

Dr. Schaff's supervision, it would have been greatly improved.—For devotional use three excellent little volumes are, *The Parting Words of Adolphe Monod* (E. P. Dutton and Co.), a series of twenty-five brief discourses delivered by the dying pastor from his sick-bed to a few friends; *Fireside Homilies* (A. D. F. Randolph and Co.), by the late Dean ALFORD, papers originally contributed to the *Sunday Magazine*, and especially worthy to be commended for Sabbath evening family reading; and *Covenant Prayers* (Martin Taylor), by Bishop A. C. COXE, a convenient and useful manual for the promotion of family devotion.

B. L. FARJEON's last novel, *Love's Victory* (Harper and Brothers), is possibly a trifle less genial than his previous stories; at least there are in it some touches of a cynical satire that reminds us more of Thackeray than of Dickens. The characterization is no less vigorous and original. Richard Barton, the returned Australian, and Mr. Armstrong, the eccentric American, are both notably original characters; Mr. Fangle, though quite subordinate, is scarcely less striking; and the confession of Mr. Chappell under mesmeric influence is a device bold enough for Wilkie Collins, and well executed.—*Ralph Wilton's Weir* (Henry Holt and Co.), by Mrs. ALEXANDER, is a very pleasant love-story, quite of the old-fashioned type. The plot is not remarkably new, and certainly is not of a kind to pique the curiosity or try the acuteness of the reader, who will at once recognize in Ella Rivers the granddaughter of the irate Lord St. George, and be quite sure from the beginning that Colonel Wilton will get both his wife and his fortune, as he does at last. Those who read novels for dash

and excitement, and those who read them for profound metaphysics in guise of a drama, will do well to pass by *Ralph Wilton's Weir*; those who like to spend an hour or two in pleasant converse with pleasant people, living, on the whole, pleasant lives, with just enough uncertainty to give them zest, will find it a charming story.—*Mr. Vaughan's Heir* (Harper and Brothers) is the most intricate and elaborate of Mr. FRANK LEE BENEDECT's novels: we do not think it is his best. There is more evidence of a study of the models of fiction, and less of a study of the models of real life. It turns on the mining and plots of about as consummate a villain as we have met for some time in fiction, Darrell Vaughan. Its best feature is the noble fidelity of his unhappy wife. She is finely conceived, finely drawn, and her character is thoroughly well maintained throughout the story. Perhaps it needed the dark background to make luminous her single figure. The intricate plot, too, though too intricate to be natural, or according to the highest art, which produces its greatest effects by simple instruments, gives occasion for striking incidents, which are powerfully described. From the court scene at Moysterville, in the second chapter, to the final exposure of Darrell Vaughan, in the last chapter but one, we recall no instance in which the author has failed in depicting the dramatic and sometimes melodramatic scenes, which the course of his story not unnaturally involves. *Mr. Vaughan's Heir* is less pleasing than *My Daughter Elinor*, less simple in structure than *Miss Van Kortland*, less original in plot than *John Worthington's Name*, but we are not sure but that the average novel-reader will declare it to be the most interesting of the author's novels.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

OUR review for the month of March includes no notice of newly discovered asteroids or comets, but numerous cases are at hand of remarkable shooting-stars, several of which have become the subject of inquiry and investigation. Among the astronomical studies that have come to hand during the month, first in order, and the finest work of its kind as yet published, is the catalogue of five hundred nebulae accurately observed by Schultz, of Upsala, who has hereby prepared the way for labors that will be undertaken one hundred years hence to determine the proper motions of these mysterious bodies. Ellery is engaged at Melbourne in a systematic review of the nebulae observed by Sir John Herschel at the Cape of Good Hope. Among the double stars we notice several determinations of the orbits of well-known pairs by Flammarion; but the most active observer in this department is Mr. Burnham, of Chicago, who has, we see, lately become a member of the Royal Astronomical Society. The publication of the observations of Coggia's comet still continues, and among the latest we note that Secchi found its spectrum to agree best with that of the oxides of carbon, while the examination of its spectrum with the polariscope showed that the continuous spectrum was only the reflected light of the sun. Vogel, in a general re-

view of questions relating to cometary spectra, concludes that there is considerable probability of the truthfulness of the hypothesis that the gases present in comets are hydrocarbons. His own and Huggins's measurements agree in showing that the motion of the comet has no influence upon this conclusion. In relation to the orbits of the comets, we notice the determination by Doberck of the path of the first comet of 1845. A series of observations of Jupiter's satellites is contributed by Mr. Todd, at Amherst, Massachusetts, and an improvement in the method of computing the orbit of a planet by Professor Ormond Stone. Mr. Stockwell, of Cleveland, contributes to the mathematical theory of the moon's motion an elaborate development of the formula proper for the computation of lunar tables, and claims to have discovered and corrected important errors in all previous works on this important subject.

In relation to the sun, we remark the defense by Secchi of Father Rosa's views as to the variable diameter of that luminary, whose dimensions vary in a period of two-thirds of a century. As the first-fruits of a laborious spectroscopic examination of the long and short spectrum lines, Lockyer announces the probable existence in the solar reversing layer of strontium, cadmium, lead, copper, cerium, uranium, and potassium.

In regard to astronomical observatories, we

note that Professor Gonzalez, director of the National Observatory at Bogota, has resigned his position in order to establish a new and private observatory at an altitude of 9000 feet in latitude $4\frac{1}{2}^{\circ}$ north. The new university observatory at Oxford is being brought into activity under the directorship of Rev. C. Pritchard, Savilian Professor of Astronomy. Mr. C. L. Doolittle has been called to the chair of astronomy at Lehigh University, where an observatory is to be established. The directorship of the new observatory at Cincinnati, which has been vacant since 1871, has recently been filled by the election of Mr. Ormond Stone, formerly of the Washington Observatory. The new building is located at Mount Lookout, a suburb of the city. The revocation by Mr. James Lick, of San Francisco, of his great deed of trust is, we are happy to say, accompanied by the assurance that he will not fail to carry out the execution of the magnificent observatory designed by him.

On the 5th of March, at the age of ninety, died the editor of the *Annuaire of the Bureau of Longitudes*, at Paris, the venerable Mathieu. On the 26th of February, at Cincinnati, at the age of fifty-nine, there died Mr. Henry Twitchell, who for twenty years was the only assistant and the principal observer at the observatory of that city. Strictly speaking, he was the contriver of the first chronograph ever constructed, the rude predecessor of one of the most important instruments in modern astronomy. Mr. Twitchell made observations of zones of the very faintest stars for many years with the aid of the declinometer applied to the twelve-inch equatorial of that observatory, but the mass of star-places thus determined still awaits publication.

An important paper by Mallet on the origin and mechanism of production of basaltic columns shows that the curved ends and sometimes axes of these prisms are due to the influence of unequal heating during the process of cooling. Cailletet gives some accurate measurements, showing that iron absorbs 240 times its volume of hydrogen before being saturated, and Johnson shows that the hydrogen is absorbed with perfect ease if the metal is immersed in dilute sulphuric acid, and put in contact with pieces of zinc or other metal. By such a galvanic arrangement the hydrogen is absorbed in the nascent state, and the metal becomes brittle and loses about three-quarters of its strength. The behavior of metals under repeated strains has been investigated by Spangenberg, and the laws of adhesion by Stefan. This latter is one of the most complete and valuable memoirs existing on the subject of molecular dynamics. The phenomena in question appear to be all resolved by Stefan's analysis; and even the side issues, such as the internal friction of molecules of water and air, are deduced with perfect accuracy.

In *Terrestrial Physics* we have to chronicle the appearance of another of Perrey's great earthquake catalogues, the present volume being especially devoted to the year 1871, but embracing occasional additions to his former catalogues since 1845.

In *Meteorology* there seems to have been a special activity of late, doubtless owing to the steady progress made in utilizing our knowledge of that subject. The German government having purchased Von Freeden's interest in his private es-

tablishment known as the Hamburg Seewarte, has made it a national institution under the same name, and given it an enlarged scope and powers. Its authority and duties now extend to the whole German coast, and include the display of storm-warning signals. In France the system of storm signals for the protection of the coast has entered upon a new organization dating from the 1st of March, since which time there have been two instead of one daily prediction.

The meteorological service of Bengal, under Mr. Blandford, has steadily increased its activity, and is now reported as publishing daily weather maps in addition to the bulletins. Reports are received by it from 145 rain-gauges in addition to six first-class and ten second-class stations.

M. Tarry has presented to the French Meteorological Association the first volume for 1874 of his review of the dynamic meteorology of the globe. He gives the details of storms for the year as based on the reports of the United States Army Signal-office and of 170 stations in Europe and Asia. Finally, a meteorological congress is announced to be held in Paris, probably in August, with special reference to French interests.

Among the numerous new or improved meteorological instruments, the meteorograph, designed to register in a compact form and simultaneously many or all of the features of the weather, seems to have attracted especial attention. Various arrangements, all very excellent though expensive, have been published by Baumhauer, Rysselbergh, and Secchi. Redier has devised a very successful self-recording mercurial barometer; and Hirn describes a megabarometer which shows the slightest changes and pressures. Tremeschini describes a self-recording metallic thermometer; and Mr. A. P. Smith sends to *Nature* an account of observations made by him upon a crude hygrometer consisting of a sheet of filter-paper soaked in a strong solution of cobalt chloride.

In reference to the quantity of hyperoxide of hydrogen which is in the atmosphere, Schöne gives some measurements showing its presence, though in very minute quantities; and Dr. Eecke has published a very extensive investigation into the relative quantities of oxygen in the air in the different climates and at different seasons. He finds an increase of as much as ten per cent. in the winter over the summer seasons. His investigation has special reference to the sanitary advantages of certain localities, and shows that Samara, a famous sanitarium in Russia, is distinguished by the abundance of oxygen.

In reference to the relation between barometric gradient and the accompanying winds a series of papers has appeared, of which the most important is that of Haun, in which he introduces to the notice of German meteorologists the views that have for some years been familiar to Americans, and originated by Professor Ferrel, of the Coast Survey. Haun gives an almost unqualified assent to Mr. Ferrel's conclusions, and finds them confirmed by the studies of Colding in Copenhagen. Professor Mohn also subscribes to Mr. Ferrel's formulæ, and, indeed, states that he had recently and independently arrived at the same conclusion from the study of European storms.

Captain W. W. Kiddle calls attention to the fact that ocean waves are much higher in a northwest than a south or southwest gale. Du-

roof has made three balloon ascents in France during very cold weather and northerly winds, and uniformly finds warmer southerly currents above, sometimes carrying much snow. Among the notable storms of the month of March the twin tornadoes that occurred in Georgia on the 20th are worthy of note; great destruction of life and property was reported in a narrow belt extending across the entire State.

In reference to the predictions of frosts, Ley states that the study of upper currents of clouds has shown him that at least in England frosts are preceded by a slight backing of the upper southwest and northwest currents. In connection with frosts, Vinard states that he finds that the best protection of vineyards against frost is secured by clouds of smoke evolved by burning large piles of a mixture of gas tar with sawdust and old straw. The mixture remains inflammable even after two weeks' exposure to the weather. The general laws of variation of temperature at Milan have been elucidated by Celoria by the study of observations recorded for the past 110 years. Silberman has observed the temperature of a small mass of a black powder exposed to the sun's rays, and explains by his observations the somewhat anomalous cases in which the northern sides of mountain chains are more fertile than the southern exposures. Auroral phenomena have been treated of by Tromholdt, who concludes that there is a connection between auroras and halos; but the most valuable contributions to this subject are found in the preliminary report, by Weyprecht, of the results of the Austro-Hungarian north pole expedition of 1872 to 1874. According to him, very intense auroras were invariably followed by storms, and, from hundreds of observations, he concludes that the aurora is an atmospheric phenomenon. By comparing the changes and motions of the aurora with the movements of the light Lamont magnetic needles, it was found that great magnetic disturbances agree with quick convulsive motions of the rays of the aurora and with intense prismatic colors. Quite regular auroral arches, without motion or radiation, exercised no influence on the needles. Almost invariably the declination needle moved eastward, the horizontal intensity decreased, and the inclination increased.

Guthrie, from observations made on the cold produced by mixing salt and ice, concludes that the temperature is independent of the quantities of the materials, and is as precise as the melting-point of ice.

Mineralogy.—Des Cloizeaux has recently contributed a very important paper to mineralogy on the optical properties of the members of the feldspar family. There has always been so much confusion among the different feldspars, and it has been so difficult to distinguish one species from another, that it is a great advance to have found a method, independent of chemical analysis, by which this can be done, even if it be not a method of easy application. Des Cloizeaux has found that the several triclinic feldspars, similar as they are to each other in cleavage and crystalline form, have very distinct optical properties, so that if we can obtain sections cut in the proper direction, we can instantly tell which species is under hand. His observations, moreover, go to show that the four species, *Anorthite*, *Labradorite*, *Oligoclase*, and *Albite*, are really inde-

pendent, and that the second and third are in no sense mixtures of the other two—a theory which has found much favor of late years.

Notwithstanding the comparative maturity of mineralogy as a science, the making of new species continues as fast as ever. *Guanovulite* is a new sulphate of potash and ammonia which has been found as a crystalline deposit in the interior of the eggs of birds in guano from Peru. It is related to the guanipite of Professor C. U. Shepard, who, it will be remembered, described a number of new guano minerals a few years since.

Cossaite is a name given by an Italian mineralogist to what he regards as a new mineral. It is a hydrous silicate of alumina and soda, and is considered by the describer as a soda pinite. The analyses given, however, correspond exactly with those of paragonite, so that it may be identical with that species. It has a green color, and occurs massive, with a micaceous cleavage, at several localities in Italy.

Siegburgite is a new fossil resin found at Siegburg, near Bonn, and named from its locality. It has been described by Dr. Lasaulx, and the chief interest connected with it lies in the fact of the large amount—eighty-five per cent.—of carbon which it contains.

As a sequel to the discoveries of large quantities of tin ore in Queensland and New South Wales during the past two years, a similar discovery of importance has been made recently in Tasmania. The ore has been found at Mount Bischoff, in the northwestern portion of the island, and it is of especial interest, as it occurs there in large masses *in situ*, and that in a kind of rock lithologically distinct from that with which it is associated elsewhere in that part of the world.

Geography.—With the approach of the season when arctic voyages become practicable, the activity of preparation for polar researches increases, and it is announced that the British expedition will be ready to take advantage of the first favorable date for departure from the English shores. The *personnel* of the two vessels is already made up and under training. The scientific corps will not be entirely complete, as there appears to be no provision for a zoologist, although it is expected that some of the officers will do good service in that direction. There will, however, we understand, be a special geologist and a botanist, and the officers themselves will take charge of the various branches of physical science. The appropriations made by the government have been very liberal, the sum of £98,620 having been voted for the preparatory work, £16,000 for the coming year, and £13,000 for the year succeeding. Provision is also made for fitting out a relief ship should it become necessary, although it is hoped and believed that the present expedition will be able to give a satisfactory account of itself.

Mr. Ricketts has, it is understood, chartered a vessel in which he proposes to accompany the expedition so long as the season will permit, and at the same time allow of his return during the present year.

It seems to be quite uncertain at present whether a German expedition will start this year or postpone its voyage until the next, the question of money and of a suitable vessel appearing to be the principal obstacle.

The Swedish government is about fitting up

an arctic expedition to visit Nova Zembla and the regions to the eastward. This will be under the direction of Professor Nordenskjöld, who was in charge of the late expedition to Spitzbergen.

In connection with the same subject, we may state that Congress at its last session passed an act directing the payment to the survivors of the *Polaris* party, or their widows and minor children, an amount equal to a full year's service pay, the Esquimaux Joe and Hans to receive \$360 each for special valuable services. Captain Hall's widow is excluded from the provisions of this act, as she has recently received \$15,000 in payment for the manuscripts left by her husband.

Lieutenant Payer has announced his intention of attempting to cross Greenland from the eastern side, a feat which his experience as a traveler and an arctic explorer fits him to undertake. All attempts heretofore to cross the great Greenland glacier have been from the west side, notably by Whymper, who, however, succeeded in traversing but a few miles, when he was obliged to return.

At its last session Congress made a satisfactory appropriation for the continuation of the surveys of Professor Hayden, Lieutenant Wheeler, and Major Powell, and for carrying forward their labors of previous years in the Western Territories, and the details are now being made out for the summer's campaign. The parties will be accompanied, as heretofore, by competent naturalists and geologists, and the usual amount of excellent work will doubtless be performed.

Mr. Henry W. Elliott and Lieutenant Maynard, of the Navy, also expect to make a second visit to the North Pacific, under the direction of the Treasury Department, with a view of investigating the fur-seal fisheries and other matters connected with the material interests of the American possessions in that quarter.

The Coast Survey is now publishing an elaborate paper, by Mr. William H. Dall, upon the tides and currents in the region of the Aleutian Islands and Behring Sea, which, it is thought, will add very much to the precision of our knowledge in regard to the currents, temperatures, and general physical conditions of the North Pacific, also furnishing important data for the general consideration of these questions.

The explorations of the United States steamer *Fortune* in the Gulf of Mexico have been prosecuted uninterruptedly during the winter, and much valuable information obtained. Among other results have been numerous specimens of soundings, which, on being submitted to Professor Hamilton L. Smith, of Geneva, New York, have furnished that gentleman with a large number of new and interesting species of organic microscopic forms. The vessel, having completed her cruise, is now on its way to a Northern port.

Mr. Alexander Agassiz was engaged during the winter in an exploration of the region about Lake Titicaca in Peru. He has just returned home with a large amount of valuable material.

Quite worthy of mention in the line of American exploration is the recent canoe voyage of Mr. N. H. Bishop, of New Jersey, this gentleman having successfully rivaled the great feats of European travelers in that unique mode of conveyance. Starting in a paper boat last autumn

from Quebec, he ascended the St. Lawrence, and thence proceeded *via* the canal to Lake Champlain, and along the Hudson River to New York, and to his home at Mannahawken, New Jersey. After a short interval he again took up his voyage southward along the coast, and finally, on the 26th of March, reached the Gulf of Mexico by the route of the Suwannee River. This, however, is by no means the first of Mr. Bishop's exploits as a traveler, his first feat having been the crossing of the continent of South America from Buenos Ayres to Valparaiso on foot at the age of seventeen.

Their report has just been published by the commission of Icelanders who visited Alaska on the steamer *Portsmouth* for the purpose of investigating its fitness for immigration from Iceland. After carefully examining certain parts of the coast, especially Cook's Inlet and Kodiak, they came to the conclusion that the land offers very decided advantages for settlement both in respect to its agricultural features and its fisheries. Its climate they considered much superior to that of Iceland, and fully equal to that of Scotland, and they cordially recommend it, and invite their countrymen to avail themselves of the opportunity thus presented. Before this can be done, however, it will be necessary to have some provision made for extending the land system of the United States to that country, and to provide the proper machinery for the ample security of life and property.

Nothing of moment has been received of the movements of the *Challenger* since our last report, the transfer of Captain Nares, her commander, to the charge of the new British arctic expedition having apparently interfered somewhat with her operations.

Captain Moresby has lately called attention to a new route between Australia and China, which, passing east of the Louisiade Archipelago instead of west of it, is much more free from danger than the old course, and at the same time is three hundred miles shorter.

Nothing of importance has lately been announced in reference to the interesting subject of African exploration. Lieutenant Cameron, however, who went out in search of Dr. Livingstone, and who, after the discovery of his fate, remained in the country, has done excellent work. His survey of Lake Tanganyika has shown conclusively that the Lualaba, or Congo, flows from it, thus establishing a very important fact in the physical geography of the continent. No recent news has been received from Mr. H. M. Stanley.

The Duke of Oldenburg has lately accomplished successfully a visit to the great oasis of the Egyptian desert, having reached El Khargeh with a party embracing several men of science. The ethnological results are especially interesting in the accounts of sundry ancient monuments of extreme antiquity, as also of traces of the Roman occupation of a later date.

For the purpose of a more thorough system in prosecuting explorations in Northern Africa the Khedive of Egypt has requested Dr. Schweinfurth to organize an African Geographical Society, and has provided the means not only for prosecuting explorations, but for publishing the results. Much is anticipated from this new scientific organization.

The British Yun-nan expedition from India to China, from which so much was expected, has, it is understood, been broken up in consequence of attacks upon it by hostile Chinese, and its further prosecution has been abandoned.

The Geographical Society of Paris is now making extensive preparations for a geographical exhibition in that city during the present summer, this to include an exposition of every thing connected with geographical science in the way of apparatus, maps, books, etc., as also a congress from all parts of the world to consider geographical questions of general interest. The meeting was to have been held in March, but has been postponed to a later period, the exhibition opening on the 15th of July, the congress itself not convening until the 1st of August. An international meeting of "Americanists" is also to be held in Paris during the coming summer. This will take cognizance more particularly of matters connected with the ante-Columbian history of the New World.

A new geographical journal has been started in Paris under the title of the *Explorateur*, with special reference to the subject of French explorations in Northern Africa.

Under the head of *Microscopical Science* we notice as worthy of attention the articles now in course of publication in the *Monthly Microscopical Journal*, by Thomas Taylor, microscopist of the United States Department of Agriculture, "upon certain fungi parasitic on plants." In the March number he describes the "black knot" of cherry and plum trees, and the *Oidium tuckeri* found on the vine. The latter appears to be not a true mould, but merely a condition of *Erysiphe*, a true parasite of the vine, which will not fruit when removed from the plant on which it grows.

Hitherto no Diatomaceæ are certainly known to have been found earlier than in tertiary deposits. The few so-called diatoms found by Dr. White in the hornstone of the Devonian are exceedingly doubtful. We should scarcely expect silica imbedded in silica to be very visible. Very recently Count F. Cartracane, a well-known microscopist, states, in the *Naturforscher*, that he has proved the existence of Diatomaceæ during the coal period. A piece of Lancashire coal was pulverized and exposed to a white heat; the decarbonized dust was treated with acid and chlorate of potassa, washed clean with distilled water, and placed under the microscope. Many diatoms, almost exclusively fresh-water genera, and species now living, were found. A piece of cannel-coal from Scotland and another from the St. Étienne mines gave the same result. The experiment needs repeating to prove that these organisms from the coal epoch to the present time have undergone no perceptible modification.

Ethnology.—The second volume of Bancroft's *Native Races of the Pacific States* is announced. It is devoted to the civilized tribes of Mexico and Central America. While it would be very difficult for the author to accompany his text with a more copious reference to authorities, the subject furnishes a fruitful source of speculation and extravagant writing, toward which there is a slight tendency in the first volume.

Dr. E. Palmer draws attention in the *American Naturalist*, March, 1875, to clay balls found in the Museum of Nassau, New Providence, and

suggests their probable use in war-clubs, or as cooking stones. Similar balls have been noticed in the Swiss lake-dwellings.

Sir Henry Maine, whose admirable work on Ancient Law first gave an impulse to the deductive method in studies of this kind, follows up the former treatise with a second one, entitled "Lectures on the Early History of Institutions." The fact comes out, on examination of the recently published Brehon Laws of Ireland, that human institutions are not so much the product of race as of certain conditions and periods of growth, and that "at certain stages various nations have possessed institutions absolutely identical."

Since our last issue the following papers of general interest have been read before the London Anthropological Institute: "Ultra-Centennarian Longevity," Sir Duncan Gibb, Bart.; "Molecules and Potential Life," Rev. Dunbar I. Heath, M.A.; "Report on the Congress of Anthropology and Prehistoric Archeology at Stockholm, 1874," by H. H. Howorth.

Dr. Barnard Davis contributed to the Dutch Academy of Sciences recently an exceedingly valuable paper relative to the Tasmanians. The entire extinction of this people within the last few years makes their history a subject of interest.

Much work has lately been accomplished in *Comparative Zoology*, particularly as to the development of animals. Progress is also making in the breaking down of the old distinctions between the lowest animals and plants. Mr. H. C. Sorby has lately shown that the highest classes of plants contain the following essential constituents, soluble in carbon bisulphide: blue chlorophyll, yellow chlorophyll, orange xanthophyll, xanthophyll, yellow xanthophyll, lichenoxanthine. He now finds all these substances in *Spongilla fluviatilis*, the common fresh-water sponge, an undoubted animal. He thinks it would be "well worthy of study to ascertain whether low animal forms which, like *Spongilla*, contain chlorophyll, have, when exposed to light, the power of decomposing carbonic acid, and supporting themselves to some extent as plants, and at the same time have the power of supporting themselves by means of organic particles conveyed into their interior by the water circulating about or through them. If so, they would be animals to some extent, capable of plant-like growth, and would thus be the reverse of those plants which have lately attracted so much attention on account of their being able to partially support themselves by means of complex animal food, which they can digest and absorb like the most perfect classes of animals."

Professor Hyatt describes in the Proceedings of the Boston Society of Natural History several new species of Floridan sponges.

The fresh-water *Rhizopoda* are engaging the attention of Professor Leidy, who has found about Philadelphia several interesting forms only heretofore known as living in Europe. The beautiful actinophrys-like *Clathrulina elegans* he finds abundantly in New Jersey in *Utricularia*.

Several papers of much value, but too abstruse to be farther noticed in this connection, have appeared in European journals, relating to the embryology of the cuttle-fishes. Professor Ray Lankester has published in the *Annals of Natural History*, 1873, and the *Quarterly Journal of*

Microscopical Science, 1875, articles on this subject, giving new information regarding the origin of the eye, ear, and pen-sac. In these points his discoveries are corroborated by Usoff, who studied at Naples, and whose results are appearing in the *Annals*. Grenacher has also published a beautifully illustrated paper on the development of an unknown cuttle-fish from eggs found floating on the ocean during his voyage to the Canary Islands. His paper appears in Siebold and Kölliker's *Zeitschrift*.

Elaborate and beautifully illustrated papers on the tape-worms, by Dr. Sommer, appear in Siebold and Kölliker's *Zeitschrift*, while the Ray Society has published a finely illustrated work on the nemertean worms by Dr. McIntosh.

A number of *Myriapods* from the Pacific States have been described in the *Annals of Natural History* by Mr. Stuxberg, of Upsala.

The embryological development of the nervous system of the king-crab (*Limulus*) has been studied by Dr. Packard, who also announces the discovery of organs in the same animal supposed to be of the nature of kidneys.

An immense number (ninety-seven species) of Gammarid *Crustacea*, allied to our common beach flea, nearly all of which are new, have been found by Dr. Dybowski in Lake Baikal.

Numerous new American moths and butterflies have been described by Messrs. Grote, Scudder, and Morrison.

In November last Mr. F. W. Putnam collected in the Mammoth and adjoining caves three species of fishes known to be peculiar to those caverns, and with them five other species of fishes which had evidently entered the cave from the Green River, as they were of the same species and in every way identical with specimens collected outside. Their colors had not faded at all, and their eyes were as perfect as ever.

Professor Jordan describes as new, in the *American Naturalist*, the "sisco" trout of Lake Tippecanoe, Indiana, under the name of *Argyrosomus sisco*.

The species of skates of the eastern coast of the United States have been revised by Mr. Garman, who gives interesting facts regarding their habits, as dependent on the structure of the different forms.

In the embryo of the sharks Professor Semper has made the remarkable discovery of a series of ciliated funnels, which he regards as homologues of the segmental organs of the worms, and thus suggest that the vertebrates may have descended from the worms, and not from the ascidians.

Dr. Dohrn has for some years been engaged in elaborating a theory of the "Annelidan Origin of the Vertebrata." Professor Gegenbaur had suggested previously the relation between the segmental organs of worms and the primordial kidneys, and Professor Morse has adverted to the correspondence between the segmental organs of worms and the Fallopian tubes of vertebrates.

The embryology of the chick, in a form very convenient to students, is given in a volume entitled *Embryology*, by Messrs. Foster and Balfour, and published by Messrs. Macmillan and Co.

The habits of the prairie gopher are narrated in a lively manner by Dr. Coues in the *American Naturalist*.

