fact in the construction of an exceedingly delicate minimum thermometer. Convenient volumes of amyl and ethyl alcohols are mixed together, brought to the required temperature, and water gradually added, drop by drop, till a slight turbidity results. The liquid is then sealed in a tube, being first colored with carmine. Whenever the temperature falls below that at which it was prepared, the two layers appear, and of different tints. If methyl alcohol and ether be thus used, a maximum thermometer may thus be made.

Berthelot has given a system of classification of acids and bases founded on the decomposition of their salts by water, as shown by the thermal changes which result. In the first class are placed strong acids and bases. These, when separately dissolved in water and mixed in equal equivalents, produce an amount of heat which is nearly constant for all, and which is not increased by a new addition of water or of the base. Such salts then are not decomposed by water. The second class includes feeble acids. These form salts, even with strong bases, which are decomposable by water, the decomposition progressively increasing with the amount of water added. With some of the bodies of this class, however, the progress of the decomposition is gradual either up to a certain limit or indefinitely, while with others it is effected totally upon the first addition of the water. In the first class are placed chlorides, nitrates, and neutral sulphates of the fixed alkalies; in the second, the borates, carbonates, cyanides, sulphides, alkali-phenates, acetates, butyrates, valerianates, as well as the alcoholates. The author thinks these results are due to the formation of hydrates of the acid and the base by the water added. In the first class the heat set free by the formation of the hydrates is less, in the second greater, than is evolved by the union of the acids and bases themselves.

Champion and Pellet have called attention to the resemblances which exist between the mode of decomposition of explosive bodies and the phenomena of supersaturation. They mention many respects, for example, in which a supersaturated solution of sodium sulphate resembles, in its instability and the means by which it solidifies, the explosive dynamite.

Soret and Sarazin have made a series of measurements to ascertain the rotatory power of quartz upon ultra-violet light, in which they used very successfully the new fluorescent eye-piece for the spectroscope recently devised by Soret. They succeeded in measuring the rotation of rays as far as the line N, and found that it increased from 51.22 at H to 55.88 at L, 59.03 at M, and 64.41 at N. The theoretical values calculated from Boltzmann's formula agreed well with these. Subsequently Croullebois has stated that he had made similar measurements, extending as far as the line O.

H. Vogel has made an examination of the absorption spectra of several salts of the iron group of metals, and has drawn the characteristic absorption curves which belong to them, with a view to utilize the spectro-analytic method in qualitative analysis. By this means he has detected permanganate in a layer one and a half centimeters thick of a solution which contained only 1-250,000th part.

Neeson has experimented at length on the so-called mechanical power of light as manifested in the apparatus of Crookes, and comes to the conclusion that the motions observed are due to heat currents produced in the residual air.

Gaugain, in a paper on the processes of magnetization, has stated that when two magnets have their contrary poles placed in contact with a bar near one of its ends, their action to develop magnetism temporarily at the middle point of the bar is very unequal, while the permanent magnetism thus produced is stronger at this middle point when but a single magnet is used. He gives theoretical considerations in explanation of these phenomena.

Warren de la Rue and Muller have described the method of construction of their new intensity battery, consisting of 3240 cells. This battery is composed of plates of chloride of silver and of zinc, excited by a solution of sodium or ammonium chloride—a form devised by De la Rue in 1868. The electro-motive force of this combination is to that of the Daniell cell as 1.03 to 1; the mean resistance of the entire battery is for each cell 38.5 ohms. It evolves from acidulated water (1 volume sulphuric acid and 8 of water), in a voltameter having a resistance of 11 ohms, 214 cubic centimeters of mixed gases per minute. The length of the spark in air, given by one series of 1080 cells, was 0.098 millimeter; with two such series, 0.629 millimeter; and with three, 1.623 millimeters; being directly as the square of the number of the elements used. In a subsequent paper the luminous effects produced by this spark in vacuum tubes are described, the striking distance being six decimeters.

Becquerel has published an important paper on the determination of the chemical force exerted by two solutions upon each other by means of

the electro-motive force developed. The method is suggestive, especially in its physiological relations, since the strength and direction of the electro-motive forces in living beings are the foundations upon which rest not only all the phenomena of nutrition, but also those of life itself.

Duchemin has proposed the use of nickel for the protection of the needles of marine compasses against rust, and he gives the results of some experiments in this direction, made with his circular compass, which were entirely satisfactory. The deposit of nickel does not seem to affect appreciably the magnetization.

Bleekrode has investigated somewhat exhaustively the question of the use of ebonite plates in electric induction machines in place of glass ones. He maintains that even in ordinary machines they are far preferable, but that in double machines, such as the one devised by him, they are the only kind to be used. Moreover, they have important theoretical advantages in addition.

Edlund has observed a fact of great importance to his theory of electricity, *i. e.*, the fact that the resistance of a conductor varies with the motion of this conductor, being lessened when the conductor and the current move in the same direction, and increased when the directions of the motion are opposite. In Edlund's theory, in which electricity is only the flow of ether through bodies, the strength of the current is measured by the mass of the ether which flows through the cross-section of the conductor in a unit of time.

Fuchs has proposed to use the electrometer as an instrument for measuring current strength, polarization, and resistance. In his experiments he employed a gold-leaf electrometer in communication with a dry pile. By combining this with the compensation method of Poggendorff, the results were satisfactory.

Kerr has been led from theoretical considerations to the discovery of a new relation between electricity and light. He has proved that dielectrified media are doubly refractive during the charge. The media employed were glass, resin, and quartz. The results prove that dielectrified resin acts as if extended along the lines of force, while dielectrified glass and quartz act upon the transmitted light as if they were compressed along the lines of force.

In *General Chemistry*, Precht and Kraut have published the results of experiments made to test the statement of Debray's that the tension of aqueous vapor which is given by a salt containing crystal-water in a vacuum is dependent solely upon the temperature, and hence that this tension may be made use of to ascertain whether all the molecules of this water of crystallization are held with equal force. Their conclusion is that while in individual cases this may be done, it can only be considered reliable when all the collateral circumstances are taken into the account.

Meusel has proposed to account for the occurrence of nitrites in spring waters, not as is usually the case by supposing the oxidation of ammonia therein, but by supposing the reduction of the nitrates in the water through the agency of bacteria. He shows (1) that spring waters which contained bacteria and nitrates, but no ammonia or nitrites, showed the nitrous acid reaction on standing four days; (2) that the production of nitrites in this way is stopped by antiseptics; (3) that aqueduct water containing nitrates produces no nitrites, even in presence of bacteria, unless a carbohydrate be present; (4) that distilled water containing both glucose and nitrates can not be made to generate nitrites if bacteria be absent; and (5) that decomposing albuminates reduce nitrates to nitrites.

Houzeau has given a new method for the volumetric determination of free carbonic acid, which consists in absorbing the gas in a titered solution of sodium hydrate, precipitating the carbonate in an insoluble form by a neutral solution of barium chloride, and then titering back with a graduated solution of sulphuric acid. To prevent the formation of sodium bicarbonate a small quantity of zinc oxide is dissolved in the soda solution before use.

Sainte-Claire Deville and Debray have published some data concerning the density of pure platinum and pure iridium prepared with great care, and also that of several alloys of these metals. They find that the mean density of platinum, estimated from ingots weighing from 200 to 250 grams, is 21.5. Iridium in the ingot has a density of 22.239; after breaking under the rolls, of 22.421. An alloy of 10 per cent. iridium has a density of 21.615; of 15, 21.618; of 33.33, 21.874; of 95, 22.384.

Scheurer-Kestner has communicated additional facts upon the corrosion of platinum stills which are used for the concentration of sulphuric acid. He finds (1) that the loss is not mechanical but chemical, the metal being contained in the acid in solution; (2) that when the acid is free from nitrous compounds, it dissolves about one gram of platinum for every ton of sulphuric acid concentrated to 93–94 per cent., but six to seven grams per ton when the concentration is pushed to 98° and above, rising even to nine grams when the acid marks 99½ per cent.; (3) that the loss is even more considerable if nitrous products are present in the acid.