In *Botany* we have to record an interesting paper by Professor Max Rees, of Erlangen, on the process of fertilization in the *Basidiomycetes*, the group to which the toad-stool, mushrooms, and puff-balls belong. On examining the mycelium of *Coprinus stercorarius* he discovered bodies which he regards as sexual organs, and he concludes from his observations that the sexual process in the *Basidiomycetes* resembles that in the *Floridae* or red sea-weeds. The venerable Professor Elias Fries, of Upsala, published, on his eightieth birthday, a systematic work on the larger fungi of Europe, entitled *Hymenomycetes Europaei*, the most complete treatise on the subject which has ever appeared, and one which, as is well observed by De Bary, no one but the learned author himself is competent to criticize. Dr. Brefeld, of Würzburg, has recently discovered the sexual state of *Pilabobus crystallinus*, and finds that it agrees with what is known of the different species of *Mucor*.

In the report of the meeting of German naturalists and physicians at Breslau is an account of some curious experiments by Dr. Moritz Traube on the growth of artificial cells. The plan of the experiments was to immerse a glass rod in a solution of some colloid substance, then withdrawing it, to let a drop fall into a solution of some other substance which, coming in contact with the first, causes a precipitate to be formed. The precipitate, under favorable circumstances, assumes the form of a membranous sac inclosing the residue of the drop. This sac constantly enlarges, and is supposed by Traube to resemble the parenchymatous cells of living plants. He concludes accordingly that the walls of vegetable cells are formed by a process of precipitation, and increase by intussusception.

The *Forest Flora of Northwest and Central India*, begun by Dr. J. Lindsay Stewart, and finished by Dr. Dietrich Brandis, gives an easily understood but, at the same time, scientific account of the trees of a very interesting region. Students will be glad to hear that the enlarged edition of the *Trees of Massachusetts* is about going to press, and those who do not read German will find a help in the English translation of Sachs's *Lehrbuch*, by Messrs. Bennett and Dyer.

Under the head of *Agricultural Science* we have to report the appearance of the second annual report of the Massachusetts State Inspector of Commercial Fertilizers—Professor C. A. Goessman, of the Amherst Agricultural College. This document of forty-five pages contains a large amount of most valuable and timely information concerning the nature and value of the fertilizers commonly sold in our markets.

The use of German potash salts in this country is steadily increasing. Professor Goessman calls attention, however, to the unfortunate fact that the main bulk of our supply is of the lower grades. Much of it contains only eight or ten per cent. of actual potash. The cost per pound of potash at the mines in the higher grades, which contain from thirty to fifty per cent., is but little more than in the poorer salts. By importing the former, the expense of freight of a large amount of other material than potash across the Atlantic would be saved.

Kohlrausch has published some results of experiments on the injurious effect of ammonium sulpho-cyanate upon plants. This salt sometimes

occurs in the ammonium sulphate from gas-works which is extensively used in fertilizers. Previous researches of Märcker, Schumann, and Wagner have shown that the sulpho-cyanate has a poisonous action upon plants. These conclusions are confirmed by Kohlrausch, who found that beets manured with ammonium sulphate containing 2.5 per cent. of sulpho-cyanate contained less sugar than with the pure sulphate, and that barley and wheat were dwarfed and sickened. In the ammonium sulphate from gas-works the sulpho-cyanate may generally be detected by the reddish-brown color, due to a compound which it forms with iron. Gray or white salts may be used without fear. The investigator recommends the testing of ammoniated superphosphates for sulpho-cyanates, which may be readily detected in these, as in the ammonia salts, by the red color which their solutions give with ferric chloride.

Fliche and Grandeau, whose interesting researches on the growth of cluster pine, *Pinus pinaster*, in different soils are already well known, have been making similar studies upon the growth of chestnut. It was found that *Pinus pinaster* flourished in siliceous soil, but was stunted and weakly in soils containing much lime. Similar results were obtained with chestnut. Analyses showed that the ash of the trees grown in the calcareous soil contained more lime, less silica and iron, and only about one-fourth as much potash as those on the siliceous soil. Both chestnut and cluster pine on lime soil showed, along with deficiency of potash and iron in the ash, a lack of starch and chlorophyll in the leaves. These results accord very well with those of the well-known researches of Nobbe, which show that the elaboration of starch in the leaf, and consequently the healthy growth of the plant, is dependent upon the presence of a sufficient supply of potash.

Voelcker has been testing the effects of a series of manures, including common salt, crude potash salts, quicklime, bones, superphosphate, and nitrogenous manures, on a number of different pasture and grass lands. Common salt and crude potash salts applied alone were injurious or of little value. Quicklime and bones were generally, though not always, beneficial. The effect of superphosphate with crude potash salts was generally quite favorable and lasting. The largest increase of crop was obtained with nitrogenous manures (guano).

Under the head of *Pisciculture and the Fisheries* we have to report a rapidly growing interest in the subject, with its important practical applications. A meeting of the American Fish-Culturist's Association was held in New York on the 9th of February, at which a large attendance was present. On the 11th of the same month the State Commissioners of Fisheries, with the United States Fish Commissioner and a representative from the Fish Commission of Canada, held a meeting with the special object of taking into consideration the general aim and objects of the State Fish Commissions and the best mode of rendering them efficient and most available for their purposes. Two new Fish Commissions have also been organized during the winter—one for Illinois, the other for Virginia. The names of the appointees of the Illinois Commission have not been announced. Those for

Virginia are Messrs. Fitzhugh Lee, of Stafford, E. M. Tibbal, of Winchester, and Dr. Robertson, of Lynchburg. Reports of State Commissions published since our last reference to the subject are by Wisconsin, Minnesota, Michigan, Massachusetts, Pennsylvania, and Rhode Island.

The success of the attempt at introducing trout into Australia and New Zealand has induced a similar effort for the Cape of Good Hope, and a number of eggs, suitably packed, have been shipped during the last winter from London. These were accompanied by a consignment of salmon eggs, although some apprehension is felt in regard to them in view of the doubt still attaching to the question of the success of the experiment with this fish in Australia and New Zealand.

Operations in regard to the collecting of salmon eggs from California, and their distribution to the State Commissioners throughout the greater part of the United States, are about beginning under the direction of the United States Fish Commissioner. Mr. Livingston Stone is about proceeding to the Sacramento to renew his work, hoping to secure at least 10,000,000 eggs. The distribution of eggs from the establishment at Bucksport, in Maine, has been already completed for the present season, and the station is now being put in order for a still larger work during the coming spring and summer.

The great importance of the salmon fisheries of the Columbia, and the danger of their diminution, in view of the very extensive scale upon which they are prosecuted, induced the transmission of a memorial to Congress, on the part of the Oregon Legislature, asking that regulations be established for a close time, and such other restrictions as might be expedient. No action was taken, however, on this subject, and the effort to secure the necessary protection will probably be renewed another session.

The question as to the ability of the salmon to remain permanently in fresh-water has received an important illustration during the past winter. It is well known that the lakes of Maine along the coast contain a variety of fish known as the landlocked salmon, which, while possessing the external appearance and peculiar habits of the salmon, together with equal excellence of flesh, is much smaller, and remains permanently in the lakes; and it is still a vexed question whether this is actually a descendant of the true sea salmon or a different species. An argument in favor of its being the former is afforded by the fact that in two localities young salmon, hatched from eggs of the true sea salmon collected at Bucksport, have lived in fresh-water ponds, and yielded ripe eggs during the past autumn; in the one case at New Hope, Pennsylvania, the fish attaining several pounds in weight, while some bred in Wisconsin were only five to seven inches in length, though perfectly mature in every respect. In the first case, however, the ponds were quite large, and offered ample space for the movements of the fish, while in the other they were confined to small trout ponds of only a few yards in extent. Whether the eggs thus obtained will produce healthy young, and whether these will attain maturity, are questions of much interest.

In our monthly *résumé* of *Engineering* news perhaps the most interesting item is the propo-

tion to construct a railroad tunnel under Newark Bay. Many of our readers are familiar with the fact that the approach to Jersey City from Newark across the marshes and the waters of Newark Bay (via the New Jersey Central Railroad) is effected by an elevated railroad carried upon wooden piles. The rapid decay of this structure, which necessitates its practical rebuilding every few years, in connection with other reasons, has led the company to seriously consider the proposition of building a tunnel under the bay from Elizabethport to Bergen Point. The project is regarded by competent engineers to be quite feasible, and a rough estimate places its cost at about \$6,000,000.

A contract, it is reported, is about to be made for laying a new submarine telegraph cable between Key West and Punta Rosa, Florida. The proposed new line will have a length of 120 miles.

From abroad we learn that the Italian government is engaged in discussing and considering plans for the improvement of the Roman Campagna, a work which is being earnestly championed by General Garibaldi. A number of plans to effect the drainage of the numerous marshes, and the prevention of the frequent inundations of the Tiber, have been proposed, but thus far no definite scheme has been adopted.

From the last published official report on the St. Gothard Tunnel, bearing date of October 21, 1874, the state of the work is summed up as follows: Total length of tunnel, 48,651 feet; total length driven up to date of report, 8661 feet; of tunnel remaining to be driven, 39,990 feet. The height of the northern entrance at Goeschenen will be 3608 feet above sea-level, and that of the southern entrance 3756 feet.

The commission appointed some time ago by the United States government to investigate the causes of steam-boiler explosions has lately held a session at New York, at which the details of future experimental work were under discussion. Since the experimental tests at Sandy Hook and Pittsburg the *personnel* of the commission has suffered certain changes. It consists at present of Professor Winlock, Professor Thurston, Isaac V. Holmes, Charles W. Copeland, and J. R. Robinson. It was decided to resume operations at Sandy Hook about the middle of June.

In accordance with the provisions of a bill passed at the last session of Congress, a general order just issued from the War Department announces the appointment of a board to conduct a series of experimental tests of iron and steel. The board is directed to convene at the Watertown Arsenal, Massachusetts, on April 15, 1875, or as soon thereafter as practicable, for the purpose of determining by actual tests the strength and value of all kinds of iron, steel, and other metals which may be submitted to them, or by them procured, and to prepare tables which will exhibit the strength and value of said materials for constructive and mechanical purposes, and to provide for the building of a suitable machine for establishing such tests, the machine to be set up and maintained at the Watertown Arsenal. The board will receive its instructions from and make its report to the Chief of Ordnance. Lieutenant-Colonel Laidley, Ordnance Department, and Professor R. H. Thurston, have been appointed respectively president and secretary of the board.

A magnetic lathe chuck is a *Mechanical* novelty worthy of note, and is designed to obviate the inconveniences involved in fixing certain kinds of work upon a lathe chuck. At a recent meeting of a well-known mechanical institute a number of samples of ground disks of hard steel were exhibited, which were ground so true that seven plates placed one upon the other appeared to be one solid disk of steel. To grind these plates the chuck had been converted into a temporary magnet, and the thin steel pieces were simply placed on the face of the chuck, which held them firmly by magnetic attraction while being worked upon.

The announcement is made that an International Exposition, in which especial prominence will be given to all matters pertaining to marine and river industries, is to be held in Paris from July to November next. The building known as the Palais de l'Industrie, in the Champs Élysées, where the Exhibition of 1855 was held, has been selected for the purpose. Great preparations likewise are being made for the approaching exhibition of machinery, fixed and in motion, which will be opened at the Royal Pomona Palace in Manchester in May.

Technology.—The very resistant glass of M. Bastie, to which we have before referred, is attracting much attention. At the last meeting of the "Society for the Encouragement of Manufacturers" a number of experiments were made upon it which are quite noteworthy. Thin plates of the material were thrown on a tiled floor from a height of three meters without injury. They were then flung with violence about the room and against the walls, and held over gas jets. A weight of 100 grams was also dropped on them with impunity from the height of three meters. The resisting temper of the glass is obtained from a chemical bath to which it is subjected when hot from the furnace. The specimens that yielded to the blows they received only broke in the spots where they were hit, and a remarkable absence of continuous cracks was observed. Wherever the hammer took effect the glass lost cohesion and transparency.

Under the head of *Miscellaneous* information of general interest we may refer to the measures taken by the United States to secure an exhibition at the Philadelphia Centennial on the part of the various government departments. A year ago a commission was established by order of the President, composed of one representative each from the War, Navy, Interior, Treasury, Post-office, and Agricultural departments and the Smithsonian Institution. This commission, in obedience to orders, made a report to the President as to the general character of what would constitute a suitable and desirable exhibition on the part of the United States, the amount of space required, and the probable expense, this last being estimated at \$971,000, to include the cost of a building at \$200,000. At the last session of Congress an appropriation of \$505,000 was made, of which \$150,000 was authorized to be used, if necessary, for the erection of a building. As the sum thus appropriated is much less than the estimate, the commission has necessarily been obliged to revise its plans, and the display will accordingly be far from representing in the best manner the operations and condition of the various departments and their works. Among the

other features contemplated is a very extensive exhibition of American ethnology, representing as nearly a perfect picture as possible of the present condition of the native races of the country, together with a series of relics of its prehistoric population. The resources of the country, as illustrated by the animal, vegetable, and mineral products, will also be presented. A special appropriation was made to enable the United States Fish Commission to make a display of every thing connected with the fisheries of the country and with fish-culture, and this will probably be a very prominent feature of the exhibition on the part of the government.

The popularity of the measures taken by Congress to establish a national park in the Yosemite Valley and on the Yellowstone has induced a third measure of a similar character in regard to the island of Mackinac. A law has been recently passed directing that this island be taken in charge by the Secretary of War, and administered in the interest of the people. Ten years' leases may be granted for the erection of such buildings as are necessary for the accommodation of the public, and the proceeds derived therefrom are to be expended in the improvement of the grounds, the laying out of roads, etc.

Some years ago the Royal Society of London undertook, mainly at the suggestion of Professor Henry, of the Smithsonian Institution, the publication of a catalogue of all the scientific papers published in transactions of societies and scientific journals, carrying it from the year 1800 to 1862. This was completed some years since, and fills five or six quarto volumes nearly of the size of the *Encyclopædia Britannica*. Persons engaged in scientific research will be interested to learn that the society will shortly commence another series, to embrace papers published from 1864 to 1873, to be continued, probably, hereafter for each decade.

Numerous *Deaths* of men of science have occurred since our last report on the subject, among them two eminent geologists, d'Omalius d'Halloy and Sir Charles Lyell. Other names are, Professor J. W. A. Argelander, the veteran astronomer; Professor C. J. Sundevall, of Sweden; C. L. Mathieu, of Paris; Professor R. Willis, Mr. Robert Hardwicke, Mr. John Timbs, Mr. W. Parkinson Wilson, and Dr. John E. Gray, of London; and Mr. W. J. Hays, the eminent animal painter, of New York.

Most of these names are those of veterans in science, who have died at an advanced age, after a life full of honors.

Editor's Historical Record.

POLITICAL.

OUR Record is closed on the 22d of April.—The special session of the United States Senate was concluded March 24. The day before adjournment a resolution was adopted, 33 to 24, declaring that "the action of the President in protecting the government in Louisiana of which William P. Kellogg is the Executive, and in enforcing the laws of the United States in that State, is approved."

Elections were held for State officers in Connecticut and Michigan April 5, and in Rhode Island April 7. Governor Ingersoll, of Connecticut (Democrat), was re-elected, and the Democrats in that State secured also three out of the four Congressmen. In Michigan the election was for Judges of the Supreme Court and Regents of the State University. The Republicans were successful. In Rhode Island the vote for Governor and Lieutenant-Governor was not decisive, and the choice will devolve upon the Legislature. The other offices were secured by the Republicans.

George Q. Cannon, Congressional Delegate from Utah, was placed on trial in Salt Lake City, April 2, for polygamy, but the prisoner was discharged under the statute of limitations.

F. E. Spinner, United States Treasurer, has resigned, and John C. New, of Indianapolis, has been appointed his successor.

Six companies of cavalry and two of infantry have been ordered to the Black Hills region as an escort to Mr. Jenny, the government geologist, who is to conduct a survey of the country.

The centennial anniversary of the opening scenes of the Revolution at Concord and Lexington was celebrated April 19. At Concord the statue of the Minute-Man, by Daniel C. French,

was unveiled. An address was made by Ralph Waldo Emerson, an oration was delivered by George William Curtis, and a poem was read by James Russell Lowell. At Lexington the oration was delivered by Richard H. Dana, Jun., and a poem was read by John G. Whittier. The President of the United States and other eminent authorities were present at both places.

The total number of passengers landed at the port of New York between January 1 and March 31, 1875, was 17,128—an increase of 1085 over the corresponding period of 1874. Of these 9058 were aliens, 2769 were born in the United States, and 5301 were persons who had previously landed at New York or other ports of the United States. The number of passengers arriving at Castle Garden was 12,597, of whom 8176 were aliens, and 4421 were citizens or persons who had before landed at this or other ports of the United States.

Of the whole number of alien passengers who arrived, 4027 were natives of the German Empire, 1685 were from Ireland, 1866 from England, 356 from France, 331 from Italy, 291 from Scotland, 233 from Russia, 201 from Switzerland, 127 from Austria, 110 from Holland, 107 from Denmark, 43 from Sweden, 32 from Belgium, 30 from Spain, 27 from Canada, 14 from New Brunswick, 12 from China, 13 from the West Indies, 11 from Norway, 10 from the Isle of Man, 10 from South America, 5 from Central America, 4 from East India, 3 from Mexico, 3 from Portugal, 2 from Greece, 2 from Asia, 1 from Africa, 1 from Nova Scotia, and 1 from Heligoland. From the registered entries of the destinations of the passengers who landed at Castle Garden, 5000 stated their destination to be New York, 1757 went to the other Middle

co. His style is lucid, his sentences short, crisp, compact. He writes as one who has much to say, and is always pressed for room, and always studying to put much in little space. A deep and earnest Christian spirit pervades his pages. The volume is elaborately and handsomely illustrated.—The death of Mrs. HENRY M. FIELD took from the literary and social life of New York city one of its most gifted and loved members. A large circle of personal friends will hold in sacred esteem as a memorial of her life the little volume edited by her husband, *Home Sketches in France* (G. P. Putnam's Sons). The first part of the volume is occupied with tributes to her life and character by some of her literary companions and friends. The rest consists of articles furnished by Mrs. Field at different times in her life between the years 1867 and 1873. Most of these papers concern France or French affairs—ancient Brittany, religion in France, charities of Paris, education in France, the old French noblesse, etc. Mrs. Field was by birth a Frenchwoman and a Romanist, by conviction a Protestant, by choice an American. Thus her early life gives her an insight into French life and character which no American born can possess, while her later associations, her religion, her domestic life, and her American sympathies enable her to interpret France to the American. Her essays produce the conviction that she, who was one of the most brilliant and magnetic of conversationalists, might also have been one of the most interesting and attractive of authors if she had chosen to use her pen in converse with that wider circle, the public. Her unpretentious papers are well worthy the careful study of any who would understand the present condition or judge aright of the future prospects of France.—Dr. AZEL AMES'S *Sex in Industry* (J. R. Osgood and Co.) is the complement of Dr. Clarke's *Sex in Education*. The practical result reached by the independent investigations of these two physicians is the same, namely, that while wom-

an is the equal of man, her constitution is not the same, and her interests, as well as those of society, demand that sex should be taken into consideration in determining the quantity and the character of labor permitted, whether it be intellectual or muscular. This general position Dr. Ames enforces by the results of a series of careful inquiries as to the conditions of homes and employments of working people, especially in the great manufacturing operations of New England. He writes, not as an advocate, but as a calm and dispassionate observer; and those who are reluctant to accept his conclusions can countervail them only by entering upon the field of investigation which he has barely opened.—*Through Normandy*, by KATHERINE S. MACQUOID (A. D. F. Randolph and Co.), will interest the past or prospective traveler through that quaint country more than the general reader. It has a very convenient and useful index for travelers, which would be of great value to the tourist, comprising, as it does, in the briefest possible compass, information respecting routes, hotels, fares, etc. But the descriptions are too literal and too prosaic. They are minute and realistic, but not graphic or pictorial.

A remarkably concise but comprehensive historical review is given in EDWARD ABBOTT'S *Paragraph History of the United States* (Roberts Brothers), from the discovery of the continent to the present time. The author has prepared this volume "for the use of those Americans who, at this Centennial period, wish to refresh their memories as to some main facts in their country's history, and have only a few moments to do it in." In the margin are given suggestive notes of contemporaneous events in European history. The book, which is chronologically arranged, can be read through in an hour, is original in its conception, and will prove of great value in these days of voluminous over-productive literary enterprises. It might be improved by the addition of some important dates.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—During the month of April there has been one new asteroid discovered. It is numbered (145), and was found at Marseilles by Perrotin on the 28th.

Besides the great labors accomplished and published by Sir John Herschel was one which he was not spared to bring to completion, but which has been carefully edited and recently published by the Royal Astronomical Society. It is "A Catalogue of 10,300 Multiple and Double Stars," a work that has long been desired, and will certainly be welcomed by all interested in this branch of astronomy. As is well known, the observation of the relative positions of double stars was first systematically undertaken by Sir William Herschel, who hoped thereby to ascertain the distances of these bodies. His labor began in 1779, and in 1802 he announced that instead of having accomplished his object, he had discovered that many of these bodies were revolving in orbits about each other, constituting binary systems. During the past sixty years, following

the leadership of the Struves and Herschels, a large mass of observations of double stars has accumulated, and the task of combining all these labors into a general catalogue was, during the last years of his life, faithfully performed by the lamented astronomer. We learn from the preface that a most important portion of this work was left quite incomplete by Sir John Herschel. We refer to the descriptions of the distances, magnitudes, and colors of the stars—items which are quite interesting to amateurs, and would be almost indispensable to one who desired to confine his attention to the wide, or the close, or any other class of doubles. This regrettable omission will, however, we have reason to hope, be easily and soon supplied by our indefatigable discoverer of new close double stars, Mr. Burnham, of Chicago.

At the recent meeting in Washington of the National Academy of Science Professor Langley gave an interesting account of some of the results of the studies of the sun that he has perseveringly conducted during the past six years at

the Alleghany Observatory, near Pittsburg. He has sought to add to our knowledge of the nature of the great source of our heat, light, and life by employing a telescope of great optical perfection, and has called in the aid of polarizing apparatus, of photography, of photometry, and of the thermo-pile. He finds that Professor Henry's early observation that the solar spots are cooler than the neighboring bright portions of the sun's surface is fully confirmed by his own measurements. Langley has, however, extended his studies to all parts of the solar surface, and has shown that there is no perceptible lowering of the temperature as we proceed from the sun's equator toward either pole, as has been maintained by some. He has also shown that within a solar spot are evidences of a somewhat complicated system of upper and lower currents, each bearing its own glowing red filaments, similar to the brighter ones on the edge of the penumbra. Both the French and Italian astronomers seem to find Professor Langley's observations conformable to their theories, but we believe Professor Langley himself abstains from giving his adherence to any theory, and merely expresses the belief that the matter composing the sun is at so high a temperature and under so strong a pressure that its condition differs utterly from any thing that we can experiment upon on the earth's surface, so that we know absolutely nothing as yet of its properties.

The solar eclipse of April 5 was successfully observed in Siam. Photographs of the corona were obtained at Singapore and Bangkok.

Among magnetic publications one of the most expensive and of permanent value is the fine quarto volume of observations just received from the observatory at Trevandrum, of his Highness the Maharajah of Travancore. This observatory was founded in 1836 through the exertions of Mr. Caldecott, and has been long known by reason of the great energy and activity of its director, Dr. J. A. Brown, on whose leaving Trevandrum in 1865 the institution would have been closed except for the support of the British residents. The present volume is, therefore, the result of many years of study, based on over twenty years of observations with the improved instruments introduced in 1852, and relates to a portion of the world concerning whose magnetic and meteoric phenomena we should otherwise be completely in the dark. In this volume, among other things, we find a note in reference to Brown's well-known discovery of the unequal magnetic properties of the two hemispheres of the sun, whence arises a small fluctuation in the variation of the magnetic needle, whose period is twenty-six days; he announces, namely, that he has found a double oscillation of the twenty-six-day period, the evidence of which he will give in the second volume.

In reference to the laws of the movement of storms, Professor Loomis, of Yale College, has made a further contribution, basing his studies, as heretofore, on the valuable maps of the Army Signal-office. He finds that centres of low barometric pressure tend to move toward centres of high pressure when the latter lie to the southward, but move from them when they lie to the northeastward. Among the other interesting conclusions that he announces is the theory that sometimes, at least, our very cold weather is only

explicable on the assumption that the cold air descends from the upper cold regions of the atmosphere. His views on this point seem opposed to those held by the leading meteorologists of Europe, and we await with much interest that full discussion of the subject which it merits.

In *Physics* the month has witnessed satisfactory progress. Boudreaux has published a simple and more general method of demonstrating the Archimedean law of buoyancy in liquids. A glass vessel with a slightly conical lateral spout is placed beneath the pan of a hydrostatic balance, to which is suspended the body to be experimented upon. This vessel is filled previously, the excess of liquid being allowed to flow off through the spout. Two thin capsules are then provided; one of them is placed on the pan supporting the body, and is balanced by shot. The body is then immersed, the overflow of liquid being collected in the second capsule. The inclination of the balance beam shows the upward pressure. But on replacing the first capsule by the second, which contains the liquid displaced, the equilibrium is restored.

Cailletet has further studied the effect of pressure on combustion, the experiments being made up to 300 atmospheres. He finds that while the luminosity of a flame increases under pressure, the activity of the combustion actually diminishes; the temperature augments, but the oxidation lessens. An alcohol flame, ordinarily so pale, becomes as bright as that of a candle, at twenty atmospheres. A candle flame under these conditions gives more light, but the wick soon becomes smoky from imperfect combustion, that which is gained on the one side being lost on the other.

De la Bastie has communicated to the Société d'Encouragement an account of his new process of tempering or hardening glass. The manufactured articles are heated to near the temperature of softening, and then cooled suddenly in a suitable bath. The glass thus treated becomes extraordinarily resistant, in some cases amounting to fifty times that of ordinary glass. It becomes also very hard, so that difficulty is experienced in cutting it with a diamond. Though so resistant, it is very brittle. A piece when broken flies into a thousand fragments, exactly like the well-known Prince Rupert's drop. Vessels were shown of the new glass in which water could be boiled over a naked fire without fear of breaking them. Upon plates of it a weight of 100 grams was allowed to fall from a height of three and a half meters without fracture. Watch-glasses made of it remained intact when thrown across the room. The hardening process is not difficult nor costly, and it promises to become of great practical importance.

Exner has made some quantitative experiments on the penetration of liquid films by gases. He finds that the velocities of diffusion are directly proportional to the co-efficient of absorption of the gas for the liquid composing the film, and inversely proportional to the square root of the density of the given gas. Adopting air as the unit of comparison, the relative velocities are—for nitrogen, 0.06; oxygen, 1.95; coal gas, 2.27; hydrogen, 3.77; carbonous oxide, 47.1; hydrogen sulphide, 165.0; ammonia, 46000.0. As to the absolute velocity, Exner finds that

1.88 c.c. of hydrogen and 0.55 c.c. of air diffuse simultaneously through each square centimeter of the soapy film.

Lissajous has described in the Bulletin de la Société d'Encouragement an elaborate machine for tracing mechanically the curves which represent the composition of vibratory movements, constructed by Froment. The driving-shaft carries toothed wheels, gradually increasing in size from right to left. Upon the pinions driven by these, which are arranged in pairs, are eccentrics, which by means of connecting rods give a differential to and fro motion to an arm transverse to their direction. To the centres of two contiguous arms two other connecting rods are attached, which move a transverse arm of the second order, and similarly an arm of the third order is thus moved, which carries the style. The motion of the style is therefore the algebraic sum and resultant of the motion of the eight driving-wheels, and the curves it describes may be exceedingly complicated.

Mayer has published a redetermination of the durations of the residual sonorous sensations, in which he was assisted by Madame Emma Seiler and her son, Dr. Carl Seiler, of Philadelphia, well known in connection with similar researches of Helmholtz. It now appears that Ut_1 has a persistence of $\frac{1}{25}$ of a second, Ut_2 $\frac{1}{35}$, Ut_3 $\frac{1}{70}$, Sol_1 $\frac{1}{100}$, Ut_4 $\frac{1}{135}$, Mi_4 $\frac{1}{133}$, Sol_4 $\frac{1}{100}$, and Ut_5 $\frac{1}{180}$ of a second. The determination is not an easy one, owing to the production of secondary and resultant tones.

Gernez has made an exhaustive research into the phenomena attending ebullition. His paper opens with a long historical note upon this subject. Then follows his own results, in which he studied (1) liquids heated in contact with solids, (2) within other liquids, and (3) the ebullition developed by mechanical action. He maintains that ebullition is an evaporation into some gaseous atmosphere contained within the liquid.

Wibel has made additional experiments upon the cause of the luminosity of flames. He finds the results of Knapp confirmed, that nitrogen, hydrogen chloride, carbon dioxide, and other indifferent gases act like air to destroy the luminosity of gas, used in a Bunsen burner; but he also finds, curiously enough, that this luminosity may be wholly or partially restored by heating the tube to redness through which the mixture passes. Hence he concludes, 1st, that the absence of luminosity in a Bunsen flame is not due to dilution of the gas; 2d, that it is due to the cooling effect of the inert gas, since, if this be heated, the luminosity returns; 3d, that the luminosity of a flame depends upon the temperature existing in its interior; and 4th, that ordinary illuminating materials are such because the rising gases and vapors are sufficiently heated in the exterior combustion zone to cause their decomposition.

Professor Mayer has called attention to a curious bit of history in relation to Young's theory of colors. It appears that Young first adopted red, yellow, and blue as the primary colors, and that subsequently, taking it for granted that Wollaston was correct when he asserted four natural divisions of color in the solar spectrum, separated from each other by dark lines, he adopted red, green, and violet, these being the divisions noted by Wollaston. Moreover, Young

seems never to have made any experiments to test his theory until some time after he had, on theoretical grounds, adopted it.

Cornu has proposed a very simple mode of correcting telescopic object-glasses for photographic rays, by separating more or less from each other the lenses composing them, an idea originally suggested by Sir John Herschel for restoring overcorrected objectives. Since the focal distance for chemical rays is about one-half per cent. of the principal focal distance behind that for luminous rays, the necessary correction is effected by separating the flint and crown components by this amount, and then carefully adjusting. Cornu has used the method with success on an object-glass of four inches aperture; the method of Rutherford is, however, to be preferred for glasses much larger than this.

Wright has experimented to obtain the spectrum of the gaseous matter evolved from meteorites when heated in a vacuum. The meteorites employed were three in number—those from Texas, from Tazewell County, Tennessee, and from Arva, Hungary. Borings from each of these were placed in a hard glass tube connected with an efficient Sprengel pump. By means of a T tube an ordinary Plücker vacuum tube was also connected with these. At a red heat the Texas iron gave off 4.75 times, the Tennessee iron 4.69 times, and the Hungary iron more than 44 times its volume of gases, which the spectroscope showed to consist of hydrogen, carbonous and carbonic oxides.

Lockyer and Roberts have investigated the absorption spectra of metals volatilized by the oxyhydrogen flame. They employed a block of lime, in which the metal to be examined was placed, and in which it was volatilized by the oxyhydrogen jet. Through a tube cut in the block the beam of electric light passed, which was viewed by the spectroscope placed opposite. In this way the absorption produced by the metallic vapor could be observed. They conclude that in passing from the liquid state to that of perfect gas the molecules pass through different orders of complexity, this complexity being diminished by the action of heat so that each molecular simplification is marked by a distinctive spectrum.

Montigny has discovered, by means of an ingenious apparatus which he calls a scintillometer, a connection between the variations of color of scintillating stars and their spectra. In every case those stars which scintillate or twinkle least are those whose spectra show numerous well-pronounced lines, sometimes united in zones.

Bertin has given a notice on projecting polarization phenomena with the apparatus of Duboscq, dividing these phenomena into three classes—those requiring (1) parallel, (2) divergent, or (3) convergent light.

In Chemistry there has been some advance. Göpner claims to have shown that the so-called hydrate of chlorine is really a hydrate of a molecular union of hydrochloric and hypochlorous acids. He bases his opinion on the fact observed by him that when this hydrate acts on mercury, mercuric and not mercurous chloride results. To this view Schiff decidedly objects, both on grounds of antecedent improbability and of experimental evidence.

Ditte has proposed a new and simple mode of

determining boric acid, which depends upon the crystallization of calcium borate when a salt of boric acid is introduced into a fused mixture of one part calcium chloride and three parts mixed sodium and potassium chlorides. This crystallization takes place upon the surface of the fused chlorides in the form of a ring on the sides of the crucible. Being insoluble in water, the calcium borate is left when the mass is treated with cold water, and may be collected on a filter, dried, and weighed.

Bauer has examined the action of strong sulphuric acid upon lead and lead alloys. He finds that small quantities of antimony and copper increase the resisting power of lead to this acid, but that bismuth in a lead alloy diminishes it.

Meyer and Lecco have sought to fix the equivalence of nitrogen in ammonium compounds by an examination of the chloride of di-ethyl-dimethyl-ammonium, derived (*a*) from di-ethylamine and (*b*) from di-methyl-amine. If the same chloride is formed by these two processes, then ammonium is a derivative of quinivalent nitrogen; if two isomeric chlorides result, then nitrogen is a triad in ammonium compounds. The most minute examination failed to show any difference in the bodies obtained, and hence confirms the variability of nitrogen equivalence.

Hammerbacher has succeeded in discovering the presence of thallium in carnallite, though the quantity was too small to enable him to isolate it. Rubidium and cesium were also detected by the spectroscope in this and in sylvin.

Hawes has made a chemical investigation of the trap-rocks of the Connecticut Valley. The results show that the ejected rock had originally the same composition, and hence, presumably, that wherever now found, it came in the first place from the same source, and that a deep-seated one. Subsequent action has converted the dolerite into a diabase, the principal action being upon the pyroxene, which was converted into chlorite. The chief minerals composing the dolerite are pyroxene and labradorite—sometimes anorthite—with a little chrysolite and apatite. Magnetite is also found in these traps, in some of them to the amount of nearly fourteen per cent.

Schöne has proved the presence of hydrogen peroxide in rain and snow water collected in the vicinity of Moscow. Only four out of 130 specimens of rain, and twelve out of twenty-nine of snow, failed to give the reaction. Quantitatively the amount in rain varies from 0.04 to one milligram per liter. The daily maximum was reached between 12 and 4 o'clock p.m., and the annual in August. The peroxide is supposed to exist in the air both free and in solution, and in the amount of 0.00000268 c.c. in a liter.

Nichols, under the direction of the State Board of Health of Massachusetts, has examined the composition of the air at different depths below the surface of the "Back Bay lands" in Boston. In three experiments, the depths being three and a half, two, and ten feet respectively, no hydrogen sulphide was detected, ammonia was found in minute quantity, and carbonic dioxide gas existed in proportions varying from one and a half to twenty-one parts per thousand of air. This amount was approximately proportional to the depth, and reached a maximum in August and September.

Frebault has observed that a peculiar green coloration is developed in oil of peppermint by the action of certain acids, notably picric acid, which has a red fluorescence similar to chlorophyll. He suggests, therefore, that this substance is formed in the reaction.

Giraud has given an analysis of gum-tragacanth, by which it appears that sixty per cent. of it is a pectic compound apparently identical with the pectose of Fremy, existing in unripe fruits and in turnip roots, etc. Pectic acid and pectin were both prepared from the gum. The other constituents are, water, twenty per cent.; soluble gum, eight to ten per cent.; cellulose, starch, and mineral matters, each three per cent.

Meyer has succeeded in producing acrolein by the imperfect combustion of ethylene. When to 100 volumes of ethylene gas 62 to 65 volumes of oxygen are added and exploded in a eudiometer, carbonous oxide, hydrogen, and condensed hydrocarbon gases are formed, and carbon is separated. At the same time the carbonous oxide unites to the undecomposed ethylene present, and produces acrolein. This was recognized by its well-known properties, and by conversion into acrylic acid.

Drechsel has succeeded in forming trimethylphosphine by heating together phosphonium iodide and carbon disulphide.

Berthelot has effected a simple dissociation of aldehyde by heating a mixture of five volumes of hydrogen and two volumes of aldehyde vapor to a red heat for half an hour. The products were carbonous oxide and methane.

Knop has made a series of experiments to ascertain the action of salicylic acid upon vegetation. He finds that it has a marked depression of action upon the vegetative activity of cells, whether these be the chlorophyll cells of the higher or the non-chlorophyll cells of the lower orders of plants, provided only the acid be free. Of fifteen grains of corn soaked in water containing $\frac{1}{100000}$ of this acid, fourteen failed to germinate. Moreover, mould is prevented by a quantity of salicylic acid as minute as this.

Boussingault calls attention to the uncertainty of the guaiacum test for kirsch cordial. He states that the blue color is not characteristic, since it is developed in zwetschen, or prune cordial, and does not always appear in genuine kirsch. Upon investigation, he finds that the blue coloration is due to the presence of copper, and asserts that any specimen of kirsch which is blued by guaiacum will give with potassium ferro-cyanide a red precipitate of copper ferro-cyanide.

Hesse has published a valuable investigation giving the exact data concerning the rotatory power of a large number of organic bodies—including the sugars—on polarized light.

Gorup Besanez notices the introduction into commerce from Manilla of a brown extract from *Echitis scolaris*, a plant belonging to the Apocynaceae, as a febrifuge, under the name Ditaine. He succeeded in extracting from it a crystallized non-volatile alkaloid. It is offered as a substitute for quinine.

Boettger states that a dilute solution of ammonia, or a moderately concentrated one of potassium or sodium hydrate, facilitates remarkably the germination of seeds, even of coffee, which usually germinates with difficulty. Grains of coffee moistened with such a solution of potash show,

even after the lapse of a few hours, a snow-white plumule one to two millimeters long.

Microscopy.—We find in the April number of the *Monthly Microscopical Journal* a paper by Mr. Wenham "On a Method of obtaining oblique Vision of Surface Structure under the highest Powers of the Microscope." He advises the use of slips of glass about four-tenths of an inch wide, ground and polished at an angle at one edge. The object to be examined is placed upon the sloping plane. One of the slips is cemented to the ordinary three by one inch slide, and the other slip being slid against it, the object will lie flat between the two inclines. It is necessary to have the two inclines to remove the objectionable color which would otherwise enter into the objective. He recommends an angle of 35° for dry and 45° for balsam-mounted objects. These prismatic slips can be cheaply and easily made by grinding and polishing, say, a hundred at a time, and will no doubt be brought often into use in deciding whether certain appearances in the ordinary mode of view are or are not illusory.

The Micrographic Dictionary, the third edition of which has been so long in press, has at last been completed. Although it has been severely criticised, and stated to be imperfect, and no doubt in some respects is so, yet, upon the whole, it is a considerable improvement upon the former editions, and a successful re-issue of an elaborate work in the wide field of microscopical research which will be welcomed and appreciated.

A self-centring turn-table, by Mr. C. F. Cox, is described in the March number of the *Monthly Microscopical Journal*, which will meet a want often felt by those who bestow any care upon neatly mounting their preparations, and especially when cells are to be prepared for reception of opaque objects.

We commend the project announced in the April number of the *American Naturalist* of the formation of a "Postal Micro-cabinet Club," for the circulation and critical study of microscopic objects, the design and methods conforming mainly to those of the successful English club. Applications for membership and for the rules of the club may be made to the editors of the *Naturalist*, or to the secretary of the club, Rev. A. B. Hervey, Troy, New York.

In the same number of the *Naturalist* is a description of a simple "spring clip" for use in mounting microscopic objects, the invention of Mr. N. N. Mason, of Providence, Rhode Island.

Dr. C. Golding Bird, in a paper read before the Medical Microscopical Society, advocates elder pith as an almost universally preferable medium for imbedding tissues preparatory to cutting sections, whether by holding in the hand or for use in the microtome. In the latter case the object is loosely packed in the tube of the microtome by means of dry elder pith, which, being wetted, in about three minutes swells so as to fill up the vacant spaces, and fixes the object immovably in place.

Professor E. W. Morley, of Hudson, Ohio, in a communication to the Memphis Microscopical Society, states as a result of his measurements of the striae of *Amphipleura pellucida* that they number 92,600 to the linear inch.

Among other interesting results from examination of the deep-sea soundings of the *Tus-*

carora, we may mention the occurrence of undoubted living foraminifera, not derived surface forms, at a depth of 2711 fathoms. At this depth, as might be expected from the large amount of carbonic acid, no calcareous organisms could exist, and none, except a stray *globigerina*, too recently dropped to be dissolved, were found; but there were multitudes of sandy *Lagenide*, some very large; also *Lituolide* (especially *L. canariensis*, and various *Trochammina*, and *Dentalina*, with polished sandy tests like *Trochammina*). But the most noteworthy fact was the occurrence of *Orbulina*, not with calcareous or sand-incrusted calcareous tests, but with shells wholly of sand grains, and perfect in shape, too large and heavy to have ever floated. The abundance and character of all these forms, along with which were numerous sand tubes and great numbers of *Acanthometrine*, *Thalassicolline*, and *Polycystinae*, preclude the idea of dropped surface forms. In another sounding, 108 fathoms, were fine specimens of *Lingulina*, and some transparent enough to show distinctly the early growth, a rapidly increasing spiral, which is masked entirely in the fully developed, and more or less sandy rectilinear tests of the matured form. At a depth of 1625 fathoms specimens were found of the genus *Ellipsoidina* of Professor Seguenza, hitherto only known as fossil from the miocene marls around Messina.

Ethnology.—Franz Keller, in his account of his tour on the Amazon and Madeira rivers, describes the habit of eating clay practiced by the natives of the forests on their border. They are so addicted to it that the prospect of a speedy and miserable death does not deter them. The negroes who work the plantations are compelled to wear iron masks, and are allowed to take them off only under the strictest surveillance. Beasts (excepting the jaguar) and birds are affected with a similar appetite. Hunters take advantage of this fact by hiding on moonlight nights near one of these clay beds, called *barrieros*, to which the deer and swine come to eat the earth, and the jaguar to secure his prey.

A decided interest is being manifested on the subject of macrobians, or post-centenarians. The *Gironde* speaks of an old woman, Jeanne Dominé, who has just died in Pessac, France, at the age of 105. Easton gives an account of 1712 cases of post-centenarianism as follows: From 100 to 110, 1310; from 110 to 120, 277; from 120 to 130, 84; from 130 to 140, 26; 140 to 150, 7; 150 to 160, 3; 160 to 170, 2; 170 to 180, 3. In the account it is stated that St. Patrick died at 122, Attila at 124, and a certain John Revin and his wife at 172 and 164. Baron Larrey reports thirty-five cases. Prichard cites nine among English emigrants in America of 107–151 years old. The following epitaph appears: "Died at Spanish Town, Jamaica, November 21, 1829, Judith Crawford, aged 151 years. She preserved her physical and intellectual powers until the day of her death. She remembered the earthquake of 1692."

Joseph Bonomi, curator of the Saône Museum, has conceived the idea of using the length of the line which takes in the outstretched arms, in its relation to the height, as a means of identifying soldiers and other persons.

F. W. Unger, in *Mittheil. a. d. Göttinger Anthrop. Ges.*, discusses a number of questions re-

lating to the ancient use of bronze for religious purposes, such as the philology of the word, the allusions to bronze in the Aryan myths, the working of this metal by the Asiatic Mongols, and the connection of cremation with the use of bronze. He concludes that the Aryans, who first introduced a knowledge of bronze into Europe, were also in the habit of burning the dead; but this practice they had in common with the Mongols in their Asiatic home, and it is difficult to determine whether the custom was derived by the Aryans from the Mongols or *vice versa*.

P. de Cessac, "*L. Ambre en France aux temps préhistorique*," affirms, in opposition to M. Schlägintweit, that a great number of repositories of amber and jade are to be found in France, England, Spain, Germany, Switzerland, Italy, and Sicily. He concludes that the origin of prehistoric objects in amber ought to be sought in general in the country where the specimens are met with. M. Cessac has expressed the same opinion with regard to tin, in which the Congress at Stockholm concurred. M. Cessac acknowledged that after a certain epoch amber ceased to be indigenous, and that some countries had the privilege of furnishing the rest of Europe. The question of amber is thus intimately connected with the history of bronze.

M. Pietrement, reviewing a former treatise of M. Sanson, agrees with him that the bones found in great abundance at Solutré are the remains of horses killed in the chase. In this view he disagrees with M. Toussaint, who holds that the horse was domesticated, and slaughtered for food and in sacrifice.

The 11th and 12th parts of the *Matériaux* for 1874 contain an excellent review of the essay of P. Cazalis de Fondouce upon the lacune which has been found to exist between the paleolithic and the neolithic times. The February number of the same periodical contains a complete account, from Mercatus and classic authors, of the so-called *fulgora*, or thunder-stones.

Hyde Clarke, in his *Researches in Prehistoric and Protohistoric Comparative Philology*, quotes from Forbes a striking resemblance between the scape-lama of the ancient Peruvians and the scape-goat of the Jews.

Zoology.—Two English manuals have lately appeared, which are spoken of with approbation in English scientific reviews. One is *Zoology*, by Professor Alfred Newton, the well-known ornithologist of Cambridge. It is one of a series of shilling "Manuals of Elementary Science" published by the Society for Promoting Christian Knowledge. The other work is *The Student's Guide to Zoology*, by Andrew Wilson.

Among short papers we find an abstract of Professor W. B. Carpenter's answer to the question whether the *globigerina*, by the accumulation of whose shells the *globigerina* ooze is being formed on the deep-sea bottom, live and multiply on that bottom, or pass their whole lives in the superjacent water (especially in its upper stratum), only subsiding to the bottom when dead. Professor Carpenter concludes that while these foraminifera live on the surface early in their lives, they sink to the bottom "*while still living*, in consequence of the increasing thickness of their calcareous shells, and not only continue to live on the sea-bed, but probably multiply there—perhaps there exclusively."

In an article in the *American Naturalist* Mr. Packard endeavors to point out that the sponges belong to a class lower than the polyps and jelly-fishes, but higher than the protozoa. In the light of the anatomical investigations of Lieberkühn, Carter, and Clark, and the combined anatomical and embryological studies of Haeckel, Metschnikoff, and Carter, there are no grounds for leaving them among the single-celled animals or protozoa. The single fact that the young sponge is a planula, like the embryo polyp or jelly-fish, enables the naturalist to at once decide that the sponge belongs to a type only less highly organized than the lower polyps, and with perhaps more analogy to the radiates than the protozoa.

It appears that slugs and fresh-water snails are less sensible to the influence of the season than the helix, as the former hide themselves later in autumn, and come forth from their winter sleep earlier in the spring. The young, also, are less sensitive to cold than the old.

In a paper on the large human fluke (*Distoma crassum*), Dr. Cobbold states his belief that the man who suffered from the presence of this parasite had obtained it by eating Ningpo oysters or fish insufficiently cooked. The victim was a resident of the East Indies.

The development of the nemertean worms has always excited much interest among zoologists, owing to the great diversity of the young on being hatched. M. Deser found that in a species studied by him the larva was an oval ciliated worm, which passed without any metamorphosis directly into the adult worm form; but another observer, Krohn, ascertained that a singular being, called *Pilidium* by J. Müller, and regarded by him as the larva of some echinoderm, actually gave rise to a nemertean worm, the latter budding out from one side of the alimentary canal of the pilidium, which is a singular helmet-shaped being found swimming on the surface of the ocean. Now we have fresh information on this subject afforded by the French zoologist J. Barrois. He has discovered a nemertean worm whose larva is intermediate between that of Deser and the pilidium of Müller. He regards the pilidium as the primitive form, while the simple larva of Deser represents a condensed form derived from the former by the abbreviation of the embryogeny. This view seems to us scarcely tenable, however, and we should regard the simple larva of Deser as the most primitive; but this is, of course, a matter purely speculative.

While the nemertean worms are allied to the flat worms, the nematode worms, or round worms, possess a strong human interest, as there are several species which live parasitically in man. Many, however, live free in the sea, and those inhabiting the shores of the Gulf of Marseilles have been studied anatomically and zoologically by M. Marion with some interesting results.

Important papers on insects have been published by Messrs. Scudder, Grote, Morrison, and Chambers, chiefly relating to the butterflies and moths.

The Colorado potato beetle is causing much anxiety in Europe, and entomologists in this country are frequently consulted in regard to the habits and ravages of this dreaded pest. The most important information regarding it is contained in the entomological reports of Mr. C. V. Riley, the State Entomologist of Missouri.

The mode of reproduction of the common eel is a mystery: whether the animal is a hermaphrodite or dioecious has been disputed. Some light has been thrown on the subject by M. Syrski, who believes that the eels are unisexual. He describes the ovaries and testes, but has not yet found any spermatozooids.

Agriculture and Rural Economy.—The much-discussed question of the influence of forests upon rain-fall has lately been made the subject of very interesting observations by Faurat and Sartiaux in France. Instruments for determining the amount of rain-fall, degree of saturation of air (by moisture), evaporation, and temperature, were placed at an elevation of about six meters (18½ feet) above the tops of trees—oak and beech—in the midst of a forest covering 5000 hectares (12,350 acres). At the same elevation, fourteen or fifteen meters above the surface of an adjoining portion of cleared and cultivated land, and at a distance of 300 meters (984 feet) from the edge of the forest, similar instruments were placed, and simultaneous daily observations made. The first report of these, from February to July, 1874, inclusive, showed, for the period of six months, a total rain-fall over the forest of 192.5 millimeters (7½ inches), while that over the open ground was only 177 millimeters. The average for each of the six months was larger over the forest than the cleared land. The same was true of the degree of saturation of the atmosphere, the monthly average in the one case being 63 per cent., and in the other 61.7 per cent.

The authors conclude that if the daily observations in the future accord with those already made, it may be regarded as demonstrated that forests form vast apparatus for condensation of moisture, and that there is more rain upon them than upon open land.

The natural processes by which nitrous and nitric acids are formed are of great importance in agriculture, since these, with their ammonium compounds, as they occur in the atmosphere and in the soil, are sources of a large portion of the nitrogen needful for vegetation. Carius has published the results of investigations upon this subject, which he considers as disproving the theory that ammonium nitrite is formed by the evaporation of water in the air, while the agency of ozone in the formation of nitrous and nitric salts is conclusively shown.

The author regards the known processes by which these acids are formed in nature as reduced by his researches to the following five: A. From free nitrogen, (1) by electric discharges in the air, (2) by oxidation of other bodies in the air. B. From the oxidation of ammonia, (1) by electrical discharges, (2) by presence of alkaline substances, (3) by ozone.

It may be further noted in this connection that Boettger has shown by a very neat experiment that ozone is produced when pure oxygen and hydrogen unite to form water.

The advantage of bringing manures into the lower strata of the soil, instead of merely applying them to the upper portion by spreading and harrowing in, is quite strenuously insisted upon by many agricultural chemists and practical farmers in Europe, though the practice finds less favor in this country. Dr. Funke, of the Agricultural School in Hohenheim, in Germany, has devised an implement for subsoil manuring, and

has used it for the application especially of commercial fertilizers. He has performed quite a number of experiments to test the comparative effects by subsoil and surface manuring on potatoes, turnips, barley, wheat, oats, lucern, and other crops, with results almost uniformly in favor of the deep manuring.

Experiments are being continually made in the German experiment stations to determine from what ingredients of the food of the animal the fat of the body is formed. It has long been known that in many cases the fat in the food is insufficient to account for that in the body. Liebig advanced the view that in such cases the carbo-hydrates are the sources of fat. This has been supported by Dumas, Milne-Edwards, Bous-singault, Lehmann, Grouven, Lawes and Gilbert, Pasteur, and others. Voit, however, advanced the hypothesis that the sources of animal fat, other than the ready-formed fat of the food, are the nitrogenous constituents of the food, and not the carbo-hydrates. This view has been confirmed not only by experiments of Voit and Pettenkofer with the respiration apparatus, but also by researches of Kuehn, Slohmann, Bauer, Fleischer, and others. Weiske and Wildt have lately reported investigations upon this subject. It was the opinion of Weiske that in the *carnivora* the fat stored up in the tissues may be derived partly from the ready-formed fat, and partly from the albuminoids of the food. To determine whether the same was true of the *omnivora*, quite extensive experiments were made with young pigs. The results, though not conclusive, made it appear probable that fat was produced from the nitrogenous materials of the body.

A new antiseptic, which may become of use in preserving milk, has been proposed by Kolbe and Von Meyer. It consists of salicylic acid, which, as is well known, may be prepared by the direct synthesis of carbonic acid and carbonic acid, and is likewise readily decomposed into these substances. Fresh milk treated with 0.04 per cent. of salicylic acid was found to remain sweet thirty-six hours longer than when left under like circumstances without the acid. Neither the taste nor the healthiness of the milk appeared to be impaired by the addition of even larger quantities of the acid. The same material was found to prevent fermentation, and to arrest it when already begun in a large number of materials, as beer, urine, sugar, etc.

Engineering and Mechanics.—In last month's summary of *Engineering* news we omitted to mention the fact that the plans of Captain Eads for the improvement of the navigation of the Mississippi had been definitely approved by Congress before adjournment. From present indications this important work will shortly be inaugurated, Captain Eads having, according to report, closed a contract with a Pittsburg contractor for the construction of 350,000 cubic yards of fascine-work and 100,000 cubic yards of stone-work at South Pass, together with a large amount of timber-work, piles, etc. As we have already described in these columns the nature of these projected improvements, the same need not be alluded to in this place.

On the 27th of April a committee of the City Council of Philadelphia, to which the subject had been referred, reported with a favorable recom-

mentation an ordinance granting the right to the "Philadelphia Pneumatic Railway Company," incorporated by enactment of the late Legislature, to construct, operate, and maintain a railroad with one or more tracks, to be located beneath the surface of Broad Street, and to extend therefrom to the dépôts of the North Pennsylvania, Philadelphia and Reading, and Philadelphia, Wilmington, and Baltimore Railroad companies. The purpose of the company, as expressed in the ordinance, is to improve and increase the facility, rapidity, and convenience of transit between the business centres of Philadelphia and the various railroad dépôts in the northern and southern districts of the city. The proposition of the company has met with some adverse criticism from the local press, but, if properly carried out, will doubtless realize its professions of public utility.

From the best sources of information at command we learn that up to the middle of April there have been constructed during the year 1875 in the United States 183 miles of new railroad. For the corresponding period of 1874 the figures were 303 miles; and for 1873, 535 miles.

From abroad we have the report that the Campagna drainage scheme of General Garibaldi, which upon its announcement was looked upon as somewhat chimerical, has secured the indorsement and co-operation of Prince Torlonia, whose name will be recalled by engineers in connection with the gigantic undertaking of draining Lake Fucino. He is now, if report is correct, about to undertake the drainage of Lake Trajan. The experiment of introducing the malaria-tree (*Eucalyptus globulus*) on a large scale is likewise said to be seriously contemplated, although the experiments already made in Italy have not proved satisfactory.

Concerning the Channel Tunnel project, the following official announcement, just made, will be of interest: "It has been agreed between Her Majesty's government and the French government that a joint commission of representatives from each country should be appointed to consider and report upon the scheme for the construction of a submarine tunnel under the Channel, so far as the same may affect the interests of either government."

The Panama Canal Surveying Expedition, under Commander Lull, U.S.N., has completed its labors and returned. The party began the survey on the 20th of last January, and finished the same on the 3d of April. Published accounts represent the results of the expedition to have been of the most satisfactory character. The canal route proposed between Panama and Aspinwall is about forty miles long, and is ten miles shorter than the railroad between these points. The main difficulty experienced by the engineers is reported to have been in locating the feeder from the river Chagres to the canal, which was satisfactorily overcome. It is certainly to be hoped that these announcements will prove to be reliable, but in connection with this vexatious question it is at least noteworthy that, after so many expeditions up and down the isthmus, the route now most favorably spoken of should be between the two points of the region with which engineers have been for twenty-five years quite familiar.

The recent diplomatic conference on the metrical system arranged for the organization of an international bureau of weights and measures at Paris.

An international telegraphic conference has been convoked to meet in St. Petersburg on the 1st of June. Twenty-four states and twelve cable companies have promised to send representatives. It is reported that a proposition will be discussed making telegraph lines neutral objects in time of war, and not liable to interruption. The main object is to frame a new international telegraphic convention.