Mermet has proposed a very delicate test for the so-called sulphocarbonates, now coming into extended use among grape-culturists as remedies for the phylloxera. If to an extremely dilute solution of a salt of nickel in ammonia a few drops of the solution to be tested be added, a characteristic currant-red color is developed. This test is extremely delicate, showing $\frac{1}{80000}$ or even $\frac{1}{800000}$ of sulphocarbonate in a solution. Braun had proposed some time before the sulphocarbonate as a very delicate test for the presence of nickel.

Remsen and Southworth have made the curious observation that carbon monoxide is not oxidized by ozone. The two were passed into a flask, and then through lime-water; but not a trace of turbidity was perceptible in the latter, even when the entire apparatus was placed in full sunlight. The authors discuss the bearing of this fact upon the question of free attractions in carbon monoxide.

In *Organic Chemistry*, Fittig's hypothesis that cumol was isopropylbenzol has been established by Jacobsen, who has succeeded in effecting its synthesis by acting with sodium on isopropyl iodide, resting upon which was an equivalent quantity of brombenzol dissolved in six times its volume of ether. The action proceeded slowly, and after four days was interrupted. On fractionating, a hydrocarbon boiling near 150° was obtained, which had all the properties of cumol.

Michaelis has succeeded in introducing arsenic into the achromatic series by acting upon arsenous

chloride with mercury-diphenyl. A heavy colorless strongly refracting liquid was obtained, which was phenyl-arsenous chloride.

Commaille has given a means of separating cholesterin from the fatty matters with which it is generally accompanied, and for which they are often mistaken, by taking advantage of the property which cholesterin has of resisting the action of concentrated alkalies, even when boiling.

Graebe and Caro have made an extended investigation of rosolic acid, restricting this name to the substance obtained by the action of nitrous acid on rosaniline and subsequent treatment with water. They find that it is capable of giving a series of tetra-substitution products, and is analogous, therefore, with the phthaleins of resorcin and orcin described by Baeyer. Reduction yields both hydrorosolic acid and leucorosolic acid, and from these come tetrabromleucorosolic acid and hydrocyantetrabromrosolic acid.

Mineralogy.—Professor Shepard has recently described a mineral (*Hermannolite*) which he regards as a new species of the columbite group. It occurs at Haddam, Connecticut, and appears in nearly square prisms. In its physical characters and in general appearance it is very like columbite, but differs in having a considerably lower specific gravity. The chemical relations have been determined by Dr. Hermann, of Moscow, after whom the mineral has been named. Hermann makes the composition analogous to, though quite different from, that of columbite.

Since March, 1867, when the first diamond was found at the Cape, it is estimated that diamonds to a value of twelve million pounds sterling have been brought away from there. As stated by Professor Tennant, of London, about ten per cent. of the Cape diamonds may be classified as of the first quality, fifteen per cent. of the second, and twenty of the third. The remainder, under the name of *bort*, is employed for cutting diamonds and for the various economic purposes by the lapidary, the engineer for rock drilling, and so on. Many diamonds containing specks and cavities can be manipulated by skilled workmen acquainted with the cleavage, who are able to remove these blemishes. Some two hundred years since the work of cutting and polishing diamonds was principally done in England; since then this has been mostly carried on in Holland, but the English stone-cutters seem now likely to regain their early reputation. One stone from South Africa, described by Professor Tennant, weighed in its original condition 112 carats; it has been cut into a brilliant weighing sixty-six carats, and this, it is stated, exceeds in size and brilliancy any diamond in the British crown. It is valued at ten thousand pounds sterling.

Herold has investigated the kaolin formations of the triassic sandstone in Thuringia. He finds that the kaolin is never pure, being generally mechanically mixed with more or less quartz. To two varieties of microscopic crystals mixed with the kaolin he has given the names of microdermiculite and microschörlite. They both occur in six-sided prisms. The kaolin he regards as having arisen from the decomposition of mica, not feldspar, as is often the case.

Microscopy.—In a recent number of the *New York Medical Journal* is a report of the Boston Society of Medical Science, in which it is stated that Dr. Webber had found that *granular corpuscles* from preparations of the spinal chord, hardened in chromic acid or bichromate of potassa, and preserved in glycerine, react peculiarly to polarized light. Neither cholesterine nor any other tissues or substances to be found in sections of the brain and spinal chord affected the light in a similar way. Hence Dr. Webber thinks that this characteristic may serve to distinguish the granular corpuscles in doubtful cases.

Some time ago we alluded to the discovery (?) of diatoms in coal by Count Castracane. In the December number of the *Monthly Microscopical Journal* he gives his method of procuring them; and as his treatment is with caustic potassa in part, it is difficult to conceive how the diatoms can escape solution. We consider the discovery (?) as a very doubtful one.

Those plants which possess the peculiar power of absorbing and digesting nitrogenous substances presented to their leaves have from time to time engaged the attention of vegetable physiologists. They are principally insectivorous plants, belonging to the genera *Drosera*, *Pinguicula*, *Dionæa*, and *Utricularia*. In all these, minute glands exist imbedded in the surface of the leaf, reddish-purple in *Dionæa*, and giving a red tinge to the leaf. They are smaller than stomates. In the *Monthly Microscopical Journal* for January, 1876, Mr. Alfred W. Bennett describes and figures these curious "absorptive glands" as observed in *Drosera rotundifolia*, *Pinguicula vulgaris*, and *Callitriche verna*. The latter has not been considered hitherto one of the "carnivorous" plants, but as these glands have never been observed, with this exception, in plants which do not possess this power, it will be an interesting question for future research whether *Callitriche* is not also carnivorous.

In the same journal, reprinted from the *Gardener's Chronicle*, October 16 and 23, is an exceedingly interesting and well-illustrated paper, by Worthington G. Smith, F.L.S., on reproduction in the mushroom tribe, from studies of *Coprinus radiatus*—a plant so minute that the whole may be placed under the cover of the microscope. Moreover, it is exceedingly common, and its entire vital functions are performed in a few days. When the cells of the old parent fungus collapse and disappear in the water, their place is, in less than two hours, occupied by innumerable quantities of bacteria, vibriones, and monads. Where these infusoria come from, or how they so speedily come into being, is difficult to say. The author finds when a single specimen of *C. radiatus* has been placed on a slide with a drop of water, under a covering glass, and this again under a propagating glass, that as the millions of fungous cells quickly disappear, so millions of infusoria just as quickly come into being; and he says, "It seems almost reasonable to believe that the fungous cells themselves become suddenly transformed, and re-appear as simple infusoria." Boiling did not destroy either their vitality or form, and those interested in the subject of spontaneous generation will read the result of the following experiment with interest. A dozen semi-decayed specimens of *C. radiatus*, swarming with minute infusoria, were boiled in a test tube for five minutes, and then hermetically sealed at the highest point of ebullition. At the end of a month the tube was opened and a drop of its liquid contents at once placed under the cover-

glass of the microscope for examination. Spores, cells, monads, bacteria, and vibriones were all there, but the latter motionless and apparently dead. In fifteen minutes, however, they showed signs of life, and began to slightly move about; in thirty minutes the movements were decided in nearly every specimen seen, while in sixty minutes the infusoria darted about with almost the same energy as they did before they were boiled. As there are about 22,500,000 cells in one of these minute plants, requiring fourteen days for their production, it follows that the cells go on multiplying all the fortnight at the rate of 1114 to the minute. In about five hours 3,000,000 of spores are produced. They as a consequence appear upon the basidia or spore-bearing spicules at the rate of 100,000 every minute!