During the past month the Executive Committee of the United States Centennial Commission agreed upon and published the system of making awards which is to be followed at the coming Exposition. While upon this subject it may be remarked that the representatives of the Chilean government in this country are striving energetically to secure a full exhibition of American industries at their forth-coming exhibition. The Chilean government has made liberal appropriations of money in behalf of the enterprise. The Exhibition will be formally opened at Santiago on September 16, 1875.

An Imperial German Exhibition, to be held at Berlin in 1878, is suggested as among the possibilities.

Monthly Report No. 6 of the Bureau of Statistics is at hand, from which the following figures, which represent our foreign trade for the year ending December 31, 1874, have been obtained and compared with those of the preceding year, viz.:

Year ending	Imports.	Domestic Exports. Specie Value.	Foreign Exports.
Dec. 31, 1874.	\$577,369,711	\$620,473,735	\$22,125,893
Dec. 31, 1873.	624,997,487	606,361,988	24,968,204

The figures of our imports of iron and steel for the last year show an enormous falling off from those of 1873.

The building of the three additional iron steamships for the Pacific Mail Steam-ship Company is progressing favorably at the Chester Works. Though smaller in size than their huge predecessors, the *City of Tokio* and *City of Peking*, they will be fully equal to them in quality. They will be similar in build and capacity, and will each have a tonnage of 3500 tons, an extreme length of 352 feet, and breadth of beam of 40 feet. The first of these vessels, it is reported, will be launched some time during the month of May.

According to the statement of Professor Lesley, director of the Geological Survey of Pennsylvania, at the recent meeting of the National Academy, the surveying parties meet with great opposition in the oil and coal regions of the State.

In *Technology* we may record the announcement of another direct process for the manufacture of wrought iron by Kazet, which is described as being a modification of Siemens's direct process, the modification consisting in effecting the reduction of the bath of molten ores in the Siemens furnace by carbonic oxide, or other reducing gases, thus involving no gasification of the carbon, and consequent loss of heat, at the time of reduction.

Among recent *Mechanical* novelties we may note the invention by M. Henri Giffard, of injector fame, of a railway carriage the body of which

is so supported on springs that all oscillation and jarring are obviated, and the passengers within are enabled to employ themselves at pleasure without inconvenience. One of these carriages is now in use on the railway between Paris and Lille, in France.

A steam hill-climber of novel construction has been built for use on Ithaca Hill, New York. The incline has five tracks. In climbing, the engine rests upon a somewhat elevated pair of rails just within the usual track, and upon a set

of small driving-wheels, which are upon the same axles as the large drivers. The fifth rail, located in the centre of the track, is a wide cogged rail, the teeth of which fit accurately into those of a cog-wheel under the centre of the engine, and between the small drivers. The locomotive is called the "Leviathan."

Large numbers of kangaroos are yearly slaughtered in the Australian colonies for their skins, which are declared by experts to make an exceedingly tough and pliant leather.

Editor's Historical Record.

POLITICAL.

OUR Record is closed on the 24th of May.—The resignation of Attorney-General Williams has been accepted by the President, taking effect May 15. Judge Edwards Pierpont has been appointed his successor.

An important bill was passed by the New York State Senate, April 23, and by the Assembly, May 7—only one negative vote being cast in either House—providing for the suspension of delinquent State officers by the Governor, and for their removal, upon conviction, by the vote of a majority in the Senate.

Two judges in North Carolina—Brooks and Dick—have in recent charges to Grand Juries declared the criminal features of the Civil Rights Act unconstitutional, "as no law could say that men are socially equal."

The Lower House of the Prussian Diet has passed the bill abrogating those clauses of the constitution which allow the independent administration of ecclesiastical affairs, the unimpeded intercourse of religious bodies with their superiors, and freedom of clerical appointments. The bill for the suppression of religious orders had its first reading May 7. The Upper House of the Diet, May 22, passed the bill abrogating those articles of the constitution which had been already abrogated by the Lower House.

The Belgium Tribunal at Liege has dismissed the charges brought against Duchesne of plotting to assassinate Prince Bismarck.

MISCELLANEOUS.

A telegram from London dated May 3 announced the arrival of the schooner *Jefferson Borden* from New Orleans, with the following report from the captain: "Crew mutinied, first and second mates killed, two sailors wounded and put in irons, one sailor wounded and chained to the pump, and another dying; vessel worked by three hands." The mutiny occurred when the vessel was eighteen days out. Captain Patterson and his officers fought the mutineers with revolvers and knives. In the struggle the first and second mates were killed. The mutineers were secured and held in irons, two of them being seriously wounded.

The Centennial anniversary of the capture of Fort Ticonderoga by Colonel Ethan Allen was celebrated May 10. Orations were delivered by Colonel William E. Calkins and the Rev. Flavius Josephus Cook.

At Charlotte, North Carolina, on the 20th of May, there was a very enthusiastic celebration of

the Centenary of the Mecklenburg Declaration of Independence. Addresses were made by ex-Governor Graham, Judge John Kerr, and the Hon. John Bright.

DISASTERS.

April 23.—Three steamers burned at the New Orleans levee. Fifty lives sacrificed.

April 26.—Collision on the Baltimore and Potomac Railroad, near Washington. Many of the employés and passengers injured.

April 28.—Destructive fire at Oshkosh, Wisconsin. A square mile of the city laid in ruins. Explosion of a powder magazine, and several lives lost. Loss over \$2,000,000.

May 20.—Fire at Osceola, Pennsylvania. Two hundred and fifty houses destroyed. Loss over \$2,000,000.

May 1.—Explosion at Bunker Hill Colliery, North Staffordshire, England. Forty-one lives lost.

May 7.—Wreck of the steam-ship *Schiller*, in a fog, on the Retarriere Ledge, near Bishop's Rock, Scilly Islands, off the Cornwall coast. She belonged to the Eagle Line, and was bound to Hamburg from New York. Three hundred and eleven persons drowned, including the captain, John G. Thomas.

OBITUARY.

April 28.—In Brooklyn, New York, Mrs. Sarah G. Conway, manager of the Brooklyn Theatre, and an actress of excellent repute, aged forty-one years.

April 30.—At Bay View, Long Island, Oliver Charlick, formerly partner of George Law, and for many years president of the Long Island Railroad, aged sixty-five years.

May 17.—In Lexington, Kentucky, John C. Breckinridge, formerly Vice-President of the United States, and during the rebellion a general in the Confederate army, aged fifty-four years.

May 20.—In Baltimore, Maryland, the Hon. Jesse D. Bright, for three terms United States Senator from Indiana, aged sixty-three years.

April 27.—In England, W. Winwood Reade, nephew of the novelist Charles Reade, and well known as the author of various African travel sketches.

May 5.—Intelligence from London of the death of Heinrich George August Ewald, a celebrated German philologist, theologian, historian, and political reformer, aged seventy-two years.—From Paris, intelligence of the death of Michel Levy, the well-known Parisian publisher.

for brute courage leads him to a hero worship at some shrines where we decline to pay reverence with him. But his pictures of this early life, if read with some reasonable allowance for his peculiar infirmities of vision, are very graphic; his jagged but vigorous style fits well his

theme; and though some question has been made of his accuracy in matters of detail, his pictures as a whole we judge to be true to life as well as life-like. With these sketches are bound up an essay on the portraits of John Knox, with six illustrations.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—May has passed without the discovery of new asteroids or comets. It has, however, been shown that the asteroid discovered by Perrotin, April 28, was one already known.

Some accounts have reached us of the results of the observations made in Asia during the eclipse of the sun on the 6th of April. A writer in the London *Times*, commenting upon these observations, states that the results are well worthy of the time, labor, and thought which have been lavished on the whole attempt. Evidence of the highest importance bearing upon the general nature of the spectrum of the coronal atmosphere in its upper region has been obtained. He thinks that there is plausible evidence to sustain the theory that there is something at the sun like an envelope or atmosphere of hydrogen, something that is cooler, something whose spectrum is confined to the higher levels of its own atmosphere, and which will not appear lower down because the compound molecules which form it will be broken up by the higher temperature of the subjacent regions.

Professor Bruhns has investigated the question whether the comet discovered by Pogson at Madras on the 2d and 3d of December, 1872, was really Biela's comet. As has been maintained by Oppolzer and others, he concludes that it was a new comet, having no connection with Biela's, nor with the shower of shooting-stars of the 27th of the preceding November.

The new method of computing the special perturbations of the asteroids, proposed a year ago by Gyldin, has been applied by Boeklund to the preparation of tables of the asteroid Iphigenia.

Meteorology.—Dr. Hildebrandsson, of Upsala, has published the results of a careful study of the observations of cirrus clouds. Having secured by personal correspondence a number of careful observers throughout Europe, he has compared the observed movements of the cirri with the prevailing clouds and isobars at the surface of the earth. He finds that the cirrus clouds, in a large majority of cases, flow out from areas of low barometer, and in toward areas of high pressure, and, as he succinctly expresses it, the movement of these clouds is toward a point some distance to the right of that toward which the lower clouds move. We had occasion a few years ago to announce precisely the same law, as deduced by Professor Abbe for the United States. It would seem, therefore, now to be a law applicable to the whole of the northern temperate zone, and is entirely in accordance with the mechanical theory developed by Mr. Ferrell in a memoir published in 1860.

Quetelet, from an examination of forty years' observations of the temperature at Brussels,

finds that "the cold days of May" actually exist, giving rise to a well-marked depression, so that the five days from the 6th to the 10th inclusive averaged at Brussels a temperature of 80.3°, but the five days from the 11th to the 15th inclusive averaged only 77.6°.

A continuous self-registering thermometer, invented by Mr. Cripps, was recently presented to the Royal Society. The peculiarity of its construction consists essentially in that the movement of the mercury in the tube of the thermometer disturbs the position of equilibrium of the whole instrument, inasmuch as it is delicately poised on two pivots. This movement, which is due essentially to the force of gravity, is made serviceable for moving the register.

The awkwardness of employing positive and negative numbers in meteorological calculations respecting temperature of the air has led the director of the Copenhagen Meteorological Institute to propose that, instead of the negative numbers, we employ their complement with respect to 100. Thus, instead of -5° , we should say $+95^{\circ}$. This system has special convenience when the averages of a long series are to be taken; but we are not aware that any body of meteorologists has as yet reported in favor of its general adoption.

The sad result of the balloon voyage from which Tissandier alone returned alive has led De Fonvielle to try several experiments on the occasion of a recent ascent. Three persons were with him, and their voyage lasted six hours; the maximum altitude was 12,000 feet, the ascent being very gradual. A number of cages containing small birds and guinea-pigs were taken along, and it was found that one of these animals, having been for a time exposed to the flow of gas escaping from the balloon, died of suffocation, suggesting the probability of the hypothesis previously advanced by De Fonvielle, that Tissandier's companions lost their lives from similar causes. Four different banks of clouds were found above Paris. The effect upon the aeronauts of the rarefied air was very trifling, and he remains of the opinion that ascents may be conducted gradually to immense altitudes.

Considerable progress in *Physics* has been made. Arzberger and Zulkowski have proposed a new form of water air-pump, founded on the principle of the increased flow of liquids caused by an ajutage like an inverted frustrum of a cone. By a lateral opening, water, under considerable pressure, enters a small cylindrical box, upon the top of which is the air tube, entering about half-way, and narrowing to a point. This enters and opens into the narrow end of a slightly conical tube called the diffuser, which projects several inches below the box, and by which the water issues. The supply of water

must keep the tube full, and as it widens downward, there is an exhaustion. With 585 mm. of mercury pressure of water, the barometer standing at 735 mm., the vacuum produced was 724 mm., and the consumption of water three liters per second. No fall of water is necessary, the pressure being all-sufficient.

Rood has described in full the important modifications he has made in Zöllner's horizontal pendulum, and has given the extraordinarily delicate measurements he has made with it. The mean probable error of the average result of four sets of observations made with the apparatus is one-tenth of a scale-division, corresponding to less than one-thirty-six-millionth of an English inch! Rood purposes to use this remarkable instrument for the purpose of studying minute changes, otherwise inappreciable, in the dimensions of solid bodies under various conditions.

Lecoq de Boisbaudran has shown that very low temperatures may be produced by means of the ammonia ice-machine of Carré by taking suitable precautions. If during the cooling the heater be surrounded with ice-water, or, still better, with a freezing-mixture, it is possible to obtain, even with a small machine holding only half a liter, the rapid solidification of several kilograms of mercury. After the freezing of nearly five kilograms of this metal in a solid cylinder, the temperature within was found to be -48° . If ice and salt be added to the water in which the condenser is placed during the heating, it is not necessary to raise the temperature of the heater so high by ten or fifteen degrees.

Violle has called attention to the thermodiffusion experiments of Peddersen and Dufour (which are properly such, since the diffusion of a gas through a porous diaphragm causes a rise of temperature on the side of the entering gas, and a difference of temperature on the two sides of such a diaphragm causes a diffusion of gas) in order to explain an experiment of Dufour's, in which he used air in different hygrometric states on the two sides of the diaphragm, and observed the diffusion. Violle believes that the true explanation of this result is to be found in Merget's experiments, in which a porous cell, filled with pumice in fragments, and closed by a cork through which a tube passes, the whole being well moistened, develops, when exteriorly heated to a dull red heat, simply from the surface evaporation, a pressure of air in its interior of three atmospheres. Experiments of his own show how extremely sensitive is this apparatus to changes of temperature. The practical importance of these facts is very great. Our clothes, the stones of our houses, the very soil itself, when heated after previous moistening, act exactly like the apparatus of Merget, with an activity truly surprising. In animals this gaseous movement plays its part in respiration; but in plants, especially in aquatic plants, it is seen in full activity, *Nelumbium speciosum*, for example, throwing from its stomata half a liter of air per minute, solely through this action going on in the leaves.

Wright has published a preliminary note on the spectroscopic examination of gases from a stony meteorite which fell in Iowa last February. The small grains of iron which it contained yielded several times their volume of gas, even on raising the temperature but slightly. Of this gas the two oxides of carbon constituted for-

ty-nine per cent. (carbonic acid thirty-five, and carbonic oxide fourteen), the remaining fifty-one per cent. being hydrogen. The spectrum exhibited, the gas being under only a few millimeters pressure, was that of carbon, especially the three brightest bands in the green and blue. This fact is especially significant when we remember that these are precisely the bands observed in cometary spectra, the close connection of meteors and comets being well established.

Pickering and Williams have investigated the foci of lenses placed obliquely, from which it appears that even the most carefully corrected lenses may still be defective in this respect. In a photographic camera, for lines passing through the axis, the surface, instead of being plane, should have a radius of curvature of only 0.3 the focus, while for lines perpendicular to these the curvature should be 0.7 the focus. Curiously enough, the actual curvature in the normal eye is about 0.5, or the mean of the above numbers.

Jacques has determined, in the laboratory of the Massachusetts Institute of Technology, the percentage of light transmitted through glass plates placed both perpendicularly and obliquely to the ray. The plates were ordinary window-glass carefully cleaned. The original light being 100, one plate transmitted 89.5 per cent., four plates 69.3 per cent., seven plates 55 per cent., and ten plates 45.3 per cent. When the plates are oblique to the ray, the amount transmitted by one plate decreases rapidly with the obliquity, while with ten plates it actually increases until the obliquity reaches 55° .

Vogel has proposed a simple form of camera for spectrum photography, which consists simply of a box, in one side of which is fixed, by means of a cork, a pocket spectroscope. With this instrument a picture of the solar spectrum from H to D was taken on silver bromide mixed with naphthalin-red in three minutes.

Terquem and Trannin have described a new and convenient form of apparatus for piercing glass by the electric spark.

Rosetti has investigated the action of the Holtz machine, and finds that it follows the law of Ohm completely, but that the electromotive force and the resistance are enormous. In his instrument the electromotive force was 57,000 volts when the atmospheric moisture was 0.35, and the resistance, with two turns per second, 2,680,000,000 ohms. From his experiments he deduced 428 as the mechanical equivalent of heat.

Tommasi states the curious fact that if a current of steam, under a pressure of five or six atmospheres, be blown through a copper tube two or three millimeters in diameter coiled in a helix about an iron bar, the bar becomes a magnet, and remains magnetized so long as the steam passes.

Rowland proposes the use of a very small electro-magnet placed upon the stage of the vertical lantern for showing diamagnetic experiments, and shows by theory that there is no advantage gained by the use of a larger apparatus.

Ducretet has noticed a remarkable property of aluminum when conveying a current. If in a voltmeter one of the electrodes be aluminum, the other being of platinum, the former being negative, water is decomposed, hydrogen is set free at the aluminum surface, and oxygen at the platinum, the current passing freely. But if the

aluminum electrode be made positive, no action takes place, and no current, or a very feeble one, passes. In the first case an electric bell in the circuit rings violently, in the second not at all. It is proposed to call a voltmeter thus constructed a rheotome. It is doubtless capable of many useful applications.

Beetz has succeeded in producing magnets by electrolysis, the iron having in one case a magnetic moment per gram of 59, and in another of 214.

Herwig has observed that the extra-induced currents in iron wires are of remarkable intensity, and supposes it to be due to the transversal demagnetization of the iron.

Barker has described a new and convenient form of lecture galvanometer based on the vertical lantern. Above the horizontal condensing lens of this lantern is the upper needle, suspended by a filament of silk. To this a second needle is attached by means of an aluminum wire passing through the condenser and the mirror. The second needle swings in a coil placed beneath the inclined mirror. Any current in this coil deflects the lower needle, and, of course, the upper one also. This latter only appears on the screen, together with the graduated scale beneath it.

In *Chemistry* the month has produced many new discoveries. Volhard has aided analytical processes by describing a new swimmer for burettes, a new form of ammonia apparatus, and a new calcium chloride tube for organic analysis.

Hübner has shown that benzoic acid will set nitrobenzoic acid free from its salts. As the latter is the stronger acid, the fact is an important one in chemical dynamics.

J. L. Smith has discovered, in investigating the anomalous fact that while ferric oxide as ordinarily precipitated and dried is not magnetic, the oxide thrown down from solutions of meteorites is invariably magnetic, that any solution of iron containing nickel, cobalt, or copper gives a precipitate of ferric oxide which becomes magnetic on drying. The exact cause of this action is obscure. Chandler suggests the formation of a saline oxide, analogous to the magnetic oxide of iron, with these metals.

Weith has shown that, by the action of ammonium chloride on methyl alcohol, there is produced both tri-methyl-amine and tetra-methyl-ammonium, the whole of the chloride being thus converted. Renard has made some experiments on the action of electrolytic oxygen upon methyl and ethyl alcohols. Using five Bunsen elements, and 100 cubic centimeters of ethyl alcohol acidulated with five per cent. of a dilute sulphuric acid, the action being continued for forty-eight hours, he succeeded in proving the presence in the liquid of methyl formate, aldehyde, ethyl acetate, acetal, and a new body, ethylidene monoethylate. It is acetal in which ethyl is replaced by hydrogen. Sulphethylic acid was also produced in the electrolysis. Methyl alcohol thus treated yielded carbon dioxide and methyl oxide gases, besides methyl formate, methylal, and methyl acetate.

Von Zotta has examined more closely the production of glyceric oxide by the action of calcium chloride on glycerin. The product is an oily liquid of specific gravity 1.16, converted into glycerin again on boiling its aqueous solution.

Claus has discovered in the alizarin paste of

commerce a peculiar substance which dissolves to a blood-red liquid with alkalies. It crystallizes from acetic acid in large dark brown needles with a bronze lustre. At 305° to 310° C. it sublimes, and condenses in orange needles. On examination it proved to be the dioxyquinone of chrysenes, *i. e.*, the alizarin of chrysenes. Hence Claus gives to it the name chrysezarin.

Hesse has given some simple methods of testing the cinchona alkaloids. He distinguishes quinidine from quinine, cinchonine, and cinchonidine by means of the behavior of water and ammonia with their iodhydrates. If to half a gram of the salt to be tested ten cubic centimeters of water be added, the whole warmed to 60° C., and half a gram of potassium iodide be added, allowed to cool, and after the lapse of an hour filtered; then, if the quinidine be pure, no turbidity results on adding a drop of ammonia. A precipitate under these circumstances proves the presence of one of the other three alkaloids.

Howard has made an examination of the bark known as *Cinchona pelleterana*, in order to prove finally the existence or non-existence of the alkaloid aricine. His results confirm those of other observers, and point strongly to the existence of aricine as a distinct alkaloid.

Boehm has studied the decomposition which marsh and water plants undergo under water. He finds that the butyric fermentation takes place, that carbon dioxide and marsh gases are evolved, and that the liquid becomes alkaline from the evolution of ammonia. A partial conversion into peat is finally observed.

Gerber has described a new and more accurate method for the analysis of milk, by which he obtains some very satisfactory results.

Gautier, by dissolving fresh blood-fibrin in a solution of sodium chloride and dialysing, has obtained a solution which coagulates by heat, and exhibits nearly all the properties of albumin.

Geology.—In a recent number of the Bulletin of the Geological Society of France, M. Michel-Lévy gives the results of investigations made by him on the acidic class of rocks, *i. e.*, those which contain a considerable amount of free silica. He claims that from the oldest granite to the recent trachytes, through the porphyries, there is a regular transition in their condition as to crystalline texture. This is, according to him, so marked that it is safe to affirm an immediate connection between the age of a given rock of this class and its crystalline or semi-crystalline character. The distinctions are based principally upon the minerals constituting the paste or mass of the rock, and its condition, whether fully crystalline, partially so, or, on the other hand, glassy and vitreous, and also whether it shows a globular or spherulitic structure.

The record for *Geography* since our last summary is limited principally to the departure of the British arctic expedition, which had occupied public attention to so great a degree for several months past. The vessels composing it left on the 29th of May, with the best wishes of the world for a successful result. At one time it was supposed that a German and possibly a French expedition would take part in the exploration, attempting to reach the same goal by a different route. Apparently, however, this has been given up for the present, we hope to be renewed another year.

Various parties of the United States government are now in the field engaged in their summer's work. That of Lieutenant Wheeler is on the largest scale, consisting of several divisions, one working on the coast of California, another in New Mexico and its vicinity. Each division consists of several parties, all properly provided with topographers, naturalists, and other scientific aids. One of the California parties will spend part of the summer on the coast of South California, in the vicinity of Santa Barbara and Los Angeles, and probably include the adjacent islands in the research.

Dr. Hayden's survey will be continued in Colorado, and that of Major Powell in Utah. With a view of determining the actual value of the Black Hills as a region for settlement, and especially as to the alleged existence of gold in large quantity, the Interior Department has sent out a party under Professor Janney for the purpose of investigating the geological structure of the region. A suitable escort has been provided for this party, which, it is understood, is about entering upon its mission, although so far nothing has been heard of the results.

The United States steamer *Saranac* left San Francisco on the 5th of June on a cruise to Alaskan waters. She took as passengers Lieutenant Maynard, of the Navy, and Dr. Emil Bessels, of the former *Polaris* expedition. Lieutenant Maynard had charge of the completion of the investigation ordered by Congress in regard to the relations of the Alaska Commercial Company to the Indians and to the fur trade generally; while Dr. Bessels, under the direction of the Indian Bureau, went especially on an ethnological mission, his object being to study the character of the Esquimaux of the Pacific coast as compared with those in Greenland, and for the better preparation of a memoir to form part of the report on the *Polaris* expedition. He also intended to embrace the opportunity for collecting specimens illustrative of the manners, customs, and characteristics of the Esquimaux, the Aleutian Islanders, and the Indians generally, with special reference to their forming part of the grand ethnological exhibition at the Centennial. The *Saranac* was wrecked, June 18, in Seymour Narrows, becoming a total loss. No lives were lost.

Ethnology.—The importance of a proper exhibition of ethnological objects at the Philadelphia Centennial has induced special effort on the part of the Indian Bureau and of the Smithsonian Institution, charged with the duty of rendering this display complete. The members of the Indian service have been directed by the Commissioner of Indian Affairs to make an exhaustive collection of every thing illustrating the life and character of the respective tribes, and it is expected that, with the objects already in the National Museum, this portion of the exhibition will be extremely full.

It is proposed, should Congress hereafter furnish the means for it, to make the Centennial the occasion of a display of the living tribes of the North American aborigines, to consist of a family, or four or five individuals, of most of the principal races, male and female, and of different ages—perhaps twenty groups in all—who will be assigned a special reservation in the Philadelphia Park, and be established as nearly as possible in their natural surroundings, in the way of

dwelling, household effects, articles of dress, etc. This, if it can be carried out, will be an extremely interesting display, but will require an appropriation from Congress for the purpose. It is, however, probable that Dr. Bessels will bring or send down representatives of such tribes as can not be reached in time should Congress make the appropriation next winter.

A very important research is also in course of prosecution, under the auspices of the Smithsonian Institution, on the coast of South California, where Mr. Paul Schumacher is engaged in disinterring remains of a prehistoric age, and obtaining large numbers of very remarkable objects.

An extremely interesting addition to the archaeological treasures of the National Museum consists of a collection of objects of stone lately received by the Smithsonian Institution from Porto Rico, the bequest of Mr. George Latimer, a well-known American citizen in that island.

Microscopy.—We note in the *Monthly Microscopical Journal* for May the completion of the excellent series of papers by Messrs. Dallinger and Drysdale, entitled "Researches into the Life History of the Monads." Five different forms of these have been thoroughly studied, and they name them respectively the *cercomonad*, the *springing monad*, the *uniflagellate*, the *biflagellate*, and the *calycine*, the latter so named from its peculiar calyx-like form. The authors state that the complete detail in the development of these monads was only successfully compassed by the one-twenty-fifth and one-fiftieth of Powell and Lealand, with diameters ranging from 2500 to 5000. They express a complete distrust of all observations founded on successive "dips" in a quickly changing organic infusion, and put no faith in observations of this sort, and not conducted on the plan of keeping the same drop under continuous observation during all alleged transformations. From their own observations on these lowly forms they are constrained to say "that not the slightest countenance is given to the doctrine of heterogenesis. On the contrary, they find the life cycle of a monad to be as rigidly circumscribed within definite limits as that of a mollusk or a bird. The heating experiments uniformly proved that the spores resulting from sexual generation have a power of resistance to heat over the adult which is greater in the proportion of eleven to six on the average—the very essence of the question of biogenesis versus abiogenesis—some of the spores resisting 88° F. above the boiling-point of water. This result agrees with the experiments of Dr. W. Roberts, and later of Huitzinga, who could not destroy the bacteria or their germs by boiling for half an hour under a heat of 230° F."

Among the additions to *Zoology* during the past few weeks are some results obtained by further dredging expeditions on the coast of New England, carried on under the auspices of the United States Fish Commission. During the summer of 1874 Professor S. F. Baird, United States Commissioner of Fish and Fisheries, established the head-quarters of the Commission at Noank, Connecticut. The results worked out by Professor Verrill (and published in the *American Journal of Science and Arts*), who had charge of the exploration, show that over one hundred species new to the fauna of Southern New England were secured. In September of the same year

the Superintendent of the United States Coast Survey offered Professor Baird the use of the steamer *Bache* to continue the dredging operations of the coast of Maine carried on so successfully the previous year. Dr. Packard took charge of the work, with the assistance of Messrs. Rathbun and Cooke. Dredgings were made at about forty stations in the Gulf of Maine at different depths down to 125 fathoms. The results were worked up by Professor Verrill. A new star-fish, a species of *Asterina*, and several new polyzoa were obtained.

Dr. Leidy has identified the *Ascaris mystax* as an intestinal worm of a Bengal tiger. This worm has also been found in the lion and domestic cat. A long thread-worm from an apple was found by Dr. Leidy to be the *Mermis acuminata*, a species that is parasitic in the larvæ of many insects, including the codling-moth of the apple.

Under the caption, "Biographies of some Worms," the *American Naturalist* publishes an article giving the life histories of the most important parasitic worms, such as the flukes, tape-worms, and round worms. The chapter on the development of the rotifers is condensed and translated from an essay on the development of *Brachionus* by Dr. Salensky. It is the first rotifer whose embryology has been studied. Salensky finds that the earliest stages are much as in certain gasteropods. Though the paper appeared in 1872, this is the first time that an abstract has appeared in English.

A brief account of the fresh-water leeches of North America, by Professor A. E. Verrill, appears as an appendix to Professor Baird's report on the fresh-water fisheries of the United States.

In the same volume is an illustrated article, by Mr. S. I. Smith, on the fresh-water crustacea of North America. Both of these papers will be very useful to students.

It appears that the males of a nematode, or round worm, are very much smaller than the female, and make their way into the so-called uterus of the latter, where they live as parasites. This discovery, made by Leuckart, is confirmed by Bütschli.

Mr. Bundy writes to the *American Naturalist* that the Colorado beetle, or *Doryphora*, was last summer destroyed in great numbers by the rose-breasted grosbeak in Wisconsin.

The *Caloptenus spretus* is occasioning much alarm in the Western States, particularly Nebraska, Kansas, and Colorado, as well as Missouri. The idea that this locust swarms down from the valleys of the Rocky Mountains may be questioned, as it occurs each year only too abundantly in the Northwest and Western States beyond the Mississippi River, and occurs also in the Northern New England States, but a little smaller and with shorter wings than in the Rocky Mountains. The red-legged locust of New England is more abundant on highlands and mountains than near the coast.

The "Buffalo gnat," so destructive to cattle during the past spring in Tennessee, is a species of *Simulium*, allied to, but much larger than, the black-fly of the Northern woods and Labrador. The editors of the *American Naturalist* received it several years since from Illinois, with the statement that it killed horses. It is allied also to the celebrated Columbatschian fly of Hungary,

which is so deadly at times to cattle. The larva of the black-fly lives in the water.

Botany.—M. Woronin, of St. Petersburg, recently read before the Society of Naturalists of that city an account of some investigations in relation to the cause of the disease known as club-foot, found in the roots of different species of cabbage and turnip. The disease, which is common in England and some parts of America, has but just made its appearance in the neighborhood of St. Petersburg. It has generally been attributed to the sting of some insect, but M. Woronin asserts that he has discovered it to be owing to the presence of a vegetable organism hitherto unknown, resembling in some respects the *Myxomycetes*, in others the *Chytridinae*. M. Woronin waits for further study before giving a name and systematic position to this new plant.

In *Botanical Necrology* we have to mention the death, May 10, at Antibes, Alpes-Maritimes, France, of Gustave Thuret, the most distinguished of French phycologists.

The subject of *Pisciculture* continues to attract public attention, numerous reports having been made by the State bodies since our last in reference to the subject. Among these we may mention the report of the Canadian government for 1874, and those of New Hampshire, New York, Massachusetts, and Connecticut. Operations looking toward the multiplication of the fishes of the United States have already been commenced, the United States Commissioner having been engaged for a month past in the rivers of North Carolina, Virginia, Maryland, and the District of Columbia in hatching shad and in turning the fry into the waters, as also in shipping a portion to localities destitute of them. The States of Maryland, Delaware, and New York are also engaged at the present time in a similar undertaking.

Mr. Livingston Stone expects to resume his labors in procuring the eggs of California salmon on the Upper Sacramento for transmission to Eastern waters, and proposes a scale of operations looking toward the acquisition of ten millions of these eggs. It is probable that some of these eggs will be shipped to Chili for the purpose of determining whether the salmon can be successfully reared in the streams of that country, many of which, heading in the Andes, discharge their waters into the ocean, apparently possessing all the necessary conditions to constitute admirable places of abode for salmon. The United States Commission has already offered to deliver a sufficient number of eggs, properly packed, in San Francisco, provided that their further transmission and subsequent hatching out are performed at the expense of the government of Chili. The offer will probably be accepted.

Mr. Stone has also paid a visit to the Columbia River for the purpose of studying the salmon fisheries of that stream, and to select a hatching station, should any provision be subsequently made for multiplying these fish artificially, to meet any anticipated decrease in consequence of the extensive scale of capture adopted on the Columbia to supply the various canning establishments.

An international exhibition of objects connected with the fisheries and pisciculture will be held in Paris in July of the present year, at which an extended display is anticipated. Reference has

already been made to the expectation of a similar exhibition of American fisheries at the Philadelphia Centennial, for which the general government and several of the States are making special provision.

Measures have been taken by the United States Commissioner of Fish and Fisheries for introducing the carp into the United States, by sending Mr. Rudolph Hessel, an experienced cultivator of this fish, to Hungary for the purpose of securing the best varieties. Opinions differ very much as to the excellence of the carp as an article of food, although it is claimed by its advocates that it is only in Eastern Europe, and in localities not often visited by Americans, that the best races are to be found. In any event, however, the fish is a desirable addition to our resources, as it ranks with poultry in point of domestication, and can be cultivated with very little trouble in almost any kind of water, thriving best in those which are warm, and thus eminently adapted to the Southern United States, where trout can not be reared. As living largely on vegetable food, too, it becomes unnecessary to feed it with meat, or, indeed, to make any special provision for its nurture.

The American grayling still continues to be a subject of attention among pisciculturists, Mr. Fred Mather having recently made a second visit to the Au Sable River, in Michigan, and obtained a large number of spawn and of young fish. The eggs are now being hatched out at Northville, Michigan, and at Mr. Mather's establishment at Honeoye Falls, New York. The fish itself is not of any special economical importance; but, as being one of great beauty, and readily taking the fly, it can be appropriately introduced into waters that are cold enough to receive it, and thus add, at least, to the resources of the angler.

Under the head of *Miscellaneous Scientific Intelligence*, we have to express our regret at the enforced abandonment of the Summer School of Natural History at Penikese, which has been conducted for two seasons with much success. The expense of maintaining the station, however, in Buzzard's Bay, so remote from markets and so inconvenient of access, together with the comparative paucity of animal life in the waters around it, has made it expedient to give up the enterprise for the present year at least. The example of the Penikese school has not been lost, however, and it is quite probable that schools on this plan, which promise to spring up all over the country, will aggregate a greater amount of benefit than any single school. Already we have one on the same plan commenced in Iowa, under the auspices of the Davenport Academy of Sciences, one at Peoria, Illinois, and one at Cleveland, under the care of the Kirtland Society of Natural History.

Professor Shaler, to whom the original idea of the Penikese School is due, will establish a summer camp of geology on the Cumberland Mountains, where his party will receive instruction for geological research in the field. The demand for such instruction is shown by the fact that while his number has been limited to thirty, he has already about one hundred applicants for admission, each to pay a fee of fifty dollars and the necessary expenses.

A summer school of botany will also be held

by Dr. W. G. Farlow on some part of the New England sea-coast, with special reference to instruction in cryptogamic botany, such as the fungi and the algae. Professor Cook will also hold a summer school of chemistry at Cambridge.

Of the deaths since our last we may mention those of Professor E. Baudelot, M. Seguin, and Baron J. J. de Waldeck, of France; Sir Goldsworthy Gurney, Rev. Charles New, Mr. W. C. Aitken, Sir E. Smirke, and Captain Sherard Osborn, of England; Carl L. C. Becker, Dr. Carl Mauch, Professor A. Schrötter, and Mr. H. H. Schwabe, of Germany and Austria; and Mr. J. G. Nieto, of Mexico.

Of current items in the field of *Engineering*, we may record that a bill providing for the building of the East River Bridge jointly by the cities of New York and Brooklyn has become a law. Among other provisions, the new enactment authorizes appropriations to the extent of \$8,000,000.

The several interoceanic canal expeditions recently sent out by the government have returned, and their reports are in the possession of the Navy Department. In this connection the announcement is made that a commission composed of Commodore Ammen, General Humphreys, Chief of Engineers, and Captain Patterson, of the Coast Survey, has been appointed by the President to examine the documents, and report upon that which they deem most advantageous for the canal line. This commission will have under consideration the Tehuantepec survey of Captain Shufeldt, the two Nicaraguan surveys made by Commanders Hatfield and Lull, the Darien surveys of Commander Selfridge and Lieutenant Collins, and the records of the late Panama survey.

In *Technology* we record a recent invention of Professor Benjamin Silliman for purifying illuminating gas of ammonia and its compounds, and obviating the necessity of washing or scrubbing the gas—a process which, though unavoidable by the methods of purification heretofore in use, is well understood to be attended with a serious loss of valuable illuminant constituents. Professor Silliman has discovered that when gas containing ammonia or its compounds is brought into proper contact with "salt-cake" (a by-product in the manufacture of acids and of soda) it parts completely and at once with all its ammonia, which combines with the free acid of the salt-cake. The separation is said to be so perfect that no trace of ammonia can be detected in the gas by the usual re-agents after passing the salt-cake purifiers. From its combination the ammonia can be readily separated by the processes now in use. The complete removal of ammoniacal compounds from illuminating gas has hitherto been one of the greatest difficulties presented to gas engineers.

Dr. Wilde, in a recent communication to the St. Petersburg Academy upon the system of electric illumination devised by M. Ladyguin, to which we have several times referred in these columns, declared that he (M. Ladyguin) had solved the great problem of dividing and rendering steady the electric light in the simplest possible manner, and urged the Academy to recognize the fact by bestowing a mark of its special distinction upon the inventor.

given her tardy succor from her woes, her good name is retrieved from the shadow of a base suspicion which through all the years has overhung it.—As a story JEAN INGELOW'S *Fated to be Free* (Roberts Brothers) is seriously defective. It lacks movement and incident, and fails to grasp the mind or to keep an aroused and alert interest. The authoress, indeed, in her preface to the American edition, declares that she has "not aimed at producing a work of art at all, but a

piece of nature." The interest of her book depends on her descriptions, which are vivid, her characters, who place duty before pleasure, and are ennobling, if not altogether delightful, companions, and on the bits of poetry and morality of which she makes her very simple narrative the vehicle. The book is, in a true sense, a religious novel, but its religion is one less of sentiment or strong feeling than of every-day practical working duty.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—During the month of June three new asteroids have been discovered—Nos. 144 and 145, on the 4th, by Peters, at Clinton, and No. 146, on the 8th, by Borelly, at Marseilles.

American astronomers have to mourn the very sudden death, on the 11th of June, of Professor Joseph Winlock, director of Harvard College Observatory. It will be difficult to fill his place.

Numerous communications have appeared from the astronomers of England in reference to the details of the observations made during the recent transit of Venus. They appear at present to be chiefly occupied in determining the reliability of the observations recorded by means of photography.

Colonel Tennant communicates what he considers an acceptable determination of the diameter of Venus as measured by means of what is known as Airy's double-image micrometer. He has obtained, as he thinks, a decided indication of the elliptic form of the disk of the planet, the compression of the shorter diameter with reference to the larger being at least the $\frac{2}{325}$ part. The mean diameter given by Tennant is very nearly a mean between the results of the five principal previous determinations.

Professor Gylden has published a catalogue of right ascensions of stars, which have been obtained by him with the utmost possible accuracy for use in the reduction of his observations at Stockholm. He considers the positions published a few years ago by Professor Newcomb to be sensibly larger than they should be, and even finds room for criticism of the absolute right ascensions published by the Pulkova Observatory.

Professor Smythe, the Astronomer Royal for Scotland, calls attention to the large and variable proper motion of the star 793 in the British Association catalogue, in reference to which star Mr. Duncan, of the Royal Observatory, remarks that the thorough examination of observations made at Greenwich of No. 793 shows that its proper motion is certainly large, and that it is important to continue observations of this star. It is, therefore, again to be observed regularly at Greenwich, in order to confirm Professor Smythe's suggestion as to the variability of its motion.

Mr. Wilson, of the Temple Observatory, at Rugby, having examined the observations of the double star *Eta Corona*, states that the recent measurements show a systematic divergence from the orbit predicted in 1856 by Winnecke in his inaugural dissertation. The discordance amounts at present to eleven degrees in the position angle.

The distance between the two stars is very nearly one second of arc. If, relying only upon modern observations, we attempt to trace the orbit backward, and predict the position of the star in 1781, when observed by Sir William Herschel, the discordances appear quite within the limits of the accuracy of Herschel's observations; but the hypothesis that best suits all known observations is that there exists at each successive revolution of the stars some shortening of the period.

The great number of remarkably accurate observations of double stars that have been made by Otto Struve must, when fully published, contribute greatly to our knowledge of the relative movements of binary stars. For some years past Struve has from time to time given the results of his investigations into the movements of some of the more interesting stars. The latest communication on the subject from him relates to the star 42, *Comæ Berenices*. This double star was discovered by the elder Struve in 1826, but appeared single in 1833, since which year it has been observed as regularly as possible every year by either William or Otto Struve, and has during the last forty years three times repeated the rare phenomenon of the occultation of one star by the other. The plane of the orbit described by these two stars coincides so nearly with the line joining them to the sun that we have no trace of a sensible inclination between the two. Owing to this circumstance it is that each star appears in the course of its orbital revolution to successively eclipse and be eclipsed by the other; and when in other parts of its orbit, with a powerful telescope, the stars can be seen distinctly separate, their position angle has remained sensibly constant for fifty years. The two stars are so very nearly of the same brightness that a certain ambiguity is introduced into the observations, such that the period of revolution might be supposed to be either about thirteen or about twenty-five years; but this uncertainty has been removed by the recent observations of Otto Struve, according to whose measurements, as computed by his assistant, Dubiago, the most probable period of revolution is 25.7 years. The major axis of the orbit of the ellipse described by the double stars is 0.66 of a second of arc. The observations made by the Struves during fifty years differ from the places, as predicted according to Otto Struve's computations, on an average only one-thirtieth part of a second. These computations also agree very satisfactorily with the observations made by Dawes and by Secchi. In observing very close double stars—which, in fact, appear not distinctly separated, but give only a

slight irregularity or elongation on one side of the main star—a source of error exists which is distinctly explained by Struve, and to which the attention should be called both of observers and of telescope-makers. A very small error, he says, in the centring of the object-glass, so small that its existence would hardly be suspected with single stars, can on such an occasion considerably modify our judgment as to the real direction in which the image is elongated. In reference to the double star 42, *Comæ*, it is a remarkable fact that Struve's computations rest entirely upon measured distances, whereas until now distances have been generally considered too unreliable to be used, as compared with measurements of position angle.

Professor Kirkwood calls attention to the fact that certain observations of meteoric showers support the conclusion that besides the shower that occurs on the 12th of November, ordinarily known as the Leonids, another cluster of meteors has been observed on the 14th of November, which is probably a small fragment of the principal group, belonging, in fact, originally to them, and separated from them within historical times, in consequence of considerable perturbations, either by Uranus or the earth.

The Melbourne Observatory has published the first Melbourne general catalogue of stars, prepared from materials printed in the first four volumes of the Melbourne observations. The remarkable star *Epsilon Indi*, according to this catalogue, has a proper motion of 4.58 seconds of arc of a great circle, rendering it thus a most attractive object for an investigation of annual parallax.

Bruhns has published some additional studies into the supposed identity of the comet observed by Pogson at Madras on December 3 and 4, 1872, with the fragments of Biela's comet, and the shooting-stars observed on the night of November 27. He concludes that the object observed by Pogson "had no relation to Biela's comet nor to the meteoric display, notwithstanding the singular fact that it was discovered by Pogson in consequence of the telegram sent to him by Klinkerfues, which was grounded on the opposite opinion."

At the regular annual visitation of the Greenwich Observatory, Sir George B. Airy, in his report of work done during the past year, and the condition of the institution, states that during the past year Mr. Glaisher has resigned the care of the meteorological department, and that in his own opinion the subject of meteorology, which has been followed for many years, is scarcely connected with the two great duties of the observatory—viz., astronomy and navigation—and, indeed, hardly deserves the name of a science (!), although it is in great popular request. He finds that the mechanical self-registration of some meteorological phenomena, as introduced by himself shortly after his assumption of the directorship of the observatory, has increased the annual expenses of the observatory in a much lower proportion than the work done. In reference to the future, he is inclined to propose that the observatory should abandon meteorology, photoheliography, and spectroscopy, not as unimportant in themselves, but as being less intimately connected with the fundamental objects of the Greenwich Observatory. On the other hand, he de-

sires to see the system of time signals extended, but would not hamper the necessary labors of the institution in reference to geography by the imposition upon it of even the least of what is now known as physical astronomy.

At a late sitting of the council of the Paris Observatory resolutions were passed regarding some researches which will be probably soon begun relating to the observations of intramercurial planets, as also the determination of the velocity of light. The intramercurial planets will be observed photographically when crossing the disk of the sun. These researches will be commenced as soon as the great Arago refracting telescope is fitted up for photographic purposes.

Dr. Fuhg contributes a short note on the dimensions of the sun. According to his investigations, based upon the observations made at Greenwich, there is no trace whatever of any periodical change, the difference between the greatest and least diameters of the sun being less than one second, and probably entirely explicable as due to the peculiarities of the various instruments that have been used, and the numerous observers employed during the past fifty years.

Galle announces that, by including in his computation of the solar parallax those observations of the planet Flora that he had in his previous memoir been unable to use, he arrives at the definitive value of the solar parallax, viz., 8.873, as based on the observations made in 1873. This result is almost precisely midway between the figures given by Cornu (8.878) and by Leverrier (8.866). He recommends that the planet Eurydice be observed for similar purposes during September and October, 1875.

It is announced that the maps of the stars of the southern hemisphere to illustrate the great catalogue compiled by Dr. Gould will soon be published, under the title of *Urano-Metria Argentina*.

Mr. Marth calls the attention of possessors of large telescopes to the fact that about the middle of August next there will be a conjunction of Saturn's satellite Japetus with the ring and ball of the planet. He is anxious that observations of this conjunction shall be made, in order to afford data for the improvement of the theory of the satellites of Saturn.

The photometer invented by Christie, and described by him over a year ago to the Astronomical Society of London, has been diligently employed by him in actual observations. He states that the probable error of the results amounts to only the twentieth part of a stellar magnitude, but that it varies for stars of different colors. A feeble red star is, according to him, more easily distinguished than a feeble blue star.

The problem of the movements of three or more bodies, such as the planets, under the influence only of the law of universal gravitation has always presented in its most general form difficulties so great as to prevent its complete solution by any mathematical process that has hitherto been devised. To the elucidation of this subject Mr. Veltmann contributes an ingenious essay, in which, by the application of the laws of determinants, he is able in a simple manner to arrive at interesting formulæ.

The earthquakes during the month have been unusually numerous and violent. Very severe

ones are reported in Asia Minor on the 3d and 11th of May, and later in the month at the Loyal Islands, in the Pacific Ocean.

A slight shock of earthquake was experienced, June 18, in the southwestern part of Ohio and eastern portions of Indiana. Many house walls were cracked, chimneys overturned, and goods on shelves in stores thrown to the floor.

Further accounts concerning the destruction on the 18th of May of the city of Cucuta, Colombia, South America, show that this earthquake was one of the most destructive on record. At least 5000 lives were lost, and property to an immense value destroyed.

In *Physics* the usual record of progress is to be noted. Carl has devised a simple apparatus for showing lateral pressure in liquids. It consists of a cylinder to hold the liquid, hung at its top upon a knife edge, and having a lateral opening near the bottom which can be closed at pleasure. An index attached at top moves over a graduated scale as the cylinder varies from perpendicularity. The condition of equilibrium is regulated by one superior and two lateral balls. If now the cylinder be filled with water, it remains perpendicular; but on opening the orifice at the bottom the water pressure is relieved on that side, and the cylinder swings in the opposite direction. The apparatus may be made to show also the change in the form of the parabola as the height of the water column decreases.

Boisbandran has shown that a remarkable inequality of action is exerted by a given supersaturated solution upon different isomorphous bodies. A perfectly regular crystal of potassiochrome alum, placed in a slightly supersaturated solution of ammonio-alumina alum—which had been rendered basic, so as to crystallize in cubes—was soon covered with a white octohedric envelope showing cubic facets. After a longer time the cubic facets had increased considerably, but the distances between opposite solid angles of the octohedron remained unaltered. Hence the author concludes that the solution must have been supersaturated relatively to the octohedral faces of the ammonio-alumina alum, but not relatively to the cubic faces of the same alum. In general it appears that in the phenomena of solution and crystallization the molecular volume, the density, the relative arrangement of the similar or dissimilar atoms in the molecule, and all other causes of dissimilarity possess their special influences. Indeed, it may be said that two bodies not absolutely identical never exhibit strictly the same physical or chemical reactions, however closely they may in certain particulars resemble each other.

Schuller has contrived an apparatus by which Lissajous's figures may be readily produced on the screen. It consists of two pendulums, adjustable by sliding weights, carrying mirrors, each movable on a horizontal axis, at their upper ends. The planes of vibration may be parallel or perpendicular, at will. The same physicist has devised a modification of the common form of this experiment with tuning-forks. Instead of having a mirror on the extremity of a prong of each fork, he places the two forks with their four prongs in the same plane, one of the forks being vertical, and four or five inches in advance of the other, which is horizontal. The lower prong of the horizontal fork carries a screen with

a small hole in it. The second fork carries on one of its prongs a small lens of short focus. The small opening in the screen is strongly illuminated by sunlight concentrated on it by a lens; an image of this is formed on a distant screen by means of the lens on the second fork. When the first fork is vibrating, a vertical line of light will appear; when the second is in motion, the line will be horizontal; when both are in action, the Lissajous curve corresponding to their rate will be given. The figures are much larger made in this way.

Neyreneuf has shown very beautifully the oscillatory or vibratory character of the detonation of a mixture of oxygen and hydrogen gases. In a tube the result may be shown in two ways: either by making the tube perfectly dry inside, in which case the watery vapor produced by the combustion condenses preferably on the cooler parts of the tube, leaving those parts transparent which the vibrating flame has heated; or by coating the tube interiorly with a thin layer of paraffin, when the melting of this substance shows the heated portions. In these experiments it is necessary to graduate the rapidity of the combustion to the size of the tube. With a test-glass an inch and a quarter in diameter and eight inches long, well dried, and filled with a mixture of equal volumes of hydrogen and air, the striæ represented fern leaves. With tubes of less diameter, the effects are more regular, especially if during the detonation there is a musical sound produced. Fine striæ are then observed perpendicular to the axis of the tube. If the tube is very long, there is no musical sound produced, but the rings are widely separated and very sharp.

Berthelot has published another important research in thermo-chemistry, in which he has studied the thermal changes produced when acids or alkalis are dissolved in water, with the expectation of solving the question of hydration. He has also given a description in a subsequent memoir of the various pieces of apparatus which he has employed in his calorimetric experiments. These are, a helicoidal agitator for mixing the water of the calorimeter, an *écraseur* for crushing salts and other solids in liquids, a distilling apparatus, with worm and receiver, for effecting reactions out of contact with water, an apparatus for measuring the heat of solution at elevated temperatures, a closed apparatus for the reaction of nitrogen dioxide on oxygen, and an apparatus for decomposing ammonium nitrite by heat.

Mascart has made some very delicate experiments on the effect of the transitory motion of the earth on the refrangibility of light, in continuation of those made by Arago, and with reference to Fresnel's theory. His apparatus was arranged under-ground, so as to be free from diurnal thermal changes. The collimator was turned to the west, so that at mid-day and at midnight the rays entering it would be moving, the one with the earth in direction, the other opposed to it. A very numerous series of observations showed that the change of deviation thus produced is entirely inappreciable, and this with a perfection of methods which would detect a twentieth part of that which Fresnel's formula supposes. Indeed, in using mixed films, for example, Mascart shows that the length of the ap-

parent paths of the interfering rays is not changed by this condition by one two-hundred-thousandth part, that in observing Newton's rings it is not one four-hundred-thousandth, and that in the fringes produced by double refraction there is not produced by the movement of the earth a change in the path of the two rays of one-millionth part.

Garriel has described some simple apparatus for explaining by construction the elementary laws and formulas of optics.

Williams has made a photometric investigation into the intensity of twilight when the sun is at various distances below the horizon. The percentage of error in the instrument employed was about three. The results of the photometer readings were reduced to the light given by a standard candle as unity, when burning at a distance of one meter from the disk. By a graphical construction of the actual results a curve was obtained, and a table deduced which gives the percentage of light, compared with that at sunset as unity, for any number of minutes after sunset up to 34. At 1 minute it is 0.95, at 10 minutes 0.290, at 20 minutes 0.064, at 30 minutes 0.009, and at 34 minutes it is 0.004.

Crosby, also in the Massachusetts Institute of Technology, has made some photometric determinations of the light of the sky at different distances from the sun, adjusting the mirror and lens which were employed so that the sun's image would fall on the disk, and then measuring the intensity of the light at regular intervals thereafter. In some cases this method was reversed. The results represented graphically show a logarithmic curve, when the intensities are taken as ordinates and the natural sines of the sun's angular distance as abscissæ. The author calls attention to the meteorological importance of his results.

Pickering and Strange have investigated photometrically the amount of light absorbed by the sun's atmosphere. By means of a *porte lumière* carrying a black mirror and lens, an image of the sun 40 cm. in diameter was thrown on a screen 230 cm. from the aperture. A circular hole was cut in the screen, and behind this the photometer disk was placed. By moving the mirror any portion of the sun's image could be thrown on the photometer, and its light measured. The results are thus given: The probable error does not exceed one per cent., except close to the edge. The light at the edge is about 0.4 that at the centre. The variations in brightness are nearly those which would be produced by a homogeneous atmosphere whose height is equal to the sun's radius, and its opacity such that only twenty-six per cent. of the light is transmitted. There appears to be a slightly different distribution of the light along the polar from that along the equatorial diameter. If the sun's atmosphere were removed, the brightness of the sun's disk would be uniform and 3.83 times that of the centre of the disk at present. Moreover, the total amount of light would be increased 4.64 times.

Descloizeaux has published an elaborate paper on the doubly refractive properties of the triclinic feldspars, albite, oligoclase, labradorite, and anorthite, in which he shows that, though so difficult of exact determination by present physical or chemical means, these feldspars may very

readily be distinguished from each other by their optical characters.

Dagnenet has proposed a simple apparatus for showing the phenomena of the spark in rarefied air. A barometer tube a meter in length has a wire of platinum sealed in at one end, and is then filled and inverted in the usual way. On connecting one electrode of an induction coil with the platinum wire and the other with the mercury, the space above the column is filled with a whitish light. By introducing air and plunging the tube in a deep cistern the spark may be observed at various pressures, and by introducing various other gases and liquids many beautiful effects may be produced.

Thalen, the Swedish physicist, has written a paper on some experiments which he has made in order to ascertain the location, depth, and magnitude of mines of iron by means of magnetic measurements. By means of careful observations, isodynamic lines are constructed. Then the line which joins the two points of maximum and minimum deviation, or the magnetic meridian of the mine, gives the general direction of the ore bed. The intersection of this line with the neutral line indicates the point where it is most desirable to begin mining. Finally, the distance of this latter point from the point on the magnetic meridian of the mine where the deviation is a minimum is one-half the distance of the centre of the mass of ore below the soil.

Pickering and Strange have given the results of their measurements on one of Farmer's large dynamo-electric machines. With a speed of 1280 revolutions per minute, a light of from 650 to 900 candle powers was obtained.

Jacques, working in Professor Pickering's laboratory, has made some experiments in answer to Jamin's criticism of Ampère's theory of magnets, in which he shows not only that Jamin's experiments are not themselves fairly capable of such an interpretation, but also that, rightly interpreted, they actually sustain the theory of Ampère.

In *General Chemistry* Nilson has made a series of experiments on the salts (particularly the selenites) of the rarer earths, with a view to determine the equivalence of the contained elements. He concludes that glucinum has an equivalence of two, and belongs to the magnesium group, while yttrium, erbium, cerium, lanthanum, and didymium have an equivalence of four, like aluminum, iron, chromium, and indium, their double atoms, also, like the latter, having an equivalence of six.

Laspeyres has proposed a more perfect apparatus for the direct estimation of water in minerals, etc., consisting of a series of calcium chloride tubes, through which a current of dry air is passed, in which the substance is heated. The chloride of calcium used is dried at 150° to 200° C.