Ethnology.—Mr. William H. Dall read before the Washington Philosophical Society, on Saturday, January 29, a long and able paper on "A Succession of Shell Heaps in Alaska." The principal part of the communication was devoted to an explanation of the three distinct layers traceable in all the beds, viz., the echinus layer, the fish-bone layer, and the mammalian layer, representing three separate and progressive steps in culture.

Professor Hayden has had a model made in miniature, about two feet square, of one of the most remarkable and best-preserved cliff-houses in Mancos Cañon, and several casts have been taken, which give an admirable idea of these curious ruins.

The German excavators at Olympia have discovered the statue of Victory, the work of Paionius, a contemporary of Phidias. It was dedicated, according to the inscription, by Messenian refugees settled at Naupactus.

Professor Rolleston contributes to the Journal of the Anthropological Institute a long and exhaustive article on the people of the long barrow period. We have not space even to present a summary of this admirable paper, but recommend it to those who are interested in the history of the burial of the dead.

The Rev. Wentworth Webster, in the October number of the *Revue de Linguistique*, discusses the comparative mythology of the Basques, with a view to clearing up the obscurity which hangs around the history of the so-called Iberian race.

Those interested in the question of the origin and development of the art idea among savages will find in *Das Ausland* for November and December a very instructive series of articles upon the artistic skill of the Africans. Sampson Low and Co. have just published a work by Dr. Georg Schweinfurth bearing upon the same subject, entitled *Artes Africanæ*.

Captain Burton, in his recently published work, *Two Trips to Gorilla Land and the Cataracts of the Congo*, devotes considerable space to a description of the natives, including the Fans and other tribes.

Mr. J. Walhouse read a paper before the London Anthropological Institute, on the 14th of December, on the belief in Bhutas—devil and ghost—worship in Western India, showing how the lower castes, while acknowledging the Brahminical gods, pay most of their homage to the Bhutas or evil spirits, to whom they attribute all the mischief in the world. At the same meeting Mr. Groome Napier read a paper on the localities whence the tin and gold of the ancients were derived.

The usual progress in *Zoology* has been exhibited during the past month. A text-book of comparative embryology, under the title, *Life-Histories of Animals, including Man*, by Dr. A. S. Packard, Jun., has just appeared, giving the elements of a subject usually more or less neglected in manuals of zoology. Dr. Sclater's admirable address "On the present State of our Knowledge of Geographical Zoology" has been received. It was originally delivered at the last meeting of the British Association for the Advancement of Science, but, as now printed, contains an appendix of much value, giving a full bibliography of the subject of the distribution over the globe of the vertebrate animals.

In special groups of animals, beginning with the lowest, we have fresh information regarding the foraminifera, or lower shelled rhizopods. One of these animals, the *Globigerina*, has at length been seen by the *Challenger* party with its "pseudopodia" or thread-like extensions of the body spreading out in the water. Professor Wyville Thompson states that if a specimen be immediately transferred from the tow-net to some fresh sea-water, and be examined with a high power, the "sarcodic contents of the chambers may be seen to exude gradually through the pores of the shell, and spread out until they form a gelatinous fringe or border round the shell, filling up the spaces among the roots of the spines and rising up a little way along their length." It will be remembered that the dead shells of these foraminifers accumulate in such immense quantities as to form modern chalk at great ocean depths.

The shells collected by Dr. Kidder, naturalist of the transit of Venus expedition, at Kerguelen Land have been, according to the *American Naturalist*, worked up by Mr. W. H. Dall, who describes three new genera. One of these was described in England under the name *Eatonia;* but as this name was long since preoccupied by Professor Hall for a genus of brachiopods, the name *Eatoniella* is substituted. Mr. Dall also describes a genus allied to *Ceropsis* of the *Carditidæ*, giving it the name *Kidderia*, in honor of the naturalist of the expedition. A new genus of chitons is described by Dr. P. P. Carpenter under the name *Hemiarthrum*.

It appears that a species of *Campanularia*, a hydroid medusa, has been found in Greenland by the *Valorous* on its return from Disco, which is said to be identical with one found by Mr. Eaton, of the British transit of Venus expedition, at Kerguelen Land; while the deep waters of Davis Strait afford a shell which was long since found fossil in the newer tertiary beds of Sicily, and was supposed to be extinct.

A living nautilus was brought up by the *Challenger* party near the Feejee Islands from a depth of 300 fathoms. According to the late Dr. Willemoes-Suhm, it is very common in shallow water, and the natives capture it upon the reefs with baskets made up for the purpose. Like the turtle, it is a dish, but so choice that the chiefs alone are allowed to indulge in it.

Professor Riley's "Notes on the Yucca Borer" (*Megathymus yuccæ*), reprinted from the Transactions of the Academy of Science of St. Louis, is an interesting account, well illustrated, of a butterfly which bores into the root, tunneling it

for most of its length. The insect is sufficiently common in the Gulf States to sometimes be found in every third plant over extended regions, its work rendering the yucca worthless as a hedge plant.

It has been asserted by Bell, contrary to the supposition of Vaughan-Thompson, that the young of the land-crabs, like the lobster and craw-fish, have the same form when hatched as their parents. The late Dr. Suhm, of the *Challenger* expedition, however, found some eggs of a land-crab belonging to the genus *Cardiosoma* containing young ones which "were not like their mother, but zoeäs." It is probable that the larvæ, called zoëæ, leave the mother and lead a pelagic life until they have undergone all their wonderful metamorphoses.

The gigantic extinct animals of the eocene beds of Wyoming, described by Professor Marsh under the name *Dinoceras*, are shown by him, in a beautifully illustrated paper published in the *American Journal of Science*, to have nearly equaled the elephant in size, though with shorter limbs. Its head could reach the ground, and it had no proboscis. The most remarkable feature about it is the exceedingly small brain, which must have been proportionately smaller than in any other known mammal, recent or fossil, and even less than in some reptiles. "It was, in fact, the most reptilian brain in any known mammal. In *Dinoceras mirabile* the entire brain was actually so diminutive that it could apparently have been drawn through the neural canal of all the presacral vertebræ, certainly through the cervicals and lumbars."

The lemurs, supposed by Haeckel to be the point of divergence of lines leading to the insectivores and carnivores on one side, and to the rodents and monkeys on the other, are found by Messrs. Grandidier and A. Milne-Edwards to have striking peculiarities in the conformation of the allantois and placenta, removing them farther from the monkey than before, but still, we would add, perhaps not disturbing the fact that the lemurs are a comprehensive type, from animals resembling which the animals above mentioned may have been derived.

Botany.—In the *Botanische Zeitung* Dr. Askenasy gives some observations on the influence of light on the color of flowers. Contrary to what is found to happen in the case of the leaves, the flowers of plants grown in complete darkness, as a rule, are as deeply or nearly as deeply colored as those grown in sunlight. In some cases bulbs could not be made to flower unless their leaves were exposed to a certain amount of sunlight. In these cases, although the flower-stalks as soon as they made their appearance were shut off from the influence of the light, the flowers were of the normal color.

The third part of Cohn's *Beiträge zur Biologie der Pflanzen* contains a number of interesting papers. Dr. Schroeter gives the results of his experiments to prove the relation between *Æcidium ranunculacearum*, D. C., and *Uromyces dactylidis*, Otth., and between *Æcidium utricæ* and *Puccinia caricis*. Dr. Schroeter also contributes a paper on the relative value of disinfectants as shown by their action on the lower organisms. Starting with the assumption of the correctness of the germ theory of contagion, Dr. Schroeter watched the action of different disinfectants on bacteria and some of the smaller moulds, and gives the following practical conclusions. Hot water is a useful means of checking contagion, and furniture and clothing in suspected places should be frequently washed with very hot water. Steam, when it can be had, is, however, decidedly better than hot water, and by its means infected rooms may often be purified. Chlorine and chlorinated lime are of little use except when in solution. Permanganate of potash in strong solution is well adapted for temporary purposes, but not serviceable for cleansing sewers. Of all substances experimented upon by Dr. Schroeter, carbolic acid seemed to prove most efficacious for disinfecting, judging by its destructive effects on lower organisms.