Schnetzler has investigated the action of borax upon fermentation and putrefaction, following out some experiments made by Dumas. He finds that borax acts promptly upon the protoplasm within living vegetable cells, causing it to contract, to separate from the cell walls, and to condense. All movement is at once stopped within the cell, and the chlorophyll grains are changed in form. The cells of yeast, of mould, etc., lose their vitality in a solution of borax. Infusoria, rotifers, entomostracans, tadpoles, are

killed in such a solution. In the infusoria the contraction of the sarcode can be distinctly seen. Grapes and currants are perfectly preserved by borax; milk containing one grain of borax in thirty cubic centimeters remained sweet for three months; and beef was preserved for a year and a half in a concentrated solution, which was renewed three times, without the least odor of decomposition. Borax is, therefore, strongly recommended for the preservation of anatomical preparations and for dressing wounds.

Schutzenberger and Bourgeois have sought to throw some light upon the production in plants of the so-called carbo-hydrates by an investigation of the products resulting from the solution of white cast iron (in which the carbon is combined) when conducted at ordinary temperatures. They find that the residue obtained on treating 100 grains of this iron with a cold solution of copper sulphate is, after removal of the copper, a brownish-black pulverulent substance weighing 7.135 grains, and consisting of carbon, 64 per cent.; water, 26.10; silica, 7.1; undetermined, 1.8. It appears to be a hydrate of carbon, having three molecules of water united to eleven atoms of carbon. Nitric acid oxidizes it to a reddish-brown amorphous substance, which the authors call nitrographitic acid.

Scheurer-Kestner has observed that the white fumes accompanying the sulphurous oxide which is produced by the combustion of iron pyrite are caused by the presence of sulphuric oxide, and that the sulphuric oxide is produced by the oxidation of the sulphurous oxide by air in presence of ferric oxide at a high temperature.

Vierordt has suggested the use of his quantitative spectrum analysis method in volumetric assay, and gives experiments which show its very great advantages.

Carey Lea has published a paper upon the influence exerted by color in changing the sensitiveness of substances to light. He finds, for example, that corallin increases the sensitiveness of silver bromide to red rays, only moderately increases it for yellow rays, and does not increase it at all for green rays, contrary to the view of Vogel. He concludes that there is no relation whatever between the color of substances and the color of the ray to whose influence they modify the sensitiveness of silver bromide.

Vogel maintains that while the chloride, bromide, and iodide of silver are sensitive to rays of both high and low refrangibility, this sensitiveness also depends on the bodies which may be mixed with them, those colored bodies which absorb certain colors (and which promote photographic reduction) increasing the sensibility of the silver salt for the absorbed rays. Moreover, certain colorless bodies which promote photographic reduction, and certain others which influence the index of refraction, also modify the color-sensibility.

One of the most valuable discoveries of the day is that made by Wolcott Gibbs, of a new physical constant, which he calls the "interferential constant." It is well known that when interference colors are viewed through a prism a series of dark bands appears in the spectrum, known as Talbot's bands. The number of these bands between any two lines in the spectrum may be calculated when we know the thickness of the plate producing the interference, the in-

dicies of the given spectrum lines, and their wavelengths. If now the thickness of the plate be made unity, and the formula thus modified be divided by the density of the substance composing the plate, an expression will be obtained of a quantity called an "interferential constant." It represents the number of bands in the spectrum between two rays whose indices are given, for a thickness of the plate equal to a unit of density. This number is for each chemical substance a characteristic optical function, and independent of the temperature. Its value will apparently be fully equal to the other physical methods of analysis, such as density, boiling-point, specific volume, rotatory power, etc., while in some examples given it finds important application in quantitative analysis. Moreover, it appears that the interferential constant of a compound may be tolerably well calculated from those of its constituents.

In *Organic Chemistry* Von Lang has measured the crystals of glycerin. They are brilliant when in their mother-liquor, but deliquesce in the air. In form they are orthorhombic, the ratio of the axes $a : b : c = 1 : 0.70 : 0.66$.

Engel has discovered some new reactions of glycecol. It gives with ferric chloride an intense red color, and it develops a blue coloration when treated with a drop of phenol and sodium hypochlorite is added. The author can not get the blood-red coloration as observed by Horsford when glycecol is boiled with a solution of potassium or barium hydrate; he hence supposes that Horsford's substance was not pure.

Kolbe has further investigated the fact, observed by his assistant, Ost, that while sodium salicylate yields on dry distillation sodium sodio-salicylate, potassium salicylate similarly treated yields potassium paraoxybenzoate. He finds that the barium, strontium, calcium, and magnesium salts act like the sodium salt, and that the potassium salt does the same when heated only to 145°. He recommends this as the best method for the preparation of paraoxybenzoic acid. A series of papers has been published in Kolbe's *Journal* by Neubauer, Kolbe, Wagner, Fontheim, Zürn, and others upon the antiseptic action of salicylic acid. It has come very extensively into use, having, for example, entirely replaced phenol in the lying-in hospital of Leipsic.

In *Physiological Chemistry* Boussingault has made analyses of gluten biscuit, with comparative analyses of other similar articles of food, with a view of showing its real value when used as food in cases of glycosuria. From his table it appears, for example, that 73 pounds of baker's bread introduces as much starch into the system as 100 pounds of the gluten biscuit, while the latter affords eight times as much albuminates.

Maly has published a paper on the chemical composition and the physiological importance of the peptones.

Epstein and Müller have sought to throw some light on the beneficial effect of phenol on glycosuria by ascertaining whether phenol prevented at all the action of the liver ferment on the glycogen. Their results were negative. Acids suspend the action of this ferment, while alkalies simply lessen it.

Berthelot has observed that perfectly pure acetic oxide is not changed into the sodium salt in presence of sodium hydrate, even after the

anhydride is completely dissolved. The acetic oxide, therefore, even when dissolved, may exist for some time in contact with water, and even of soda, without union. In presence of an alkali the union is much more rapid, taking place in the course of two or three minutes, whereas in the case of water it requires more than an hour.

Rautert has given an improved method of purifying salicylic acid by distilling it in a current of superheated steam. Recrystallization from water makes it snow-white.

Microscopy.—We commend to the careful reading of microscopists and microscope-makers the excellent paper of Mr. Slack, read before the Royal Microscopical Society of London, May 5, 1875, and the discussion thereon, contained in the June number of the *Monthly Microscopical Journal*. The paper is entitled, "On Angle of Aperture in Relation to Surface Markings and accurate Vision." Mr. Slack proves, from the results already accomplished by Zeiss, of Jena, working under the direction of Professor Abbe, that resolving power and penetration are not in that condition of irreconcilable hostility generally supposed, and that a new era is dawning upon physiologists, and, indeed, all who care for something more than the mere display of diatom dots. It is well known that in the extravagant desire to display these dots, angular aperture has been pushed to an extreme, and a certain amount of chromatic error allowed as necessary to sharpest definition. By very careful construction, centring, and elimination of errors, the objectives of Zeiss, *e. g.*, a one-quarter inch of forty-eight degrees, and a one-sixth inch of sixty-eight degrees, will perform work, as Mr. Slack proves, hitherto supposed to be only within reach of the most expensive large-angle objectives. Zeiss has, so to speak, minimized angles of aperture, and secured great working distance and penetration, and yet obtained the amount of separating and resolving power of much larger angled objectives. Mr. Slack truly observes that opticians have been encouraged to make excessive apertures substitutes for good corrections, and that naturalists and physiologists have been too contented with feeble resolving powers, under belief that any more capacity for resolution must mean less penetration.

Not indirectly connected with this subject of large angle is the "Measurement of the Möller Probe-Platte," by Professor E. W. Morley, reported by J. E. Smith, in the same journal. The measurements were made by means of a Tolles one-sixteenth and a Troughton and Sims micrometer. Professor Morley's measurements are, no doubt, pretty accurate, but any one who knows any thing about diatoms also knows that the number of striæ in 0.01 inch is subject to considerable variation in the same species.

Ethnology.—The president, council, and fellows of the Royal Geographical Society of London have prepared a manual of arctic geography and ethnology, in addition to the Admiralty arctic manual, with Mr. Clements R. Markham as editor, and who contributes four papers, *viz.*: "On the Origin and Migration of the Greenland Eskimo;" "On the Arctic Highlanders;" "A Sketch of the Grammar of the Eskimo Language;" "A List of the Names of all Places on the Coast of Greenland, from Latitude 65° 15' N. on the Eastern Side, round Cape Farewell to the

Entrance of Smith Sound." Dr. Rink furnishes an article on the "Descent of the Eskimo," and Dr. John Simpson, of H.M.S. *Plover*, one on the "Western Eskimo." The report of the Anthropological Institute, and a list of ethnological questions for explorers, drawn up by various members of the society, close the volume.

Among those recently wrecked though not lost on the *Saranac* near Vancouver Island was Dr. Bessels, the arctic explorer, who was on his way to Alaska, fully equipped with photographic apparatus, etc., to make a complete study of the inhabitants, and to collect for the Centennial as large a number as possible of implements to illustrate their mode of living and their grade of progress. This enterprise was part of a scheme to represent the whole country as fully as possible.

The Municipal Council of Paris have voted in part the means to pay the professors of a superior school of anthropology, which will be opened next November in a building lent gratuitously by the *École de Médecine*. No fees are to be charged to pupils. Five courses of lectures are to be delivered, including a series by M. Broca on craniology, one by M. Dailly on human races, and one by M. G. de Mortillet on prehistoric times. The number of lectures is to be increased as the resources of the association multiply.

The report of the fifth general meeting of the German Society of Anthropology, Ethnology, and Proto-History, held in Dresden 14th to 16th September, 1874, is edited by Dr. Hermann von Ihering. In addition to many interesting papers upon local researches, exhibiting the intense interest manifested throughout Germany upon this subject, there are several of a more general character, among which we notice remarks by Herr Fraas upon the tertiary man, discussions by Schaffhausen, Virchow, Von Ihering, and others upon the early dispersion of the Lapps, and upon methods and apparatus of craniometry and craniography. Herr Graf Wurmbrandt awakened considerable discussion by his statements upon the chronology of prehistoric discoveries.

Zoology.—The infusoria have been lately studied by Dr. Bütschli, who has found true lasso cells in an infusoria comparable with those found in the hydra and jelly-fishes. He is also inclined to doubt whether a true fecundation of eggs takes place in these animals. Häckel also does not believe in the sexuality of the ciliate infusoria.

Nerve fibrils with numerous nerve cells and ganglionic cells have been found by Eimer in a *Beroë* studied by him at Capri, but he detected no true nerve cord.

A very elaborate paper on the anatomy of a *Helix (Zonites algirus)* is published, with plates, in the *Annales des Sciences Naturelles* by H. Sicard, while M. Vayssièrè describes some points in the anatomy of the naked pelagic mollusk, *Glaucus*.

A further contribution to the history of the singular parasitic worm, *Echinorhynchus*, is given by Leuckart. He has discovered that *E. proteus*, which lives in the adult state in the intestines of cyprinoid fish, when young inhabits the little crustacean of fresh-waters, *Gammarus pulex*. In the latter state it is globular or ovate, with the proboscis retracted, but internally fully organized; only the sexual organs are still immature. It is introduced into the digestive tube of

the *Gammarus* as an egg, but makes its way when hatched through its walls into the abdominal cavity. The singular fact is discovered that the perfect worm is developed with all its organs within the embryo from a central mass of cells, the embryonic germ, which may be regarded morphologically as a rudimentary digestive system. Leuckart hence believes that the relations between the embryo and the developing *Echinorhynchus* are somewhat analogous to those between the *Pluteus*, *Pilidium*, or *Tornaria*, and the star-fish, nemertean worm, or *Balanoglossus*, viz., it is a true metamorphosis that takes place. In other species of *Echinorhynchus* the metamorphosis is less marked, as, for example, in *E. angustatus*, which in the adult state lives in cyprinus, but when young in *Asellus aquaticus*.

On examining certain galls on the common milfoil (*Achillea millefolium*), Dr. Löw, of Vienna, found in the interior a soft whitish lump, which, when brought in contact with a drop of water, disclosed hundreds of little round worms, *Anguillula*, or vinegar eels, in all stages of development. It was previously known that these minute worms lived in plants. That they, like the tardigrades and rotifers, can be dried up and then revived was known to Linnæus. Baker in 1775 found that the young of *Anguillula tritici*, inclosed in diseased grains of wheat, could be revived even after a desiccation of twenty-seven years by moistening with water; and other naturalists observed the same fact for shorter periods.

Hering has ascertained from the dissection of numerous young dogs that *Ascaris mystax* is never found in new-born puppies, and therefore is neither introduced directly into the fetus from the mother nor through the milk. The eggs are probably transferred to the stomach of the sucklings through their licking the belly of their mother, and in that of the adult dogs through their licking their own anal region. The greatest number is found in young dogs which are not yet half a year old.

A splendidly illustrated and lengthy memoir on the simple Ascidians of the coast of France, by Professor Lacaze-Duthiers, appears in his "Archives." His studies refer to those species in which the larvæ are not tailed. He believes that these animals are mollusks, while the idea is gaining ground in Germany and this country that they are worms.

Among recent works on insects may be mentioned the first part of a synopsis of the horse-flies, or *Tabanidae*, of this country, by Baron Ostensacken. Mr. Scudder has described in Hayden's Bulletin several fossil *Thrips* from the tertiary strata of Colorado.

The fresh-water fishes of China are to be monographed by Messrs. Sauvage and Thiersant from material sent to the Museum of Natural History of Paris by the Abbé David and others. A number of preliminary descriptions have already appeared in the *Annales des Sciences Naturelles*.

A valuable essay on the classification of the *Falconidae*, by Mr. Ridgway, appears in the fourth Bulletin (second series) of Hayden's Geological and Geographical Survey of the Territories. He adopts Huxley's innovations in the arrangement of the birds of prey, based on osteological characters. The paper is illustrated by outline drawings.

In *Botany* we have some interesting observations on the conjugation of zoospores by Professor J. E. Areschoug, of Upsala. This mode of conjugation was first noticed by Pringsheim in *Pandorina* and in some plants belonging to the Zoosporæ. About a year ago Professor Areschoug published his observations on the conjugation of zoospores in *Ulva* (sea-lettuce), and recently he has observed a similar conjugation in *Dictyosiphon hippuroides*, Lyngb.—a plant belonging to the order Phæosporæ, to which our devil's-aprons belong. Although the Phæosporæ include some of the largest known plants, *Macrocytis pyrifera*, found on our west coast, being sometimes a thousand feet long, the only reproductive bodies yet known in this order are minute zoospores.

The volume of the International Scientific Series on Fungi, by M. C. Cooke, will give to the American reader a fair idea of the general structure of that group of plants. The descriptions of the uses and notable phenomena of fungi are good, but in all points relating to the development and microscopic structure the book falls far below the average Continental text-books. In the department of North American botany we have a conspectus of the North American *Hydrophyllaceæ*, by Professor Asa Gray, and a revision of the genus *Ceanothus*, by Sereno Watson. Professor Van Tieghem, of Paris, in the *Comptes Rendus*, confirms the observations of Rees on the fertilization of the *Hymenomyces*, and we understand that he is about presenting further remarks on the *Mucorini* in the *Annales des Sciences*.

Agriculture.—In agricultural science we note the appearance of Part IV. of the Bulletin of the Bussey Institution of Harvard University, whose contents, like those of the previous parts, show that this institution is, in fact, what it modestly refrains from styling itself, an efficient agricultural experiment station.

Among other articles is a "Record of Trials of various Fertilizers upon the Plain Field of the Bussey Institution." These experiments are a continuation of a series that have been in progress for four years. The effects of stable and yard manure, fish scrap, guano, phosphates, nitrogenous manures, potash, salts, etc., upon the growth of barley and beans on a light, porous, and rather dry soil, have been tested by applying the same manure to the same crop on the same plot of land year after year.

The results of these experiments favor quite decidedly the practice of using combinations of the different fertilizers rather than the individual articles by themselves. "Mixtures of a phosphatic, a potassic, and a nitrogenous fertilizer produced very good results, even when compared with barn-yard or stable manure applied at the rate of ten cords to the acre."

One of the interesting conclusions drawn by Professor Storer from these experiments is that "stable manure may be more profitably applied in small quantities along with artificial fertilizers than in large quantities by itself alone.....It is probably true that in the vast majority of cases the real efficiency of barn-yard manure would be increased by the addition of a certain proportion of soluble potassic and nitrogenous fertilizers, and by dressing the land beforehand with superphosphate." And further: "Just as the mulch-

ing and diffusive power of the stable manure would tend to increase the efficiency of artificial fertilizers, so the ready solubility of the latter—their so-called activity—would enable the crop to use the constituents of the dung more fully than would otherwise be possible.”

The present condition of our knowledge of the *Peronospora infestans*, and the questions which science has still to answer concerning its habits and the means of preventing its ravages, are quite clearly set forth in the Bulletin referred to in an article upon the potato-rot, by Professor W. G. Farlow, formerly a pupil of De Bary, who is well known as the most thorough investigator of these subjects. It is well settled that the rot is due to the action of the mycelium or vegetative threads of the fungus called *Peronospora infestans*, which develop in the stem, leaves, and tubers of the potato, exhaust the matter stored in the cells of the plant, and thus produce the disease. Asexual spores are at the same time produced, which, falling on the leaves of the healthy plants, or working through the soil into the tubers, spread the disease more or less rapidly. How the disease is propagated from year to year is not yet fully determined. The only way yet proved is by the mycelium in tubers kept over winter. Analogy would point to oospores as another means, but these have not yet been observed. When botanists learn how the disease is propagated from year to year, a preventive may be discovered, but until then none may be hoped for.

The need of experiment stations to exercise a control upon the trade in fertilizers has received a new illustration in some analyses of fertilizers sold in Connecticut during the past season. One article was found to be heavily adulterated; another contained nearly 1300 pounds of sand, coal, brick, and other equally useless materials, to the ton; while others, though not so positively bad, were yet of so low a grade that to purchase them must have been very uneconomical.

In *Engineering*, the substantial progress toward the solution of the rapid-transit problem in New York is the subject of general comment. The route from the Grand Central Dépôt to Harlem River by a tunnel four miles in length is now open throughout for the passage of trains.

A contract has lately been awarded for the construction of a new bridge over the Monongahela River at Pittsburg which is to possess some novel features. It will be built on the suspension principle, but instead of wire cables, immense chains will be employed. These chains, two in number, will be composed of wrought-iron links each twenty feet in length, and formed of sixteen flat bars placed side by side, and at a distance from each other of one and two inches; into these spaces, at the ends, fit the bars of the next link, and the entire thirty-two bars are joined by an immense iron pin six inches in diameter and four feet long. The lateral width of the chain is forty inches.

The seventh annual convention of the American Society of Civil Engineers was opened at Pittsburg on Tuesday, June 8, Vice-President W. Milnor Roberts delivering the customary opening address. The subjects of papers and discussions were quite numerous, but those eliciting the greatest share of attention were rapid transit, cheap transportation, and river mouths. Upon the last-

named topic several speakers referred approvingly to the action of the general government in appointing a commission for the improvement of the mouth of the Mississippi, and the final adoption of the jetty system.

The twentieth iron steam-ship launched from the yard of John Roach and Son since October, 1871, was successfully sent into the water at Chester, Pennsylvania, on the 5th of June.

The work upon the buildings of the Centennial Exhibition are, at the time of this writing, in an advanced state, and the comparison of the condition of general preparation with that of the late European Exhibition at a corresponding period before its formal inauguration is a highly favorable one. There is now an excellent prospect that the display of mining and metallurgical products, which it has hitherto been feared would be but poorly represented, will be very complete, as befits their eminently practical character. The Smithsonian Institution, aided by a governmental appropriation for the purpose, superintends the formation of the collection, which will be made under the personal direction of Professor Blake, of New Haven, and will supplement it from the material already in its possession.

The latest reliable returns place the total mileage of American railways at the close of the year 1874 at 69,273 miles, an increase of 4.6 per cent. upon the figures of 1873. The aggregate cost of construction is estimated at \$4,221,763,594. From the *Railroad Gazette's* record of railway construction we have the information that up to the end of June 312 miles of new railroad have been completed in the United States in 1875, against 570 miles reported for the corresponding period of 1874, and 1271 miles in 1873.

In *Technology* we may note a new application of the sand-blast, namely, for producing a lustreless, very finely grained surface (termed by the trade satin finish) upon plated ware or silver. This finish has heretofore been accomplished by the use of rapidly revolving brushes made of fine wire. A Connecticut manufacturing firm have lately found that the sand-blast performs this stippling work much more rapidly and effectually, and have introduced the necessary apparatus for its employment upon a large scale.

The chemical composition of metalline, the new lubricating material which has of late attracted much attention, is given out to be as follows:

Paraffine.....	4.98	Alumina.....	2.53
Carbon.....	18.89	Lead.....	32.40
Silica.....	6.44	Zinc.....	20.07
Lime.....	3.96	Copper.....	2.75
Magnesia.....	1.99	Tin.....	1.55
Ferric oxide.....	3.94	Moisture.....	0.51
Total.....			100.01

An interesting experiment upon the decomposition of salt by superheated steam is reported by Mr. S. Cabot, Jun. He declares that when submitted to this treatment appreciable quantities of caustic soda are produced, accompanied by the liberation of volumes of hydrochloric acid vapors. It may be remarked in this connection that a technical process founded upon this reaction would be by far the most direct method of producing soda lye and the soda of commerce. It could, however, be made available as a technical process only when the yield approached closely to the theoretical one, which has thus far not been realized.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—In our astronomical review for July we are for once unable to record the discovery of any new asteroids or comets. Among the publications in astronomy for the past month we may note the *Annales de l'Observatoire de Moscou*, volume ii., part i. (with eleven plates). The subjects of observation have been the belts of Jupiter, the meteors of August, the asteroid Juno for determination of parallax, as well as spectroscopic examination of the solar prominences and of Coggia's comet. This observatory likewise sent three expeditions to observe the transit of Venus, under the charge of Dr. Breichin, director of the observatory, and of Céraski and Döllen respectively. Of these expeditions, Döllen's, to Egypt, was highly successful, while the other two were hindered by cloudy weather from obtaining results of importance. The volume contains a photograph and an engraving of the equatorial telescope of the observatory (eleven inches aperture), with photographs of sixteen drawings of the belts of Jupiter, and of the physical appearance of Coggia's comet. These last drawings are particularly interesting, as confirming those of other observers as to the existence of a complex system of envelopes about the head of this comet. Four lithographed plates of drawings of the solar prominences are given, as well as plates showing the paths of the August meteors.

In reference to the variable colors of stars, we note that in the *Uranometria*, composed in the middle of the tenth century by the Persian astronomer Al Sûfi, and which has been recently published by the Imperial Academy of Science at St. Petersburg, under the editorship of Schjellerup, it is stated that at the time of his observations the star Algol was reddish—an epithet applied also by him to the stars Antares, Aldebaran, and a few others. Most of these exhibit a reddish aspect in the present day. Algol, however, appears at present as a white star, without any tinge of color. This change of color is of great interest, and, indeed, highly significant, when taken in connection with the fact that the apparent brightness of Algol is subject to a periodical fluctuation of remarkable and, in fact, inexplicable character. Spectroscopic analysis has most plausibly suggested that in many cases the established variability in brightness of stars is due to such internal changes in the body of the star as bring a different class of chemicals to the surface, giving rise thereby to a variation in intensity of the light, a variation in its color, and a change in the spectrum lines and bands. The observed changes in the color of Algol, therefore, are quite in accordance with this theory. It may be added that Sûfi speaks of the great nebula in Andromeda as generally known in his day, so that Simon Marius (1612) can no longer be considered as its discoverer. Sûfi likewise records the position of the new variable star near Alpha Virginis, which has been recently discovered by Professor Schmidt, of Athens. Dr. Tempel, of Florence, calls attention to a nebula first discovered by him in 1860, which he considers without doubt to be variable. It is close to the star Merope, of the Pleiades, and

can now be seen with a telescope of four inches aperture.

Only two other variable nebulae are, we believe, known, and neither of these has had sufficient attention paid to it. This is a subject to which some of our American amateurs might well give attention.

Professor Newcomb, of the Naval Observatory, has written a letter to the *New York Tribune* upon the real needs of astronomical science in America, which deserves general attention. Professor Newcomb says, what is perhaps not generally known, that some of the legacies now so frequently left by rich and cultured men for the founding of astronomical observatories might well be diverted to the formation of schools for practical astronomy and computing, which could be done at small cost; and he calls attention to the fact that a sum of a few thousand dollars devoted to the subject of theoretical astronomy would be productive of more benefit to the science in general than twice the amount expended in costly astronomical instruments. The attempt of Professor Abbe in 1869 to establish a school of practical astronomy at Cincinnati, after the model of the famous schools of Struve at Dorpat and Pulkova, is one well worthy of imitation, and it is hoped that he may soon have an opportunity to carry out his plans.

Terrestrial Magnetism.—The first volume of the official and detailed publication of the observations on terrestrial magnetism made at Trevandrum, India, has lately been received. These observations have been in great part made and discussed under the superintendence of John Allen Broun. The first volume is confined to the subject of magnetic declination, and embraces all the observations from 1852 to 1870. After an unusually minute and laborious investigation into the errors of the instruments, Mr. Broun deduces from them a great number of interesting, and in some cases actually new, results. Some of these have already been published in the scientific journals; but the more remarkable of them are still worthy of notice. He finds that the slight diurnal influence of the moon upon the magnetic needle consists of a double maximum and minimum of easterly declinations repeated through every month. The maxima occur in December and January at the times of the moon's upper and lower transits across the meridian; but in June the minima occur near the times of these transits. The range of the lunar diurnal variation and that of the solar variation were a minimum in 1856 and a maximum in 1860. The action of the moon on the declination of the needle is greater in every month of the year during the day than during the night.

Meteorology.—In some comments upon Hildebrandsson's investigations into the upper currents of the atmosphere, Clement Ley, the author of a valuable treatise on the laws of the winds prevailing in Western Europe, states that the winds on the surface of the earth, as compared with the upper currents, show inverse relations to areas of low and high pressure; thus the upper currents blow inward upon, but the lower outward from, areas of high pressure. Consequently an area of low barometer is nec-

essarily the focus of ascending currents, which, when they have arisen to a great height in the atmosphere, flow away from the central space of low pressure toward regions of high pressure, where they sink gradually down to the surface as descending currents, and in this manner a vertical circulation is constantly maintained between the surface of the earth and the higher regions of the atmosphere.

It is very important that the theory and systematic observations on the motions of the cirrus cloud be carefully made by observers throughout the world, and this subject has been strongly insisted on since 1871 by the United States Weather Bureau.

On the 7th of July an extraordinary series of hail and thunder storms extended from Geneva, Switzerland, northward over a large part of France. The paths of these storms will be investigated by the meteorological bureaus of the various sections of France, in hopes of adding thereby somewhat to our knowledge on the subject.

Unusual rains have also been experienced in many parts of the United States, and we are forcibly reminded of the results of Dr. Koppen's studies, according to whom the present should, on the average, be a cool and wet year throughout the north temperate zone.

Physics.—Mr. Pockington states that he has examined by polarized light some specimens of hardened glass prepared by himself according to De la Bastie's method. Having prepared a small cube in this manner, its sides were ground plane and polished, and on examination by the polariscopic apparatus it became at once evident that the contraction of the exterior of the mass must exert a powerful compressing force upon the interior. The outer surface of the glass can be made, according to his experiments, nearly twice as hard as ordinary glass. On grinding away either surface it is evident that the interior of the mass consists of ordinary glass, being little, if at all, harder than before the application of De la Bastie's process, and subject to fracture in the ordinary way. There appears to be a limit beyond which the opposite surfaces can not be unequally removed without producing such phenomena as, under the polariscope, show the existence of unsymmetrical tensions; but there is practically no limit beyond which both surfaces may not be simultaneously removed, as is shown by dissolving away the softer portions by means of hydrofluoric acid.

Mr. W. Whitehorn has communicated to the Physical Society of London some experiments on the electric conductivity of glass. He shows that, although a perfect non-conductor at ordinary temperatures, yet glass, when heated to redness, allows the electric current to pass freely. Even at the temperature of boiling water a slight amount of electricity is conveyed by it. The resistance at a temperature of 165° C. is nearly forty times that observed at a temperature of 300°. The glass used by Mr. Whitehorn contained oxides of lead, thereby making it a better insulator than other kinds of glass.