Agriculture and Rural Economy.—Some very extensive investigations on the chemistry of forests have been made by Dulk at Hohenheim, in Germany. They comprise analyses of seedling trees, litter of forests, and beech and pine leaves at different periods of growth. The ash of pines, beeches, and firs, one year old, was much richer in phosphoric acid and poorer in lime than that of older trees of the same kinds. The approximate composition of beech leaves, taken from the trees at monthly intervals from May to November, showed variations similar to those of many common plants, like grass and clover, the percentage of albuminoids decreasing and that of crude fibre increasing during the successive periods of growth. The percentage of tannin increased continually, and was greatest in the November leaves. After the leaves had attained their growth, the percentage of dry substance remained nearly constant, while that of the ash increased. Phosphoric and sulphuric acid and potash decreased more or less during growth, thus explaining and confirming the general impression that matured leaves have comparatively little fertilizing value.

As compared with beech, pine leaves contain very small percentages of ash. The latter contained little silica, and a good deal of iron and manganese. The pine leaves appeared to lose mineral ingredients during the fall and winter, and to regain them in part during the following summer, the unrestored portions being probably used in the formation of new leaves. The experiments show that pines and firs make much smaller drafts of mineral food from the soil than trees with deciduous leaves.

Of interest in this connection are some observations on the litter of leaves in forests by Ebermeyer, which, though reported over a year since, have not been mentioned in these columns. In woods in Bavaria the annual deposit of leaf litter was found to be larger in rainy years and on soils with much available plant food than during dry years and on poorer soils. The size of the leaves is dependent upon temperature, and grows less with increase of elevation above sea-level. Notwithstanding this, the accumulation of humus is greater on mountains, because the oxidation is slower. As the result of seventy-six analyses of litter of forests, Ebermeyer finds that, with the same tree, the quantity of total ash and of phosphoric acid in the ash decreases with the height above sea-level. The ash of pine and beech from the low lands was five times richer in phosphoric acid than that from trees on mountains. The litter from low lands would thus be richer as manure, but its removal would, at the same time,

be more hurtful to the growth of the trees in the low land than on the mountains.

Schulze and Umlauft have studied the occurrence of asparagin in freshly germinated lupins. On exhausting the dried shoots with warm water and evaporating the extract to a thin sirup, crystals of asparagin separated. By treating the mother-liquor with alcohol, still more asparagin was obtained, so that the total amount was nearly 18 per cent. of the dried shoots. The same treated by the method of Sachsee yielded 19.6 per cent. of asparagin.

Boehm has studied the function of lime in the germination of the scarlet-runner bean (*Phaseolus multiflorus*). It was found that the seeds, if allowed to germinate in distilled water, die sooner or later, when the reserve of nourishment is exhausted. This effect is prevented by the presence of various calcium salts. No other base, however, can be substituted for lime. The author believes that the function of lime in the development of the plant is important, and similar to that which it manifests in the animal economy in the transformation of cartilage into bone; but that its action in causing the transfer of starch is obscure.

The respiration and fermentation of plants have been studied by the same author, who finds that less oxygen is used in the respiration of water plants than of land plants in air. Dead water plants absorb free hydrogen, while land plants do not. Some plants undergo butyric fermentation when boiled and placed hot in an atmosphere of hydrogen, the amount of the latter being at the same time increased.

It is a matter of common experience that sheep fatten better after shearing than when carrying a full coat of wool. To test the question whether this is due to a better digestion of food has been the object of some experiments by Weiske and his assistants at Proskau, in Germany. The sheep experimented upon were found to digest no more of their food after shearing than before. They consumed much less water, however, when shorn, and excreted some less in the excrement and urine, and very considerably less in respiration and perspiration. The appetite was also much improved, and to this the better results in the fattening of shorn sheep are probably due.

Weiske and assistants have also experimented upon the influence of salt upon the digestion of fodder by sheep. In the first of four periods, no salt; in the second, five grams (about one-sixth of an ounce) per head per day; in the third, ten grams; and in the fourth, none was given with the food, the latter consisting of hay, straw, and barley. No essential variation in the digestion of either albuminoids, crude fibre, or other carbohydrates was observed in the different periods. The authors conclude that salt is without influence upon the digestion of these ingredients in the food. On the other hand, the digestion of the mineral substances increased with the addition of the salt.

In the field of *Engineering* we may record that on January 15, 1876, up to which date reliable information has been published, the jetty works at the mouth of the Mississippi had been so far extended into the sea that a decided control of the river discharge had been attained through a distance of one and a half miles from the land's end, and within 2500 feet of the crest of the bar. The *Scientific American* affords us the statement that the works on each line of jetty are partly constructed out beyond the crest of the bar to the full distance they are intended to be built. The work is being pushed forward with the utmost vigor, over 25,000 cubic yards of willow mattress-work having been constructed and securely placed in position during the thirty days preceding the above date, the total amount thus far laid being about 125,000 cubic yards. About 20,000 cubic yards more is all that will be required to build the jetties up above mean low tide, and out to the crest of the bar. The influence of the works already constructed in deepening the channel has manifested itself very satisfactorily, so much so that our informant remarks, "It is confidently believed that a sufficient amount of material is now in place, if no more work were done, to insure a depth of twenty feet of water across the bar within three or four months." The fears of those who argued that the action of the jetties would simply be to pile up the excavated material on the outer slope of the bar are shown to be groundless, from the fact that the water at that portion of the bar is already deepening, although the jetties on the outer slope are yet very incomplete. It is estimated that in the present condition of the works the river current is deepening the channel by scouring at the rate of about 30,000 cubic yards per day, having removed, up to January 1, 1876, as nearly as could be judged, 1,500,000 cubic yards of the bar.

The opening of the New York Elevated Railroad to the Central Park on January 17 is worthy of notice. The city is now provided with a rapid-transit railroad from the Battery to the Park, a distance of five miles.

Considerable difficulty has been experienced, it is affirmed, in effecting the ventilation of the Hoosac Tunnel. It is found practically that there is never current enough to clear the tunnel from end to end. Among other things in this connection, the efficiency of the central shaft as a chimney has been called into question.

The president of the Morris and Essex and Delaware, Lackawanna, and Western railroads published the fact during the past month that the contractors of the new Bergen Tunnel had broken through the last heading, and that the tunnel had been passed through from end to end.

The Canadian and Nova Scotia papers are discussing the project of building a canal to connect the Gulf of St. Lawrence with the Bay of Fundy. The project involves the connection of Baie Verte, in the gulf, with Cumberland Basin, at the head of the Bay of Fundy, by an artificial channel across the isthmus which separates those bodies of water. An improvement of this character, it is urged, would shorten the ocean route from Montreal to New York by 500 miles.

A conditional agreement has been made, it is said, by the officers of the Poughkeepsie Bridge Company for the construction of a bridge across the Hudson River at that point. Three million dollars is named as the price of the contemplated structure.

The secretary of the American Iron and Steel Association has just published the following estimates of the production, etc., of pig-iron in the United States in 1875, concerning which the secretary affirms that the figures presented will be found to approach very closely to absolute accu-

racy. For comparison we present the authentic totals of production and stock on hand for 1874, viz.:

Ascertained production of 1874, 2,689,413 net tons; estimated production of 1875, 2,068,696 net tons; stock on hand unsold, December 31, 1874, 795,784 net tons; ditto, December 31, 1875, 686,360 net tons. Whole number of furnaces, 1874, 701; whole number of furnaces, 1875, 713. Number of furnaces in blast December 31, 1874, 365; number of furnaces in blast December 31, 1875, 345. Number of furnaces out of blast December 31, 1874, 336; number of furnaces out of blast December 31, 1875, 368.

The above figures indicate a reduced production of pig-iron in 1875 of 620,717 net tons as compared with the production of 1874, and a reduction of stocks at the close of 1875 of 109,424 net tons as compared with the stocks at the close of 1874. We may notice here incidentally that the British Iron and Steel Institute is about to add to its organization an association similar in character and purpose to the American Iron and Steel Association. This supplemental body will collect and tabulate the statistics of the iron trade, and discuss questions affecting the trade interests of the iron industries of the United Kingdom.

The *Railroad Gazette* has published the following estimate of the number of miles of new railroad constructed in the United States during the year 1875, as compared with the ascertained figures of former years. It estimates the total mileage constructed in 1875 at 1483, against 2025 constructed in 1874, 3833 in 1873, and 7340 in 1872.

The New York and Philadelphia New Line has nearly completed the laying of its tracks, and will immediately complete the necessary arrangements for its freight and passenger traffic. The length of the new line from Liberty Street, New York, to Berks Street, Philadelphia, is stated to be eighty-eight miles. The opening of the road will take place about the beginning of next April.

The practicability of establishing telegraph stations in mid-ocean is a subject which is said to be attracting the attention of several European naval powers. The practical realization of this suggestion would enable messages to be sent from any part of the ocean along the line of a cable to the terminal points on shore, and *vice versa*, so that communication with iron-clads, mail steamers, and other vessels when out at sea could be established.

The adaptability of the bamboo as a source of paper stock has recently been prominently advocated. It is urged that the bamboo can be made to furnish excellent fibre cheaply by simply using the plant when young and green. When mature, the stalks become too hard and dense in texture for this purpose. Excellent samples of paper have been made from it; and as the plant is of very rapid growth, and flourishes with little or no care in every tropical country, the suggestion to utilize it in the manner proposed is worthy of notice.

The electric light has lately been applied for lighting the mills of the Messrs. Heilmann, Ducommun, and Steinlein, in Mulhause, Alsace.

Professor E. J. Houston, in a paper on "The Phenomena of Induction," urges, with regard to the alleged discovery by Mr. Edinson of an "etheric force," that all the experiments adduced to support the assumption of a new force can be satisfactorily explained by the presence of induced electrical currents.

Editor's Historical Record.

POLITICAL.

OUR Record is closed on the 22d of February. In the House of Representatives, Mr. Morrison introduced a bill for the revision of the tariff, which was referred to the Committee on Ways and Means. The bill reduces the taxes on all articles except cigars, the duty on which is increased. The tax on tea and coffee is re-imposed.

The proposed constitutional amendment (sixteenth), providing that "no person who has held or may hereafter hold the office of President shall ever again be eligible to said office," was defeated in the House, February 2, failing of a two-thirds majority. The vote stood 144 to 106. The amendment to the amendment, extending the term to six years after 1881, and the minority substitute providing for one term of six years after 1885, were previously considered, and did not even secure a majority vote.

The Senate, February 7, passed a bill providing for the payment of the *Alabama* claims awarded by the Commission.

The House, February 8, passed a bill, 178 to 58, repealing the bankrupt law. The first section repeals the Bankruptcy Act of March 21, 1867, and all laws and parts of laws amendatory thereof and supplemental thereto. The second section provides that all suits and proceedings now pending in the United States courts wherein an adjudication in bankruptcy has been made shall be proceeded with and governed by the provisions of existing laws, which are continued in force only for the purpose of closing up suits and proceedings now pending. The act is to take effect from and after the 1st day of January, 1877.

The Centennial Appropriation Bill was passed by the Senate February 11. The President, on the 16th, signed the bill with a quill from the wing of an American eagle shot near Mount Hope, Oregon.

The House, February 11, passed the Consular and Diplomatic Appropriation Bill. The amount appropriated, $914,000, is less by $470,000 than the sum appropriated last year.—On the 15th, the House appropriated $315,000 for repairing, arming, and improving the harbor defenses of the United States. On the same day the Senate passed the Pension Appropriation Bill.

The bill reorganizing the Judiciary was passed by the House February 21.

Mr. Jenks, chairman of the Committee on Pensions, February 21, reported to the House a bill for the transfer of the Pension Bureau from the Interior to the War Department. The bill was accompanied by a statement of considerable importance. The Pension Bureau, according to this report, disburses annually $30,248,660 to about 234,000 persons. Of this sum, $1,071,778 (over four per cent.) is consumed in office expenses. The number of pension agents in the country is fifty-

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—The 160th asteroid was discovered by Professor Peters on February 24. It is of the eleventh magnitude, and was first seen February 20. This is the twenty-third asteroid discovered by Dr. Peters.

One of the most important events of the month of February has been the mounting of the large reflecting telescope, of 46.8 inches aperture and 23.3 feet focus, at Paris. The instrument is to be used in the open air, its temporary covering-house being moved away during observations. The mounting is a modification of the English equatorial form, and all the motions are said to be easy and satisfactory. The mirror (of silvered glass) is of high optical perfection. The instrument, which is to be used as a Newtonian reflector, is in the immediate charge of M. Wolf, who intends to devote himself to astronomical spectroscopy and photography and to an investigation of the satellite systems.

Zenger, of Prague, announces that he has been able to photograph the solar corona on several occasions with an uneclipsed sun. If his results are confirmed, this success is of capital importance.

Several of the binary systems have lately received attention. Schiaparelli has investigated the orbit of *Gamma* Corona Australis with results which agree closely with observation. The period is 55.582 years, the semi-major axis being 2.400″. An ephemeris is given extending to 1882, and it is desirable that attention should be paid to this interesting couple.

Another binary which has been frequently observed and investigated is 70 Ophiuchi, the different orbits of which have never satisfactorily agreed with observation. Tisserand, of Toulouse (aided by Perrotin, of the same observatory), has exhaustively studied this system, and has arrived at elements which he shows may be corrected by further observations at suitable times, which he indicates. It is possible that the double star *Beta* Leporis (discovered by Burnham, of Chicago, in December, 1874) may prove to be a binary of short period, as observations by Burnham, Dembowski, and Hall show that the position angle has changed from about 270° in December, 1874, to 280° in February, 1876. In this connection we may refer to the extensive collection of double-star measures made by Wilson and Seabroke at Rugby, and Gledhill at Halifax, published in vol. xlii. of the Memoirs of the Royal Astronomical Society.

Weiss, of the Vienna Observatory, has investigated the orbit of the comet discovered by Coggia November 10, 1873. He concludes that there is scarcely a doubt but that this comet is identical with one discovered by Pons in 1818, and in this case the determination of the period of revolution becomes of importance. There are three possible periods, viz., of 55.82, 18.61, and 6.20 years; of these, the second is the least probable; and Dr. Weiss considers that of 6.20 years to be the most probable for the present, although his computations are not yet concluded.

A study of the nebula of Lyra has been published by Holden, in which most of the previous measures are compared with those made at Washington. These comparisons seem to show that some changes in the brightness of the interior star and of the bright patches in the ring itself may have occurred. We have seen advance proofs of a fine series of drawings of nebulæ and clusters made by Vogel, of Bothkamp, which will be published in the fourth volume of the publications of that observatory. Terby, of Louvain, continues his studies on the physical aspects of Mars. Plummer, of the Durham Observatory, publishes a list of stars which he has selected from those observed both at Armagh and Greenwich, which probably have large proper motion. Christie, of Greenwich, describes a new form of solar eye-piece which he has had constructed, and which he has found to be convenient. Martin, of Paris, gives the details of his present processes for silvering glass speculæ. Harkness, of Washington, has lately described the details of an ingenious application of the spherometer for determining the inequality of the pivots of transit instruments.