Professor Dewar, in a recent lecture, after explaining the method adopted by Professor Tait and himself for obtaining very perfect vacua by taking advantage of the power that charcoal has

of condensing gases, states that these vacua are so perfect that it is impossible to force through them an electric spark between electrodes one-quarter of an inch apart, even when a powerful coil is employed. Such vacua are, therefore, eminently proper to repeat the investigation recently made by Mr. Crookes upon the action of a beam of light on a disk at the end of a delicately suspended glass fibre. Such an investigation has been made by Dewar, and he finds that the movements of the disk are due entirely to radiant heat, and not to any mysterious agency, as Mr. Crookes seems to imply. The sensitiveness of the disk increases with the perfection of the vacuum. The sides of the glass receiver must be quite thin. If the disks are covered with lamp-black, they are affected much sooner than if left white. The conductivity of the suspended body for heat, and the nature of the residuum gas within the vacuum, determine the density of the gas corresponding to the neutral point observed by Mr. Crookes. The intensity of the movements of the disk increases in proportion to the inverse square of the distance of the source of radiation. If we interpose between the light and the disk a substance opaque to heat rays, although transparent to light, the movements of the disk immediately cease. If we interpose a substance transparent to heat, but opaque to light, the deflection of the disk is large. If two disks are taken, one of rock-salt and the other of glass, it is found that the rock-salt is inactive when a beam of light is thrown on it, but the glass disk is active, the reason being that the rock-salt is not heated, whereas the glass is heated. To show the sensitiveness of the apparatus, it may be stated that an ordinary lucifer-match will, at a distance of four feet, produce instant action. Professor Dewar has not accepted the suggestion of Reynolds that the action is due to the evaporation of some of the fluid on the surface of the disk. These phenomena allow of a very perfect explanation, according to the principles of the kinetic theory of gases and the mechanical theory of heat, according to which the particles of gas are flying about in all directions with a velocity which depends upon their temperature; the length of the path of each particle is dependent principally upon the barometric pressure. Under ordinary barometric pressure of thirty inches, the length of the average path is about one-ten-thousandth of a millimeter, but when the barometric pressure is reduced to the one-millionth part of an inch, the average length of the path between two collisions is about eighteen inches. If, therefore, Mr. Crookes's disks are in such a vacuum, and heated by radiation on one side warmer than on the other, the particles of gas that impinge on that side of the disk leave it at a higher temperature, and therefore with a greater velocity, than those striking the opposite side. Hence there is a recoil of the disk as observed by him.

Mechanics.—Professor Silvester states that by the study of linkages he has been led to the conception of a new instrument by means of which a figure in the act of being magnified or reduced may at the same time be slewed around the centre of similitude. This instrument may be used, therefore, to transfer a figure from one position on a sheet of drawing-paper to any other position upon it, leaving its form and magnitude unaltered, but its position slewed around through any desired

angle. Again, it enables us to apply the principle of angular repetition, to produce designs of complicated and captivating symmetry for any simple pattern or form, such as a flower or sprig; and still it may safely, by practice, be found to place a new and powerful implement in the hands of the engine turner, pattern designer, and the architectural decorator.

Clerk-Maxwell's lecture before the London Chemical Society upon the dynamical evidence of the molecular constitution of matter presents in an admirable way the conclusions which have been reached on this subject by mathematicians who have studied molecular physics.

Amory has published a brief note on the great facility with which the horizontal pendulum of Zöllner can be used to demonstrate Ampère's laws of the attraction and repulsion of currents.

Pfaundler confirms the unequal solubility of different faces of the same crystal, recently observed by Lecoq de Boisbandran, and calls attention to his theoretical explanation of it, first published in 1869. He concludes that those faces of a crystal which possess favorable conditions for resisting the impact of the moving molecules are preserved and grow at the expense of the others. "Thus," he says, "the principle laid down by Darwin is applicable also in the world of molecules. Those forms and combinations which possess the most favorable conditions of existence are the ones which are preserved."

La Cour has devised a very ingenious use of the tuning-fork for transmitting signals on telegraph lines, which promises to become of great importance. It is based on the well-known fact that if a given fork be made to interrupt an electric circuit by its vibrations, and the intermittent current thus produced be passed through a series of electro-magnets, each in connection with a fork of different rate, only that fork will be thrown into vibration which is in unison with the first one. Practically the time required to do this is a small fraction of a second. The advantages of this method are numerous. Not only may many receiving instruments at one station be operated, each by its own key, through a single wire, but many different stations in the same circuit may be operated, that one alone receiving the message which has the requisite instrument. Moreover, many signals may in this way be transmitted over the same wire at the same time, and many dispatches sent simultaneously to as many stations. All this may be done, too, without affecting the line for its ordinary use, and independent of atmospheric and terrestrial currents.

Decharme has described a new form of sonorous flame. When gas under the ordinary pressure is burned from an opening three to five millimeters in diameter, a flame thirty to fifty centimeters in height is obtained. If now, by means of a similar tube held horizontally, a moderate current of air be directed against the flame, persistent and very varied sounds are produced. The experiment succeeds very well with a Bunsen burner giving a luminous flame (its air-openings being closed), the tube supplying the air being placed horizontally a little above the orifice and in contact with the flame. The phenomenon acquires special interest when viewed in a revolving mirror.

Desains has continued his researches upon so-

lar radiation, and has determined the quantity of heat received per minute at Paris by one square centimeter of the earth's surface placed normal to the direction of the rays during an entire year. The maximum was on June 22, when the amount received was 1.29 units, and the minimum on January 30, the amount being 1.00 unit. He finds also that the proportion of the solar rays transmitted by a layer of water eight millimeters thick reached its maximum July 4, 0.71, and its minimum on April 25, 0.63.

Krüss has described a new eye-piece formed of a divergent flint lens, placed between two convergent lenses of crown, so that the faces in contact have the same radius of curvature, and consequently touch at all points. Of the four radii of curvature present the first is +5.27 lines, the second +10 lines, the third +2.9 lines, and the fourth -5.73 lines. The sign plus refers to curves having the convexity toward the eye of the observer. This eye-piece has been constructed by Steinheil, and is sensibly applanatic and achromatic, with a field of about thirty degrees.

Wright continues his paper upon the gaseous constituents of the meteorite of February 12, and formulates the following conclusions: 1. The stony meteorites are distinguished from the iron ones by having the oxides of carbon, chiefly the dioxide, as their characteristic gases, instead of hydrogen. 2. The proportion of carbon dioxide given off is much greater at low than at high temperatures, and is sufficient to mask the hydrogen in the spectrum. 3. The amount of the gases contained in a large meteorite, or a cluster of such bodies serving as a cometary nucleus, is sufficient to form the train as ordinarily observed. 4. The spectrum of the gases is closely identical with that of several of the comets.

Capron has examined with a spectroscope especially constructed for the purpose the spectrum of the aurora, and has compared it with that of hydrogen, oxygen, oxides of carbon, coal gas, air, hydrogen phosphide, iron, and mercury under various conditions. He differs from Angström in his conclusions, first, as to the presence of moisture in the auroral regions, and second, as to the importance of the violet pole spectrum in air.

In *General Chemistry*, Pebal has examined euclorin and hypochloric acid critically, and comes to the conclusion that the former is a mixture of the latter and free chlorine in variable proportions. He assigns to the latter the formula ClO_2 .

Buchanan, chemist to the *Challenger* expedition, finds that sea-water, artificially cooled, crystallizes in hexagonal tables, the water from the melting of which yields 1.578 grams of chlorine to the liter. Iceberg ice, on the contrary, gave only 0.052 to 0.1723 grams in a liter.

Kingzett has succeeded in crystallizing a hydrate of calcium hypochlorite from a saturated solution of bleaching powder.

Reyman has detected bromoform in commercial bromine, and says it may easily be recognized by its odor, and by the fact that it lessens the solubility of the bromine in water.

Boussingault has published an elaborate research into the manufacture of steel by cementation, the analytical results of which must prove of great value.

Treue and Durassier have studied the relation

which exists between the composition of a steel and its coercive force. Durassier gives a note of great practical value on the choice of steels for different purposes.

Hartley has given a simple mode of assaying an iron ore when the facilities of a laboratory are wanting. The ore is balanced (on a rude pair of scales without weights) against pure iron wire, both are dissolved and made up to the same volume, and one-fiftieth of each is taken for titration.

Bibra concludes from his investigations that silver chloride when blackened by the action of light is not subchloride; the true subchloride, obtained by the action of hydrochloric acid on argentous citrate, having the formula Ag_2Cl_3 .

Heumann, in a paper upon the cause of the luminosity of flames, gives experimental evidence to prove (A) that a flame may be rendered non-luminous (a) by cooling it, (b) by diluting it with an indifferent gas, the temperature of combustion not being increased thereby, and (c) by energetic oxidation of the luminous matter; and (B) that the luminosity may be restored (a) by heating the flame, (b) by raising the temperature of its combustion, as by heating the gases before they burn, and (c) by diluting the oxygen with an indifferent gas.

Bach has described some simple devices for laboratory apparatus, viz., a water-blast, a wash-bottle with constant stream, and a gas cock.

In *Physiological Chemistry*, Boehm has continued his experiments on the respiration of water plants. He finds that much less oxygen is consumed by them than by land plants, and correspondingly much less carbonic acid is evolved. Indeed, he thinks the relation between the two much the same as between gill-breathing and warm-blooded animals. When dead, these water plants undergo a fermentation, attended with the absorption of hydrogen.

Thudichum has published an extended memoir on bilirubin and its compounds, in which he maintains that the transformation claimed by Maly of this substance into urochrome has not yet been effected.

In *Technical Chemistry*, Stierlien has given a method for the detection of the artificial coloring matters used in red wines, together with the results of his examination by it. In these wines he finds logwood, Brazil-wood, red poppy, mallow, blueberry, cherry, elderberry, cochineal, litmus, aniline red, and red beet.

Fordos has published an additional paper on the action of liquids, used for food or medicinally, upon the so-called tin lining of utensils which contain lead. He shows that the deleterious results of the use of such vessels are far more general than is supposed.

Zöller and Grete propose the use of potassium xanthate to destroy the phylloxera, the pest of the grape culture.

Zoology.—The *Zoological Record* for 1873 has just been issued. It is the tenth of the series, and is an invaluable manual of reference for those who have not the advantage of recourse to large libraries. No systematic zoologist can well do without it. It is edited this year by Mr. E. C. Rye, assisted by several other gentlemen. It is stated in the preface that Count August von Marschall has published in 1873, under the auspices of the Royal Zoological-Botanical Society

of Vienna, a *Nomenclator Zoologicus*, in continuation of Agassiz's work of that name. It begins with the date at which the latter ended (1846), and ends with 1868.

Attention is called by Dr. Packard, in the *American Naturalist*, to a drawing by J. Müller of a *Cercaria* with a tail along the middle of which is an axial row of cells, which remind one of the cells composing the *chorda dorsalis* of the "tail" in the larval ascidian. In the tail of another *Cercaria* (the tailed young of the fluke) Vallete St. George figures what he supposes to be a nerve. This is of interest, as showing that this vertebrate character may possibly exist in the *Cercariae* as well as the larval ascidians, and that the ascidians are probably as truly worms as the *Distomae*.

In the department of *Entomology*, Mr. Riley's seventh annual report abounds with valuable information regarding the Western grasshopper, the Colorado potato beetle, and the grape phylloxera, as well as other injurious insects.

Mr. S. H. Scudder announces the discovery of fossil dragon-flies in the carboniferous rocks of Cape Breton. Dragon-flies have not previously been found in rocks lower than the mesozoic lithographic stones of Solenhofen.

Entomological notes of interest continue to appear in the *Canadian Entomologist* and *Psyche*.

A most interesting addition to our knowledge of cave-animals has been made by Wiedersheim. He has found in the cave of Falkenstein, in the oolitic rocks near Urach, Würtemberg, an eyeless *Hydrobia*, a fresh-water shell, associated with a new species of *Ancylus* with well-developed eyes, and a species of *Pisidium*, found living with the eyeless *Hydrobia*.

Herr C. Jickeli has ascertained that the fresh-water shells of the Nile, even in Egypt, are truly African, whereas the land shells of Egypt belong to the Mediterranean fauna. Four species found by the author in Abyssinia are remarkable for their very wide geographical distribution, viz., *Pupa umbilicata* occurs in many parts of Europe, *Bulimus fallax* in North America, the East Indies, and Polynesia, *B. pullus* in the East Indies, and *Melania tuberculata* from the Malayan Archipelago to Morocco.

Messrs. Gréhaut and Picard have made experiments from which they infer that a peripheral excitement of the extremity of the muzzle is the cause of the respiratory movement in fishes.

Dr. Günther is publishing descriptions and illustrations of the fishes of the South Seas, made during many years by Andrew Garrett, who still acts as collector to the Godeffroy Museum.

Professor Steenstrup has ascertained that the peculiar appendages attached to the branchial fringe in the basking-shark, mentioned by Gunnerus and other authors, are to be considered as elongated and modified teeth, and that their function is to serve as a sieve, in the same manner as the well-known analogous apparatus in whalebone whales. The food of this shark must, then, be entirely confined to minute animals.

Spallanzani selected for his experiments in hybridization not species nearly related, but such as corresponded in the period of their breeding; and the result of these attempts with forms belonging to different families and even orders was, as is well known, unsuccessful. By prosecuting similar researches among different forms

of the same genus the following results have, however, been obtained by De l'Isle: Hybridization between *Rana fusca*, *agilis*, and *viridis* in a state of nature being rendered impossible by the different periods of the year at which those species generate, tadpoles of males and females of *R. agilis* were produced *inter se* by artificial impregnation, but attempts with any two of the species failed completely. In the genus *Bufo*, however, where the species (*B. calamita* and *vulgaris*) are much more dissimilar in most respects, belonging, in fact, to different sections, the intermixture was readily effected, and produced tadpoles. These opposite results are traced to the much greater uniformity in the generative organs in toads, even of species widely removed by other characters, than in frogs (*Rana*), where these organs are a principal source of specific distinction.

The beak of the spoonbill and flamingo has been found by Herbst and Jobert to be an organ of great sensibility, owing to the presence of large nerves splitting up into minute branches, and following the osseous canals and foramina in the beak. The minute internal bony vacuities play under the slightest pressure, equilibrium is established by the elastic tissue, and the most delicate shock readily conveyed to the very sensitive nervous apparatus.

In *Botany*, we have to record the appearance of the long-expected book by Darwin on insectivorous plants. Although much has been written about such plants both in Europe and this country, the present work far surpasses any previous publication in the number and variety of the experiments and the accuracy of the results recorded. The observations are confined principally to members of the Droseraceæ and Lentibulariaceæ, the greater part of the book being devoted to an account of experiments on *Drosera rotundifolia* (common sun-dew), *Dionæa muscipula* (Venus's fly-trap), and *Utricularia neglecta*. In the first-named plant the upper surface of the somewhat concave leaf blades is covered with glandular hairs, which secrete a sticky substance at their tips, by means of which insects are caught. If an object is placed on the hairs in the centre of the leaf, an impulse is communicated to the radial hairs which causes them to bend over until their tips touch the object. If an object is placed on a hair remote from the centre, the other hairs bend over toward it. At the same time that the hairs bend, the secretion from their tips increases in quantity and becomes acid. The rapidity with which they converge over an object is found to depend on the chemical character of the object itself, nitrogenous bodies acting more powerfully than non-nitrogenous bodies. No substances affect the hairs so strongly as salts of ammonia, and the amount of phosphate of ammonia required to cause the hairs to bend is so incredibly small that, were it not for the accuracy of Darwin's record, one would be inclined to doubt the fact. By means of the secretion nitrogenous substances, as insects and pieces of meat, are softened and dissolved, whereas little or no effect is produced on non-nitrogenous substances. Although the chemical analysis of the secretion is difficult, owing to the small amount produced by any plant, judging by its power of dissolving different substances Darwin concludes that it is very closely allied to, if not identical

with, the gastric juice. After dissolving digestible matter which has been caught, the hairs straighten themselves into their original position; when an indigestible body is caught, the hairs recover their position much more quickly. Whereas the hairs of *Drosera* are adapted for catching small insects by means of a sticky substance, the two lobes of the leaves of *Dionæa* are furnished with three highly sensitive hairs, which when touched cause the lobes to shut up quickly. The margins of the lobes are furnished with teeth, which interlock as the lobes come together, and imprison any insect on the leaf, unless it be very small. An acid secretion is then poured out by glands on the upper surface of the leaf, and digestion takes place as in *Drosera*, but the process is more difficult to observe than in the last mentioned plant, since the leaf is folded together. In both *Drosera* and *Dionæa*, although the hairs are sensitive when touched, they do not seem to be affected by falling drops of rain or by strong currents of air. The species of *Utricularia* catch their food by means of little traps on the leaves, and the insects caught slowly putrefy. Frequent reference is made throughout the book to experiments by Cauley, Mellichancho, and Mrs. Treat on American species of insectivorous plants.

The oospores of *Peronospora infestans*—potato-rot fungus—for which botanists have searched for years in vain, have at last been found in England by Mr. Worthington Smith in the leaves of the potato, where they form black spots, which at first were supposed to be caused by a species of Protomyces. This important discovery, in an agricultural point of view, settles the disputed question as to the probability of the oospores being in wheat or rye straw or in some species of clover, and the supposed liability of potatoes to rot when following a crop of grain or clover proved to be without foundation.

Under the head of *Agricultural Science*, we note some experiments by Heiden on the digestion of pease, maize, barley, and bran of rye by swine. In investigations continuing through three years, trials were made to determine the comparative effects of water and sour milk upon the amounts digested from these foods. When pease were fed with water, about the same proportions of carbohydrate were digested as when fed with milk. Of the albuminoids and fats, however, more were digested with milk than with water. In general, more of the albuminoids of all the foods were digested where they were mixed with milk than when fed with water. The rye bran was least digestible of all the foods. Heiden considers bran at best but poor food for swine.

The German agricultural journal *Der Chemische Ackermann* gives a *résumé* of results of several extensive feeding trials with sheep in England and Germany, in which have been tested the capacities of full-blood South-Downs, full-blood merinoes, and a cross between South-Downs and merinoes for utilizing food. Reckoning the production by the increase in live weight, the South-Downs gave over twice as much return for their food as the merinoes. Representing the production from a given amount of food by the merinoes as 1, the production from the same food by the half-bloods would be 1.75, and by the South-Downs 2.17.

The necessity of loosening the soil in the cul-

tivation of root crops is nicely illustrated by some experiments of Bretschneider on the growth of sugar-beets. It is well known that Knop, Sachs, Wolff, and others have raised large and normally developed plants, particularly of corn, oats, barley, and buckwheat, not only in artificial soils of pure quartz sand moistened with solutions containing the essential soil ingredients of plant food, but also in such solutions with no soil at all. In experiments with sugar-beets, however, Bretschneider met with no success either in the artificial soils or in the solutions. Several repetitions of the experiments, in which organic matter and clayey substance in the form of artificially prepared humus and zeolitic silicates were mixed with quartz sand, brought little better results, either in a glass house or in open air. Finally, after eight or nine annual trials, the effect of loosening the soil was tested. Beets were grown in a mixture of quartz sand and artificial zeolites moistened with the nutritive solution. The soil was stirred from time to time to make room for the enlargement and penetration of the roots, and for access of atmospheric oxygen. The result was a yield that could hardly be excelled in the most favorable field culture.

A number of very important practical lessons are to be learned from the field experiments with various fertilizers made by Professor Storer, of the Bussey Institution of Harvard University, to which reference has been made in these columns. This is particularly true in view of the fact that many of our commonly accepted theories are based upon the results of European experience and investigations, where conditions obtain quite different from our own.

For instance, the idea has come to us from the other side of the Atlantic, that the only essential ingredients of commercial fertilizers are phosphoric acid and nitrogen. Mr. Lawes, the famous English experimenter, expressly declares that this is the case, and that potash is not needed in artificial manures. This is doubtless true for Mr. Lawes's farm, and for many others in England and on the Continent. But Storer's experiments prove conclusively that what was most needed on the field of the Bussey Institution near Boston was neither phosphoric acid nor nitrogen, but potash. And the same is doubtless true of thousands of other fields in New England and elsewhere in this country.

Again, the theory is widely and stoutly maintained that lands should always be heavily manured, and that the greatest concentration in this respect will bring the highest profit. But in Storer's experiments on a light, dry soil, only moderate quantities of manure proved economical, and larger amounts failed to give corresponding returns. The soil was thin and lacked moisture, and hence had only a limited capacity to profit by the application of manure. And the case is the same with many other soils outside of Boston. And, as Professor Storer very pertinently explains, farmers in this country, where land is cheap, and the cost of labor and manuring high, will do best, except in special cases, to make the fullest use of the stores of plant food present in their soils, finding what ingredients are deficient, and supplying them, without storing up unnecessarily large quantities of others.

A great many cases of failure in the use of commercial fertilizers are ascribed to poor qual-

ity of the manures used, and the manufacturers or sellers are accused of dealing in spurious wares. That such accusations are sometimes well founded is only too true; but fertilizers of even the purest quality are often misapplied, and with unfortunate results. In some of Storer's field experiments with beans and barley, phosphates known to be of fair quality, instead of increasing, actually diminished the crops. This injurious action of phosphates Storer has noticed only on sterile soils. He is inclined to think that the young seedling, at the time when the shoot is beginning to draw nourishment from the seed, can not endure an excess of phosphate of lime, at least when the soil in which it stands is too poor to supply all the other food the plant may need. Hence the bad effect of large quantities of phosphates on sterile soils.

This suggests a new reason for the superior value of the superphosphate of lime. Being more uniformly diffused through the soil, no hurtful excess would be apt to come in contact with the roots of the plant. The soluble phosphate is therefore better than the insoluble, because safer.

In our *Engineering* summary for the month just past it is of interest to record the fact that the work of deepening the mouth of the Mississippi River is making progress. From the statements of Captain Eads, to whom the task has been intrusted, it appears that some 3600 feet of the provisional jetty have been completed already, and that his best expectations have thus far been exceeded by his experience.

Work upon the Kanawha improvement scheme, for which the last Congress appropriated \$300,000, is now being inaugurated. Proposals have lately been opened at Baltimore for the construction of a lock on the Great Kanawha River just below Charlestown, West Virginia. Of the character of the projected work of improvement it is reported that it is the intention of those in charge to open up one of the four great water ways favored by the Senate committee by means of the improvement of this river and the extension of the James River and Kanawha Canal across the mountain, so as to connect the James River at Richmond with the Ohio River at the mouth of the Kanawha by canal, slack-water, and open river navigations.

Upon the Hudson River Tunnel, the inauguration of which we chronicled some months ago, work has been stopped for some time by reason of legal difficulties.

A new iron bridge over the Genesee Falls at Portage, New York, has just been completed for the Erie Railroad, and opened for traffic. The new bridge is 800 feet in length, and takes the place of the famous wooden structure lately destroyed by fire.

Another bridge between New York and Long Island has been authorized by legislative enactment, and some steps preparatory to its erection have already been taken. The new company proposes to bridge the East River from New York to the Long Island shore at the lower end of Blackwell's Island. At this point the river is comparatively narrow, and a pier can be placed on the island. The surveys and soundings for its location have lately been completed by G. E. Harding, engineer in charge. The total length of the proposed structure will be, including ap-

proaches, about two miles. The largest spans will be 715, 600, 367, 320, and 300 feet respectively. The approach on the New York side will begin at the corner of Third Avenue and Seventy-seventh Street. It is proposed to lay railroad tracks across it, and to make connection with the New York Central and Hudson River tracks, through a tunnel under East Seventy-seventh Street, on one side, and with the Long Island, the Southern, and the Flushing and North Shore roads, at its termination at Graham Avenue and Lockwood Street, on the other side.

The New York Rapid Transit Commissioners have held frequent meetings during the past month, receiving and arranging plans, models, and suggestions, and discussing the merits of various inventions.

A telegraphic cable connecting Martha's Vineyard with the main-land was successfully laid across Vineyard Sound during the past month. The laying required about two hours, and was accomplished by a United States revenue steamer.

The Mexican Congress has granted a concession providing for the construction of a railroad of the standard gauge (four feet eight and a half inches) from the city of Leon, in the State of Jalisco, to the Rio Bravo del Norte, there to connect with the International Railway of Texas. The company is under obligations to finish the entire road within nine years from the date of the law.

The average daily progress on the two headings of the St. Gothard Tunnel for the first four months of the present year was as follows :

	Northern Entrance.	Southern Entrance.
January.....	9.81 feet	10.83 feet.
February.....	9.71 feet	11.69 feet.
March.....	9.77 feet	9.06 feet.
April.....	10.80 feet	14.12 feet.

The *Engineering and Mining Journal*, which has devoted especial care to the collection of authentic statistics of the coal production of the United States during the past year, authorizes the following statement. The totals are in tons of 2000 pounds :

	Tons.
Anthracite.....	24,281,471
Bituminous.....	25,248,684
Lignite.....	1,217,020
Total.....	50,747,175

In connection with this subject it is worthy of remark that quite lately at Harrisburg, Pennsylvania, a newly invented apparatus of Dr. J. R. Hayes for pressing coal dust into fuel was put in operation at the Harrisburg machine-shops. The machine is alleged to be simple, cheap, and practicable.

The *Railroad Gazette* of latest issue gives the number of miles of new railroad constructed in the United States in 1875 to be 457, against 727 miles completed during the same period of 1874, and 1578 miles in 1873.

In connection with the Centennial Exhibition at Philadelphia, the preparations for which are being pushed forward with most commendable energy, it is reported that a contract has been closed by the managers with a local passenger railway company, by which the said company is to construct, maintain, and operate within the Exhibition grounds a double-track narrow-gauge railroad, which will traverse the entire circle between the several buildings, a distance of some

three and a half miles. The road will be handsomely equipped.

A series of exhaustive and valuable trial tests of the several forms of continuous train brakes is about to be made by the administration of the several English railways.

The iron steam-ship *Brashear*, the pioneer vessel of Morgan's line from New York to Brashear City, Louisiana, was lately launched at Wilmington, Delaware, from the yard of the Harlan and Hollingsworth Company.

In *Technology*, the experimental trial of the hot blast in the Bessemer process is a novelty worth recording. We learn from the *Berg-u. Hüttenmännisches Jahrbuch* that some fifty or sixty charges were lately run in the Bessemer plant at Zeltweg, Germany, with a blast heated to 700° C. (about 1300° F.). As a result it was found that the supposition to which theory gave rise, that a slightly carbonaceous iron could be used for the Bessemer process with hot blast, proved to be correct. It was also possible to throw in more rail ends than otherwise. Iron which with cold blast would bear only twelve per cent. of rail ends, took up eighteen per cent. with hot blast. Practical difficulties, however, were met with which rendered it impossible to conduct the operation continuously. An important evil was that the bottoms of the retorts were severely attacked; while usually one would serve for fifteen or sixteen charges, it was found in this case to be often useless after two charges. Again, it was found that the excessive heating of the parts of the apparatus in contact with the hot air made its handling a matter of great difficulty. These were the causes that put a stop to the use of the hot blast, notwithstanding the favorable results obtained. It is now practically proved, concludes our authority, that the Bessemer process can be advantageously conducted with the hot blast; the manipulations, however, require experience and practice.

Herr Rautert announces that salicylic acid, which has lately acquired such commercial importance, may be readily obtained in a pure state by subliming it in a current of superheated steam. Its recrystallization from hot distilled water affords the acid in beautiful snow-white crystals. One of the disadvantages attendant upon the use of this interesting disinfectant is its difficult solubility in water. This difficulty is partly obviated by the addition to the solvent of phosphate of soda, which has the effect of somewhat increasing the solubility of the acid, while it in no wise interferes with its valuable properties. A Russian chemist has lately suggested for the same purpose the sulphite of soda, a salt which itself possesses a certain antiseptic power, and which therefore increases the disinfecting power of the mixture.

Carré, of ice-machine fame, has lately invented a very ingenious household ice-machine, in which the water is frozen by its own evaporation.