Ellery, of Melbourne, describes an adaptation of the parabolic pendulum of Huyghens to the regulation of the motion of chronographs (and possibly to the motion of equatorial telescopes), which has proved successful. The posthumous papers of the late Professor Rigaud, of Oxford, have been catalogued and presented to that university. They contain many autograph letters of scientific men; among them some of Bernouilli, Boscovich, Cassini, Euler, and others. Rigaud's life of Edmund Halley, which he left unfinished, is to be completed by Professor Pritchard, of Oxford. The gold medal of the Royal Astronomical Society is to be awarded to Leverrier for his researches on the theories of Jupiter, Saturn, Uranus, and Neptune. It will be remembered that in 1868 he received the gold medal for his researches on the interior planets of the system. We note the appointment of Professor J. J. Sylvester, of London, to be Professor of Mathematics at the Johns Hopkins University, of Baltimore; and among the lectures announced for the first term are two courses—one on the History of Astronomy, by Professor S. Newcomb, United States Navy, and one on Geodesy, by Professor J. E. Hilgard, United States Coast Survey.

In the steady growth of *Meteorology* as an exact science no problems are more important than those that relate to the motions of the atmosphere, whether as a whole or in minuter detail. We therefore welcome every research into the laws of moving air, and among these some of the most interesting are those that relate to the motions of vortex rings. The remarkable mathematical investigations into this subject by Helmholtz and Sir William Thomson have been supplemented by careful experiments and observations by Professor R. S. Ball, of Dublin, who has sought to determine to what extent the motion of the vortex ring is retarded by the fact that air is not a perfect fluid. He finds that the ring is retarded as if it were acted upon by a force directly proportional to the velocity. The influence of temperature and barometric pressure is at present undetected.

The refractive and dispersive powers of numerous gases, among them the atmosphere and the aqueous vapors therein, have been carefully inves-

tigated by Lorenz, of Copenhagen. The comparison of his results with those deduced by astronomers such as Bessel, Gylden, Fuss, etc., shows a good agreement, and also the necessity of introducing a correction for moisture in the tables of astronomical refraction.

The radiometer, or instrument for measuring in units of force the strength of the radiation emitted from the sun or other body, has lately been applied by its inventor, Mr. Crookes, to the measurement of actinic effect, his previous researches having been confined to the heat and light rays. It seems probable that this simple instrument will afford a valuable substitute for the various apparatus that have hitherto been applied to the important meteorological question of the absorption of the sun's heat by the atmosphere.

At the annual meeting of the Meteorological Society of England, Mr. H. E. Eaton was elected president, to succeed Dr. Mann. The number of first-class observing stations has been considerably increased. The subject of solar radiation has been officially taken up by the society, which will undertake to carry on the work begun by Rev. F. W. Stow; but the society will adopt the comparison of the black with the bright bulb thermometers, both *in vacuo*, instead of comparing the black *in vacuo* with the maximum temperature of the air as recorded in the shade.

The applications to meteorology of mathematical and mechanical principles have of late years rapidly increased in number. Among the latest contributions of this kind we notice papers by Captain Ansart and by Lieutenant Antoine, published in the *Revue Maritime et Coloniale.*

A new form of siphon barometer has been proposed by Wild, of St. Petersburg, and introduced by him at the Russian meteorological stations. It consists essentially of two vertical tubes firmly inserted into the cover of the cistern; it is heavier and more costly than the ordinary Fortin barometer, as made by Green and others, but has some advantages as to accuracy.

An office for the study of maritime meteorology has been opened at the "Dépôt des Cartes et Plans," in Paris, and has been placed under the superintendence of M. C. Ploix.

M. Gautier communicates to the Physical Society of Geneva a second note on the meteorological observations made in Labrador by the Moravian missionaries. The observations available to him were made in the years 1867–74, and possibly surpass in value and accuracy those which we have, as he says, reason soon to hope to receive from Professor Abbe, of Washington, into whose hands fortunately there has fallen the long-lost original record of the observations made in Labrador from 1776 to 1784. M. Gautier gives a valuable list of dates of auroræ observed from 1869 to 1873.

The important tidal observations made by Dr. Bessels at Polaris Bay from November, 1871, to June, 1872, and the conclusions drawn by him as to the certain existence of an open polar sea, have been so frequently misunderstood that he has published in advance a short synopsis of the forth-coming chapter in his official report on the scientific results of the Hall expedition. The tidal waves from the Atlantic divide at Cape Farewell, whence they travel to the northeast and the northwest around Greenland, until they meet in Smith Sound.

In *Physics*, the activity of the month has not been great. Kimball has published the results of some experiments made by him to ascertain whether the co-efficient of sliding friction is constant at all velocities, as it is ordinarily stated to be, or whether it varies inversely as the velocity, as certain practical results seem to render probable. The figures given show: (1) that with a given inclination of the plane, the co-efficient of friction decreases as the velocity increases, rapidly at first, but more slowly afterward; (2) with the same velocity, the co-efficient of friction is greater the greater the inclination of the plane, within the limits of the experiments; (3) that the co-efficient of friction in each experiment tends toward a constant quantity; and (4) this constant seems to be the same in each experiment.

Wagner has made an investigation of the accuracy of the results obtained with the effusion apparatus of Schilling for determining the density of gases. Three perforated platinum plates were used, having holes of different sizes. With coal gas the density was 0.46 with the largest, 0.47 with the mean, and 0.48 with the smallest opening. Oxygen gave 1.21, 1.08, and 1.21 under these conditions, the true density being 1.10. Hydrogen gave 0.22, 0.20, and 0.23, its actual density being 0.069. Carbonic acid gave 1.51, 1.36, 1.36, instead of 1.52. For gases other than coal gas, therefore, the method is inaccurate. And even for this the variation from the actual density, as determined by the balance, was 0.03, a value of great importance so far as the illuminating power is concerned.

Crova has suggested a most excellent experiment for showing the relation of heat, electricity, and mechanical work to each other. The apparatus used is a Clamond thermo-battery, a Gramme magneto-electric machine, and a coil of platinum wire inclosed in a glass globe. 1st, if the wire coil be attached to the battery alone, the heat from the gas flame, transformed into electricity by the battery, re-appears as heat in the external circuit. 2d, if the Gramme machine be put in the circuit in place of the coil, the electricity developed by the heat is transformed into mechanical work, and the machine acts as a motor. 3d, if both coil and machine are put in circuit, heat is produced in the coil, and work in the machine. But if now the machine be stopped, the incandescence of the wire is increased; as it gradually acquires velocity again, the glow of the wire is reduced. The expenditure of heat necessary to produce a given quantity of work is thus made evident to the eye. Finally, if the machine be turned by hand in the direction of its previous rotation, the incandescence of the wire diminishes, until finally a velocity is reached at which the wire no longer glows at all. But if the rotation be in the opposite direction, the incandescence increases until the wire fuses. The additional energy introduced appears as heat.

Ettinghausen has made an ingenious use of the stroboscopic method of Mach for the purpose of studying the uniformity of motion of rotating bodies. The rotations compared were obtained with an electro-magnetic motor with Helmholtz's regulator and an accurately constructed clock-work. The former of these gave the most uniform motion.

Witz has experimented successfully with the freezing mixture suggested by Pierre and Puchot,

i. e., a mixture of hydrochloric acid and snow. He finds, for example, that 250 grams of fine snow at zero mixed at once with 250 grams of hydrochloric acid (commercial) of sp. gr. 1.1823, at $-1°$, gives in the course of one minute a solution having a temperature of $-37.5°$. If the acid be cooled previously to $-18°$, the mixture produces a cold sufficient to freeze mercury very readily.

Page has described a simple form of gas regulator, which has the especial advantage that it is not affected by variations in the barometric pressure. It consists of a mercurial thermometer, the stem of which is open at the top. The gas is admitted through a fine tube which is placed within the thermometer tube, so that the rise of the mercury within this cuts off the supply of gas when the desired temperature is exceeded. This regulator kept a beaker of water for four or five hours within a range of 0.2° C., and kept the temperature of an incubator for six weeks within 0.5° C.

Gaumet has devised a new telemeter, or distance measurer, which is small enough to be carried in the pocket, and which gives the distances it measures to within one-fiftieth of their actual value. Even this may be exceeded by using an observing telescope. It is founded on doubly reflecting the object from two mirrors placed at 45° from each other, one of which is movable. By means of a base-line, and the angle formed by the lines drawn from the distant object to the extremities of the base-line, the distance may be calculated.

Salet has investigated anew the question of spectra of different orders. He combats the view of Schuster that nitrogen ceases to give the characteristic channeled spectrum after being heated with sodium, and shows, 1st, that the spectrum in question can be obtained from nitrogen heated in contact with sodium; 2d, that the disappearance of this spectrum in the experiment is due to the disappearance of the nitrogen itself, it being absorbed by the sodium under the influence of the electric discharge; and 3d, that the spectrum described by Schuster is really due to vapors of the alkali-metal.

Tresca has given the results of some experiments with the Gramme machine, made with great care to determine the economic value of this machine for the production of light. Two machines were employed, one of about six times the power of the other. The number of candle powers obtained from the first was 12,950; the consumption of power 7.68 horse-powers, or 1686 candles to the horse-power. From the second and smaller machine the light was equal to 2114 candles; and the power consumed was equal to 2.81 horse-powers, being 752 candles to the horse-power, thus showing the greater economy of the larger machine. The cost of the illumination by the larger machine was only one-hundredth of that of the same light when obtained with oil, and only one-fiftieth of that obtained with coal gas.

In *Chemistry*, Mills has published an important paper on "The First Principles of Chemistry," in which he places in a strong light the dynamic theory of chemistry in distinction from its statical theory now generally received.

Lodge has given an interesting discussion on nodes and loops in connection with chemical formulas, showing that the number of each may be easily calculated in any given case.

Ostwald has experimented to determine the effect of mass in the chemical action of water upon other bodies. He used a solution of bismuth chloride, to which various quantities of water were added, the amount being in all cases more than enough to produce the precipitate. These precipitates were analyzed, and the ratios of the chlorine and bismuth determined. From them a curve was constructed, which is hyperbolic along two-thirds, and straight for the other third of its length. Hence the author believes Berthollet's law is true, the action being proportional to the mass, the curve being due to external influences.

To the *Monthly Microscopical Journal* for January Dr. Joseph G. Richardson, of Philadelphia, contributes an article on the microscopic test for blood stains, in which he describes his improved method of procedure where the greatest possible economy or even parsimony of material is needful, and he states that from a single particle of blood, which certainly weighed less than one fifteen-thousandth, and probably less than one twenty-five-thousandth, of a grain, he has actually obtained three kinds of evidence, to wit, that of spectrum analysis, that of the microscope, and that of chemical reaction. He also states that his method is an improvement on the ordinary and facile application of spectrum analysis to blood stains, by which this important test is rendered at least one hundred times as delicate as it has hitherto been when employed according to the directions of the highest British or Continental authorities, thus enabling us to detect a recent blood spot on white muslin covering one ten-thousandth of a square inch, and forming a speck scarcely visible to the unassisted eye.

The analyses of the air and other experiments made by Pasteur for the purpose of investigating the doctrine of spontaneous generation have demonstrated that the germs of inferior organisms, micrococci, bacteria, etc., are every where present in the air. In a hospital the air contains a great number of these elements, and, in addition, certain special bodies, such as pus globules and spores of epiphytic parasites, which emanate from diseased organisms, and owing to their volatility after desiccation, are susceptible of hovering in the atmosphere. One square meter of the wall in the surgical ward of La Pitié having been washed, after neglect of two years, the liquid expressed from the sponge (about thirty grams) was examined immediately afterward. It was black, and showed micrococcus in large amount, bacteria, epithelial cells, pus globules, red globules, and irregular blackish masses and ovoid bodies of unknown nature. More recently Dr. Esbeth, of Zurich, has, says the *Medical Record*, found, by aid of the microscope, in the sweat from the face, axilla, breast, and thigh, enormous numbers of bacteria. They appear to have originated from minute bodies found upon the hairs in the mentioned regions, forming little nodules on them, and appearing as accumulations of micrococci.

Anthropology.—The fourth number of Vol. I., Memoirs of the Peabody Academy of Science, is devoted to a report upon the Fresh-water Shell Heaps of the St. Johns River, Florida. The work was in press when its author, Professor Jeffries Wyman, died. It has been carried on by

friends, especially by Professor F. W. Putnam. After a careful relation of localities, the author gives a minute description of each mound examined, and also of the remains of man and his works. The subject of cannibalism is thoroughly discussed.

The New York *Herald* of January 27 has a long illustrated letter describing the discoveries of idols, ornaments, etc., collected for the National Museum, in Middle Tennessee, by Dr. W. M. Clarke.

The Russian government is about to publish a photolithographic edition of the famous *Codex Babylonicus*. This codex contains all the later prophets in the original, and is distinguished from the ordinary Hebrew Bible by having the accents above instead of below the various readings.

A small pamphlet entitled *The Pipes of all Peoples* is reproduced from the Birmingham *Daily Post*, December 16, 1870, giving a graphic account of the magnificent collection of Mr. William Bragge, containing over 3000 specimens from all parts of the world.

Mr. George Smith has succeeded in obtaining permission from the Turkish government to renew his excavations at Nineveh, and ere this is doubtless on his way. He hopes to continue his researches until all the remaining fragments of Assur-bani-pal's library are recovered, which will enable him to complete the interesting set of legends upon which he has been engaged.

As a contribution to *Zoological* science, the Academy of Sciences has received from M. P. Fischer a paper on the hypsometric distribution of mollusca, that is, the altitudes at which they are found. It is a striking fact, says Galignani, that plants thrive on mountains with great regularity, each at a certain height. Every species has its peculiar habitat, and if the mountain exceeds 8000 feet or 9000 feet, vegetable life gradually disappears near the summit. The terrestrial mollusca, being unprovided with means of locomotion enjoyed by birds and insects, and being, moreover, dependent upon vegetable life for food, could not, our author thought, fail to be distributed in the same way as plants, and this supposition is confirmed by observation. Each species extends to an altitude the limits of which it does not overstep. M. Fischer has verified this in the Central Pyrenees as well as in the Alps, and divided the altitudes into five zones, comprised between 1500 feet and 7500 feet. Each zone is distinguished by the name of a species of *Helix*. Thus in the Pyrenees the first zone, ending at a height of 3000 feet, is called that of *Helix carthusiana;* the second, ending at 3600 feet, *Helix aspersa;* the third, terminating at 4500 feet, *Helix limbata;* the fourth, limited at 6000 feet, *Helix nemoralis;* and the fifth, ending at 7500 feet, *Helix carascalensis*. In the Alps, at the same altitudes, the names of the zones are respectively *Helix carthusiana*, *obvoluta*, *Fontenelli*, *sylvatica*, and *glacialis*. A few individual mollusks may, indeed, climb as high as 9000 feet, but they will stop at the limit of perpetual snow. Various genera of fluviatile mollusks do not ascend higher than 3000 feet—a circumstance of some importance to geologists, since it proves that in the quaternary beds the fossiliferous strata containing those genera, such as *Neritina*, etc., were deposited at small altitudes.

A snake-eating snake is noticed in the *American Naturalist*. Mr. Gabb recently brought one of these snakes (*Oxyrrhopus*) from Costa Rica, almost five feet long, which had swallowed nearly three feet of a large harmless snake about six feet in length. The head was partially digested, while three feet projected from the mouth of the *Oxyrrhopus* in a sound condition. Professor Cope suggests that its introduction into regions infested with venomous snakes, like the island of Martinique, would be followed by beneficial results.

In *Agricultural Science*, the most interesting subject we have to record is the report of the Transactions of the Section for Agricultural Chemistry of the German Association of Natural Philosophers and Physicians, whose forty-eighth annual meeting took place at Gratz, in Styria, in September of last year.

Dr. Fittbogen reported results of observations on the amounts of carbonic acid in the air at Dahme, in Prussia. The maximum during the year from September, 1874, to August, 1875, was 4.17, the minimum 2.70, volumes of carbonic acid in 10,000 volumes of air. The mean of 347 daily observations was 3.34. On the basis of former observations by Saussure and Boussingault, the average amount of carbonic acid in the air has been assumed to be 4 to 4.15 volumes in 10,000. But the later determinations by Henneberg, at Weende, who found an average of 3.2, and of Franz Schulze, in Rostock, who made 1600 determinations, with an average of 2.92 volumes in 10,000, unite with those of Fittbogen in indicating that the figures just mentioned are too high. The very low proportion of carbonic acid in the air at Rostock, however, may be due in part to the proximity to the Baltic Sea, by whose waters some of the carbonic acid of the air was doubtless absorbed.

Dr. Kellner, of the experiment station at Proskau, reported results of experiments on the influence of shearing, and of small doses of arsenic, upon the digestion of food by sheep. As has been already noticed in these columns, shearing was found to have no effect upon digestion. The better fattening of shorn sheep is thought by Kellner to be due to improved appetite. But the feeding of twenty milligrams (about one-eighth grain) of arsenious acid (white arsenic) per head daily increased both the digestion and the accumulation of flesh in slight degree.

It is well known that a large number of experiments have been made within the last few years in the German stations on the influence of potatoes and turnips upon the digestion of hay and other coarse foods with which they are fed. It has been found that concentrated foods which contain little albuminoids and considerable carbohydrates (starch, sugar, etc.) decrease the digestion of coarse foods, and that this is quite true of turnips, and still more true of potatoes. Dr. Wolff, of Hohenheim, gave the results of 109 different feeding trials with sheep, in which these results are fully confirmed.

Dr. Wolff reported some experiments upon the much-discussed subject of the influence of the fats and oils of food upon digestion. Four full-grown wethers were fed in each of several experiments with hay, to which were added in the individual trials concentrated foods, in some cases nearly free from oils, and in others containing more or less fatty or oily substance. Bean-meal, palm-oil cake, with varying quantities of oil, were

the substances employed. Wolff concludes from these experiments that the fat in nitrogenous foods causes no alteration in the digestibility of the albuminoids, unless, as is apt to be the case when an excess of oily substance is fed, a disturbance of the digestion is thereby brought about.

In *Engineering*, we may record the fact that a contract for the construction of the much-talked-of bridge over the Hudson River at Poughkeepsie has been awarded to the American Bridge Company. From the published details of the proposed structure we glean that the main river bridge will be composed of five spans of 525 feet each, from centre to centre of piers, each span having a clear width of 500 feet at water-line. The river spans and approaches are to be built for two tracks, with sidewalks and iron hand-rails throughout, and when completed the structure will be what is termed an under-grade or deck bridge. The total length of the bridge and its approaches, as designed, will be 4500 feet. The erection of the above-described structure, it is understood, will be a preliminary step to the opening of a new line of railroad between New York and Chicago, which, it is affirmed, will be but 921 miles in length, or fifty-nine miles shorter than the shortest existing route.

The accounts from the jetty works in course of construction at the mouth of the Mississippi continue to be most favorable. The results of the works so far constructed are beginning to appear on the bar itself, where some thirteen feet of water was reported some weeks ago; and the daily papers of a few days ago contained the statement that a schooner of thirteen feet draught had successfully made the passage over the bar.

The statistics of ship-building in the United States during the past year indicate somewhat of a falling off in this important industry as compared with previous years. The diminution, however, is principally confined to a class of vessels which do not figure very prominently in the ship-building industry proper, such as canal-boats and barges. The cause of the decrease in this special branch of the trade is to be ascribed mainly to the fact that the railroads are gradually absorbing the carrying business from the canals. The following figures may prove of interest as indicative of the work of the last year compared with that of the two preceding years:

Year.	Ships and Barks.	Brigs.	Schooners.	Sloops, Canal-Boats, and Barges.	Steamers.	Total.
1873	28	9	611	1221	402	2271
1874	71	22	655	995	404	2147
1875	114	22	502	340	340	1318

Our commercial marine at the close of 1875 comprised, according to the best sources of information at our disposal, a total of 32,285 vessels, representing a tonnage of 4,853,732, showing an increase of 53,080 tons over the total of 1874, of some 157,700 tons over 1873, and of 415,995 tons as compared with 1872.

The submarine cable between Sydney, Australia, and Wellington, New Zealand, has just been successfully laid, and is now open for business traffic. Every colony of Great Britain, it is affirmed, is now in telegraphic connection with the mother country.

The following is a summary of the prominent facts relating to the iron industry of the United States, as set forth in the Centennial edition of a work entitled *The Iron-Works of the United States*, just published by the authority of the American Iron and Steel Association:

Whole number of completed blast furnaces, January 1, 1876	713
Annual capacity of same, in net tons	5,439,230
Whole number of rolling-mills, January 1, 1876	332
Total annual capacity of same, in finished iron, net tons	4,189,760
Annual capacity of all-rail mills, in heavy rails, net tons	1,940,300
Number of Bessemer works (twenty-four converters), January 1, 1876	11
Annual capacity, net tons	500,000
Number of open-hearth steel-works, January 1, 1876	16
Annual capacity of same, in net tons	45,000
Number of crucible and other steel-works, January 1, 1876	59
Annual capacity of merchantable steel, net tons	108,250
Number of Catalan forges making blooms direct from ore, January 1, 1876	39
Annual capacity in blooms and billets, net tons	59,450
Number of bloomeries making blooms from pig-iron, January 1, 1876	59
Annual capacity in blooms, net tons	60,200

In *Technology*, we may record the fact that a new variety of bronze, containing manganese, is now being introduced by an English manufacturing firm. It is affirmed to be very valuable for all kinds of small work where gun-metal is now used, and to be capable of being forged like iron.

Dr. Vogel, of Berlin, gives an account of a curious novelty devised by a Paris physician, which may ultimately result in an altogether new and useful application of photography. It consists of a flame burning at an opening made in the head of a drum of some very elastic membrane. Any noise, as by speaking, singing, etc., sets the membrane in vibration, which vibration is communicated to the flame. If now a rotating mirror is placed behind the flame, and revolved at the proper rate of speed, a succession of intricate figures is thrown upon the wall or a screen, which figures vary according to the sounds emitted. It has been suggested that by employing a flame of high chemical intensity, the figures produced by it in the mirror might be photographically reproduced upon a properly prepared sensitive surface passed before the mirror at the proper rate of speed. Carrying the idea a little further—that is to say, should it be possible to interpret the images thus continuously produced—we will then be able to take down speeches, addresses, etc., photographically, instead of reporting them stenographically, as is now the custom.

MM. Trève and Durassier have made some interesting researches on the internal magnetism of magnets, and find that the magnetism, far from being confined to the surface, penetrates to the very centre of steel. Their experiments involved the solvent action of acids on bars of steel magnetized to saturation, and they conclude that either the magnetism, at first superficial, penetrates successively into the mass in proportion as the outer layers are dissolved away, or that the magnetism penetrates into the entire mass of a piece of homogeneous steel.

Dr. Barnard has addressed a memorial to Congress advocating the preparation of coins of metrical weight and uniform fineness ($\frac{9}{10}$), and the securing of legislation and treaty stipulations, whereby such coins shall become legal tender according to their weight.