Ethnology.—The third volume of Mr. Bancroft's *Native Races of the Pacific States* is devoted to "Myths and Languages." It opens, like the other volumes, in language often obscure and pompous, with a philosophical chapter in which the author attempts on purely materialistic grounds to account for the origin of language, worship, prayer, myth, beliefs, hierarchies, sacri-

face, and even life itself. After this he gets down to his true work, and in the present volume manifests the same untiring, painstaking, enthusiastic spirit which shines out in the other volumes, and which will make the work an American classic.

On the 22d of June Mr. Herbert Spencer read a paper before the London Anthropological Institute upon comparative psychology, drawing attention to the valuable results which the division of labor had brought about in the study of the physical character of the races of men and of culture-history. He maps out the subject in his usual lucid style, and draws attention to those psychological observations to which specialists might with profit direct their labors.

The Hon. Horace Capron, late Minister of Ag-

riculture in Japan, has returned, and has brought for the National Museum six beautiful life-size papier-maché images of the natives of that country—to wit, a nobleman and his wife, two soldiers, a farmer and his wife—all perfect in form, and clad in their native costumes. There is also a fine collection of agricultural implements, ornamental screens, silver birds, etc.

An effort is making in Tennessee to collect at the State capital representative specimens of the antiquities of the State and descriptions of the mounds and other structures. This most laudable example ought to be followed by all the States of the Union, in order to furnish material for a correct and exhaustive summary of American archaeology.

Editor's Historical Record.

POLITICAL.

OUR Record is closed on the 23d of August. — The Maryland Democratic State Convention at Baltimore, July 22, nominated John Lee Carroll for Governor, and adopted a hard-money platform. The Minnesota Republican State Convention at St. Paul, July 28, nominated John S. Pillsbury for Governor, and adopted a hard-money platform.

The State election in Kentucky, August 2, resulted in the election by a large majority of M'Creery, the Democratic candidate for Governor. The North Carolina Constitutional Convention election, August 4, resulted in a Republican majority.

The Governor of Tennessee has appointed the Hon. D. M. Key to fill the vacancy in the United States Senate caused by the death of Andrew Johnson.

The yellow fever has done its terrible work among our soldiers stationed at Fort Barrancas. An unusually large number of soldiers were retained there, notwithstanding the almost certain fate confronted, until after the disease broke out, when those who were well were removed to Pensacola. Out of about one hundred and fifty persons, including the officers' families, over one-third were attacked by the disease. Among those who died was one commissioned officer, Lieutenant George W. Deshler—a young soldier of eminent worth and brilliant promise.

The French Assembly adjourned, August 4, after passing the bill constituting the Senate.

The projected Spanish constitution, while apparently securing religious liberty, declares the state religion to be Roman Catholic, and forbids public ceremonies or demonstrations of any other religion.

A serious insurrection against the Turkish government has broken out in Herzegovina, a province with 7000 square miles of territory and a population of 250,000. The disturbance has already involved Bosnia and Montenegro, and threatens to extend to Servia and Wallachia unless speedily suppressed. Other governments have intervened, and it is likely that important political reforms, especially in the matter of religious toleration, will be secured from the Sublime Porte.

The centennial anniversary of Daniel O'Con-

nell's birthday was celebrated in Ireland, August 6, with great enthusiasm.

The Merchant Shipping Bill has been passed by the British Parliament. Parliament was, August 13, prorogued until October 29.

On the 16th of August the monument to Hermann, the ancient German hero, the first apostle of German unity and of opposition to imperial Rome in the first years of the Christian era, was inaugurated on the Grotenberg. The Emperor William was present, and the day was made a national festival among the Germans. The monument has been the life work of Joseph Ernst von Bandel.

DISASTERS.

August 6.—Explosion in the arsenal at Bridesburg, Pennsylvania. One person killed and nineteen wounded.

August 5.—A water-spout bursting over the town of Kirn, in Rhenish Prussia, inundated the place, and thirteen persons were drowned.

OBITUARY.

July 31.—In Carter County, Tennessee, ex-President Andrew Johnson, aged sixty-seven years.

August 2.—In New York city, General Alexander Hamilton, son of the famous Alexander Hamilton, aged ninety years.

August 4.—In Newark, New Jersey, Commander Andrew Jackson Drake.

August 11.—At Saratoga, New York, ex-Governor William A. Graham, of North Carolina, aged seventy-one years.

August 12.—In Philadelphia, Horace Binney, an eminent lawyer, in his ninety-sixth year.

August 16.—At Oberlin, Ohio, Charles G. Finney, president of Oberlin College.

July 23.—Announcement from France by cable of the death of Athanase Josué F. Coquerel, aged fifty-five years. Like his distinguished father, he was an eminent Protestant leader. —Announcement from London of the death of Isaac Merrit Singer, inventor of the sewing-machine which bears his name, aged sixty-four years.

August 4.—At Copenhagen, Denmark, Hans Christian Andersen, the well-known writer of wonder-stories for children, aged seventy years.

practical. For bird-keepers it will be a useful little manual.—*The Birds and Seasons of New England* (J. R. Osgood and Co.) is a companion volume of the *Woods and By-Ways of New England*, by the same author. We know not that we can give it higher praise than to say that it is a worthy companion. But the book is one hardly amenable to the laws of criticism. There is no standard by which to judge it except the standard of an individual taste. If, knowing but little of birds, you yet love them and wish to know more; if, having but a chance acquaintance with Nature in her various phases, you would like an interpreter to explain to you her somewhat mystical language; if you enjoy not merely the study of nature and of birds, but talks with them and talks about them from one who has studied them sympathetically rather than scientifically—then you will like Mr. WILSON FLAGG for an interpreter, and his two volumes as companions and friends.—*The Speeches of Pope Pius IX.* (Harper and Brothers), republished from the *Quarterly Review*, is, of course, interesting reading, as is every thing which comes from Mr. GLADSTONE'S always graceful and lately trenchant pen, and is

important as one of the campaign documents in the battle which he is so vigorously waging against the papacy. It is a pamphlet of forty-four pages.—E. P. Dutton and Co. publish a very tasteful edition of *Faber's Hymns*, with a few vignette illustrations, and a biographical sketch of the author which might profitably have been fuller. The hymns themselves are not only full of spiritual life—the present half century has produced no richer devotional Christian poet—but they are also a psychological study, since, in fact, the hymns of simplest and serenest faith in Christ of any English poet are the production of one who left the Protestant Church to become a Roman Catholic priest. The present edition contains all of Faber's hymns except those which are of strictly ecclesiastical character, such as those for the festivals of the Virgin Mary and of the various saints. The size of the volume makes it convenient for the hand and pocket, and adapts it to one of the uses the author had in mind in the original collection, namely, in "ministering to those with whom, from their being in sickness or in sorrow, the effort of following a connected prose book is hardly to be expected."

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—We have to note the discovery of the 147th asteroid, by M. Prosper Henry, at Paris, on August 7. This small planet is of the eleventh magnitude.

Among the most important astronomical publications of the present year may be counted the extended series of astronomical engravings from the observatory of Harvard College. This series, we understand, is not ready for final publication, as the text, which was to have been furnished by Professor Winlock, the lamented director of the observatory, is not yet prepared. The drawings, which were made in crayon by Mr. L. Trouvelot, under the direction of Professor Winlock, are intelligible without this text, and are of great fidelity and artistic beauty.

The Melbourne reflecting telescope (four feet aperture) has recently been employed in the photographing of the moon, and the photographs which have reached this country seem to be fully equal to the best of the kind, that is, to the works of Rutherford and of Henry Draper, of New York. They are about six inches in diameter, but are very full of detail and quite sharp, so that they would bear magnifying to the size of the other pictures just referred to.

From another observatory of the southern hemisphere we have the record of valuable observations. The report of the National Observatory of the Argentine Confederation (Dr. B. A. Gould, director) has just reached America, and it shows that work of the highest scientific importance has been done in the midst of that community, and that this has been prosecuted with a rare and almost unique zeal. Dr. Gould has had during 1874 four assistants, and during a large part of that time he was himself absent from South America, yet the report shows that during 1874 12,400 observations were made upon 3600 stars for the catalogue of southern stars, besides 12,537

zone observations made by the director himself before April 14. Reliable observations of Coggia's comet were secured from July 29 to October 18, and the data of the uranometry have received a third revision. It is to be expected that the thirteen charts of the uranometry, which will give all stars visible to the naked eye from the south pole to ten degrees of north declination (8500 in number), will be completed in the course of 1875. One hundred and four thousand stars have been observed in the southern zones, and six-sevenths of the results are already transcribed on sheets ready for the computer. While the Argentine observatory is so fully occupied with scientific work, it does not neglect its practical duties. Telegraphic time signals are sent to the railroads of the country, and also to the port of Buenos Ayres. When shall we see time balls dropped in the harbors of New York, Boston, Philadelphia, Baltimore, and other cities, and at important harbors of refuge, like Hampton Roads? This seems to be a duty which Congress might reasonably impose on our own Naval Observatory.

The tables of the movements of Saturn on which Leverrier has been engaged for a long time have now been completed. They are understood to be of very considerable extent. They are based upon the observations of Greenwich and Paris, and the exhaustive theoretical investigations of the author.

Wolf, who has for some years made the study of sun spots a matter of attention, states that, according to the observations last received by him, we are now approaching a period of minimum with somewhat unusual rapidity.

As the result of his general spectroscopic review of the stars in the northern hemisphere, D'Arrest states that whereas as yet the occurrence of strongly marked absorption spectra has been supposed to be confined to the red stars, it

on the other hand must now be considered as established that this is not essentially true, and that the occurrence of this form of spectra is not peculiarly characteristic of the colored stars.

The meteors ordinarily seen in August were successfully observed in France during that month. A very extensive and systematic plan of observation at the principal meteor epochs has been for some time past organized by the Scientific Association of France at the instance of Leverrier, and is worthy of being followed in this country. About forty stations keep watch on the nights of important meteoric showers.

It is proposed by Leverrier to furnish standard observatory time by telegraphic communication to all the public clocks of Paris.

In *Meteorology*, we note that during the month of August there have been distributed to those co-operating with the Army Signal-office throughout the world the first copies of the Bulletin of International Simultaneous Meteorological Observations. By this publication General Myer hopes, it is said, to initiate the comprehensive study of the movements of the atmosphere throughout the globe, being persuaded, in common with most students of meteorology, that a single continent is too small an area to enable one to study to advantage the great storms that travel over the earth. The Bulletin of the Signal-office embraces reports from some five hundred stations, representing nearly every civilized nation of the world, and is welcomed as the most important step that has been taken of late years in the study of meteorology.

From Dr. B. A. Gould, of Cordova, South America, we receive a report of the operations of the Meteorological Office of that province during the year 1874. The instruments employed by his observers (of whom he has seventeen) are all graduated in accordance with the metric system. The general rule kept in view in his work has been, he states, excellence in a few researches rather than a wider range of inquiry with a probable sacrifice of accuracy. All the observations taken during the year 1874 have been properly reduced, and the means taken by decades of days, as well as by months, seasons, and years. Several valuable series, extending over a number of years, have been secured by him, and subjected to a detailed study. Among the curious facts spoken of by him is the singular contrast between the climates of Cordova and Buenos Ayres in respect to the moisture of the air. The average relative humidity at Cordova is a maximum in February (their midsummer), and is a minimum in September, the range being from eighty to fifty-six per cent. In Buenos Ayres the maximum humidity is in June, and the minimum in December.

Hoffman states that in continuing his researches on the quantity of heat necessary to vegetation he has by a series of observations on a number of plants in 1875 been able to show that almost exactly the same quantities of heat are required for the blossoming of plants at Giessen and at Frankfort, and that the quantities for this year do not differ materially from those required for the same plants at the same places in 1866, 1867, 1868, and 1869, notwithstanding the uncommonly cold winter and spring of the past season.

Data relating to the meteorology of India have

been collected in an important memoir by Blanford, entitled, "The Winds of Northern India," which, however, contains much more than the title would seem to indicate, being, in fact, the complete meteorology of Northern India, based upon the latest and most reliable results of observations. India being shut in on the north by the gigantic wall of the Himalayas is quite independent in its meteorological relations of the other portions of Asia, and its climate may even be said to be developed in a manner peculiar to itself under the influence of the periodical changes of solar heat. Blanford has pursued especially the investigation of general problems of physical meteorology, including in his studies one on the formation of cyclones in the Bay of Bengal.

A return has been presented to Parliament showing the percentage of verifications of the storm warnings made by the British Meteorological Office, from which it appears that seventy-eight per cent. were justified by gales or strong winds—a result perhaps as good as may be reasonably expected until the system be further extended and developed.

Professor Piazzzi Smyth and P. G. Tait, of Edinburgh, seem apparently to have been at work upon the same problem that has been so carefully studied by Desains, viz., the application of the spectroscope to the determination of the quantity of moisture in the atmosphere. They agree that certain fine telluric lines in the solar spectrum, as described by Angström, become dark smoky bands when the quantity of moisture in the atmosphere is abnormally great.

The progress in *Physics* has been considerable. Töpler has given an extended illustrated description of the admirable new physical laboratory which has just been erected by the Austrian government at the University of Grätz.

G. von Liebig has contrived an exceedingly useful modification of Frankland's apparatus for gas analysis, in which the measurements are made, not by measuring the volume under equal pressures, as is common, but by measuring the pressures, the volumes being made equal. It is simple in construction, satisfactory in operation, and accurate in its results.

Lippmann has published *in extenso* his important memoir on the relations between electric and capillary phenomena. In it he establishes the following important laws: 1st, the capillary constant at the surface of separation of mercury and dilute sulphuric acid is a function of the electric difference which exists at this surface; and 2d, when by mechanical means a liquid surface is made to change its form, the electric difference of this surface varies in such a way that the superficial tension developed in virtue of the first law opposes the continuance of the movement. These laws he has ingeniously applied, 1st, to the accurate measurement of capillary constants, hitherto so uncertain; and 2d, to the measurement of electro-motive force by means of his capillary electrometer. His ingenious electro-capillary motor, which shows the direct conversion of electrical into mechanical energy by means of capillarity, is also fully described.

Chaumont has experimentally investigated the question of ventilation, so far, at least, as the amount of air necessary for health is concerned. His determinations were made on the air of barracks, of prisons, and of hospitals; and he con-

cludes from them that 85 cubic meters (3000 cubic feet) of air per head per hour are necessary in health, in ordinary diseases one third more than this, and in serious diseases and epidemics even more still.

Kundt and Warburg have obtained an interesting result in investigating the specific heat of mercury vapor. On the kinetic molecular theory of Clausius, the quotient of the specific heat of a gas at constant pressure, divided by the specific heat of the same gas at constant volume, should be 1.67, while, in fact, for most gases this quotient is only 1.405. Clausius explains this by the fact that molecules are not material points, but are composed of atoms; and only in a monatomic gas would there be a correspondence with theory. The molecule of mercury is shown by its vapor density to be monatomic; and it is now found by experiment that in the case of this vapor the above quotient is actually 1.67. Hence a molecule of mercury, so far as its theoretical and mechanical properties are concerned, acts like a material point.

Merz has described a new telescope which he has just completed for the observatory at Quito. It has a clear aperture of 9 Paris inches, and a focal distance of 116.75 inches. The position circle is divided directly to five minutes, and reads with a vernier to one minute. A doubling micrometer and a filar micrometer are attached, the latter having eight eye-pieces, magnifying respectively 105, 160, 245, 350, 455, 585, 780, and 910 diameters. The hour circle is 18 inches, the declination circle 20 inches, in diameter; the former is divided to one minute, and reads to two seconds of time, the latter is divided to five minutes, and reads to four seconds. A number of improvements in the mounting are noticed.

Champion, Pellet, and Grenier have published a memoir upon the applications of electricity to the firing of blasts, of torpedoes, and to mining purposes generally, in which are considered the recent improvements in electromotors, in primers, and in fuses, with the various methods of using them to the best effect.

Wilson has communicated a paper to the London Physical Society on a method of measuring electrical resistance in liquids, in which polarization of the electrodes is entirely avoided. A long narrow trough is filled with the liquid to be measured, and a porous cell filled with sulphate of zinc solution is placed at one end, and a similar one containing copper sulphate at the other. In the first of these cells a plate of zinc is placed, and in the second, one of copper. The external circuit is completed through a resistance coil and galvanometer. A suitable deflection is obtained at the start, and then one of the porous cells is moved toward the other. The deflection is of course increased, and resistance is introduced to bring it back to that originally obtained. This introduced resistance is evidently equal to that of the column of liquid taken out of the circuit.

Bequerel has studied the action of magnetism on the induction spark, and shows that the loud sound which is produced when the current which flows around a powerful electro-magnet is suddenly broken between the poles is due solely to the mechanical action of the magnet, the same effect being produced by a strong blast of air directed on the spark at the instant of breaking circuit.

Schrötter has proved that when the spark passes through a Geissler tube containing phosphorus vapor, the walls of the tube are covered with a thin layer of amorphous phosphorus. Moreover, if the vapor is contained between two sealed tubes, and the spark passes through the interior one, the same effect results, showing that it is due to induction.

Rowland has described a simple method of determining the distribution of magnetism on iron and steel bars by means of a small coil of wire one-quarter to one-half an inch in diameter, containing from ten to fifty turns, which he calls a magnetic proof plane. The coil being attached to a galvanometer, it is to be placed on the required spot, and when the needle is at rest it is to be suddenly removed to a distance; the momentary deflection of the galvanometer needle will be proportional to that component of the lines of force at that point which is perpendicular to the plane of the coil.

In *General Chemistry*, a noteworthy occurrence is the communication to the Chemical Society of Berlin of some interesting reminiscences by Professor Wöhler of his early life spent in Stockholm as a pupil of Berzelius, where he met the noted men of that and other countries.

Meyer and Lecco have proved that in the higher substituted ammonias no exchange of radicals takes place within the molecule; thus answering Lossen's objection to the results he had previously obtained, which proved that ammonium chloride and its substitution derivatives were atomic and not molecular compounds, and that hence the nitrogen in them was quinquivalent.

Delachanel and Mermet have proposed a method for determining the amount of carbon disulphide contained in the alkali sulphocarbonates of commerce which are now coming into quite general use for the destruction of the phylloxera. The solution is precipitated with acetate of lead, the lead sulphocarbonate decomposed into lead sulphide and carbon disulphide by heat, the latter being carried over into sulphuric acid to retain the accompanying vapor of water, and then into a tared portion of olive-oil, where it is retained.

Heumann, in a paper on the theory of flame, asserts, contrary to the view expressed by Blochmann, that it is to the cooling of the gas by the burner itself, or by some object introduced into it, that the space between the flame and the burner or the object is due.

Kaemmerer has succeeded in obtaining well-defined crystals of cadmium by distilling the metal in a current of hydrogen. The crystals are isometric, being octohedrons, dodecahedrons, and their derivatives.

In *Organic Chemistry* the progress is to a very large extent purely of theoretic interest. Barbier has investigated the hydrocarbon discovered by Berthelot, and called fluorene. By oxidation it yields diphenylene-carbonyl, and this acted on by sodium amalgam produces fluorene alcohol in hard white hexagonal plates. This substance is interesting as being the first alcohol which by heat alone loses water and forms an ether.

Ekstrand has prepared the hydrocarbon retene from the heavy oils obtained in the distillation of wood, and has studied its properties. It forms sulpho-conjugated acids, and by oxidation

affords dioxyretistene and two other bodies, both monobasic acids.

Berthelot has contrived an interesting lecture experiment for showing the direct union of the olefines with the hydracids. Two flasks of about three hundred cubic centimeters capacity are previously filled, the one with propylene gas, the other with hydrogen iodide gas. In the lecture these flasks are opened and placed mouth to mouth, the joint between them being made tight by a band of rubber. Drops of isopropyl iodide soon appear, and the combination is complete in half an hour.

Pinner has described a new hydrocarbon, C_3H_2 , which he has produced by the action of sodium upon allylene dichloride, and which he calls propargylene.

Bouchardat has succeeded in condensing isoprene by heating it to 290° in a sealed tube, and in obtaining from it the polymer terpine, a well-known member of the turpentine series.

Gutzeit has succeeded in isolating from the fruits of several plants sufficient ethyl alcohol to prove that this substance, hitherto supposed to be solely a result of fermentation, is a normal constituent of the unfermented juices of plants.

Lorin has described a method of preparing concentrated formic acid, which consists in adding to concentrated glycerin, contained in a tubulated retort, and heated to 87° , dehydrated oxalic acid in powder, repeating the process whenever the evolution of gas ceases. The formic acid which distills over is rectified, and then contains ninety-four per cent. of real acid.

Bremer, by the action of phosphorus and iodine upon ordinary tartaric acid (dextrorotatory) in presence of water in a sealed tube, has succeeded in obtaining from it a new malic acid, which also rotates to the right. He is now experimenting upon levorotatory tartaric acid, in the hope of producing a left-handed malic acid, and by the union of the two an inactive acid.

Weiske proposes the use of salicylic acid in titration, especially in acidimetry. A convenient quantity of it is dissolved in distilled water, and a few drops of ferric chloride solution is added. To the intensely colored solution soda solution is added to exact neutralization, the color changing to yellowish-red. If a few cubic centimeters of this liquid be added to the acid to be titered, the color becomes of a deeper violet as the soda solution is added, reaching its highest intensity just before neutralization, and becoming colorless on the slightest excess of alkali.

Kolbe has thoroughly reinvestigated the properties of his "salylic acid" obtained by reducing chlorosalylic acid with sodium amalgam, and has come to the conclusion that it is nothing but benzoic acid to which some foreign fatty substance, formed at the same time, obstinately adheres. When oxidized by potassium permanganate, pure benzoic acid crystallizes from the solution.

Zöller and Grete have made a series of experiments in the Royal Agricultural School at Vienna upon Dumas's remedy for the phylloxera, that pest of the grape culture. They find that while his potassium sulphocarbonate will do the work, yet that the ethylsulphocarbonate will do it better, since, while it also evolves the effective carbon disulphide, it does not evolve the deleterious hydrogen sulphide. Moreover, it is more readily made, and is cheaper. They recommend more

especially, however, the amylsulphocarbonate of potassium as being cheaper, costing only about fifteen cents per pound.

In *Physiological Chemistry*, Pierce has studied the physiological action of cotarnine as contrasted with that of hydrocotarnine. While half a gram of the former could be subcutaneously injected into rabbits and kittens without effect, a similar dose of the latter produced rapid and well-marked tremors, passing into severe epileptiform convulsions, sometimes proving fatal.

Schutzenberger has continued his researches upon albumin, and gives now the general conclusion that albumin and its congeners are combinations of urea or of oxamide with either saturated or non-saturated amic acids belonging to well-known series.

Scolosuroff has determined that the principal localization of arsenic in animals poisoned with this substance is in the nerve tissue. Hence, in all cases of acute poisoning, the brain should especially be examined, since, when the case is a very rapid one, even the liver may not contain a detectable amount of this poison.

In *Agricultural Science*, we have to report some experiments by Eichhorn on the absorptive power of soils. It is well known that soils possess in varying degrees the faculty of retaining the valuable fertilizing substances, phosphoric acid, potash, and ammonia, which would otherwise be carried off by drainage waters and lost to vegetation. Of late the view has been widely accepted that the absorption of potash and ammonia is due to zeolitic minerals in the soil—hydrated silicates of alumina with lime and soda. Eichhorn has experimented on the absorption of ammonia by a number of these minerals, as chabazite, stilbite, together with feldspar, kaolin, etc., finely pulverized, and in some cases ignited or treated with hydrate of lime. The results confirm the above view. In a number of cases the absorption of ammonia was found to be almost exactly proportional to the amount of water in the hydrated silicates. The effect of hydrate of lime in increasing the absorptive power of feldspathic rocks (by inducing the formation of hydrated double silicates) was very noticeable in Eichhorn's experiments. The efficiency of lime as a fertilizer thus seems to be due not only to its correcting acidity, favoring nitrification, and setting free other elements in the soil, but also to its increasing this most important faculty of the soil to absorb potash and ammonia.

Dr. Wagner, of the experiment station at Darmstadt, has been experimenting with the Leopoldshall kainit, which is used in considerable quantities as a fertilizer in Europe, and is being imported to the United States. As is well known, this is one of the lower grade of German potash salts, containing generally about twenty-three per cent. of sulphate of potash and considerable quantities of chloride of sodium and chloride of magnesium, which latter is injurious to vegetation. Wagner's investigations indicate that the potash of these salts is quite completely absorbed by the soil, but is more deeply diffused than is the case with the concentrated potash compounds, while the chlorine may after a time be carried off by drainage waters. He considers not only the chloride of magnesium but also the chloride of sodium objectionable, since the chlorine of the latter may combine with the magne-

sium present in the soil. His investigations confirm the common opinion that kainit, if used at all, should be applied as long as possible before the crops are sown. It is quite certain that the higher grades of German potash salts are more profitable for American farmers than the kainit.

The physical properties of milk have been made the subject of study by Fleischmann. The specific heat of milk, as shown by the average of several determinations, was 0.847, that of cream 0.78. The point of maximum density of milk was found to be not over 1° C. (1½° F. above the freezing-point of water). It thus appears that milk continues to grow denser as it is cooled, until the temperature reaches 1° above freezing or lower, while water, as is well known, is densest at 4° C. above freezing, and expands in cooling below this. The upward and downward currents formed in a mass of water thus cooled to the freezing-point would accordingly, as Fleischmann infers, not occur in milk. Hence the cooling of milk to the freezing-point would help rather than hinder the rising of the cream.

Horsby proposes a very simple method for detecting adulterations in butter. A lump is dissolved in the smallest possible quantity of methylic ether; methylic alcohol is then added, when the fat of pork, beef, or mutton, if present, will be precipitated, while if only butter be present the solution will remain clear.

Microscopy.—In the August number of the *Monthly Microscopical Journal* is a paper by Dr. George D. Beatty, of Baltimore, reprinted from the *Cincinnati Medical News*, on "Double Staining of Wood and other Vegetable Substances." The author states that benzole fixes the anilines when used in staining tissues, and also renders them transparent. The double staining the spiral vessels, *e. g.*, of leaves red and the other parts purple or blue, is obtained by immersing the section for five or ten minutes in an alcoholic solution of roseine (Magenta), and afterward in Nicholson's soluble pure blue for thirty or ninety seconds, rarely longer, with examination during this time to decide upon the proper instant for fixation by immersing in the benzole. We commend the article to those interested in this subject.

In the same journal Dr. Bastian's address, delivered before the Pathological Society of London, opening a debate on "The Microscopic Germ Theory of Disease," is partially given. The conclusion that Dr. Bastian has arrived at, so far as presented in this paper, is opposed to the two forms of the "germ theory" of Dr. Sanderson and Dr. Beale, and, indeed, adverse to the holding of any germ theory in the only form in which it may be at all tenable. No doubt a lively discussion will be elicited, but we much doubt whether any conclusion acceptable to all will be arrived at.

Herr J. D. Möller has issued a circular in which he proposes to publish a work "On the Preparation of the Diatomaceæ," giving the results of his own great experience. The preparations of Herr Möller are unrivaled, and if his proposed book will enable others to approximate to them, it will be exceedingly acceptable, and supply a want largely felt. Messrs. J. W. Queen and Co., of Philadelphia, are the agents in this country, and orders should be sent at once.

The book was only to be issued in case a sufficient number of subscriptions were received before October, 1875.

In the proceedings of the Philadelphia Academy, April, 1875, we find a paper by Dr. Leidy upon a curious rhizopod, which he terms *Biomyxa vagans*. He compares it to the reticular pseudopods of a gromia separated from the body. The creature moved actively and assumed the most varied forms. We have long ago made observations on this curious rhizopod, and especially in connection with the diatomaceæ. When, in moving along the stems of conferva, it encounters a group of diatoms—synedra, *e. g.*—instantly the whole mass spreads out and envelops them, and for hours remains motionless, except the movement of the internal granules. A partial solution of the silica is effected in the process of digestion; for after some hours an enveloping case, partially siliceous, and which has formed during the interval, inclosing both rhizopod and diatoms, is ruptured, and in one or more streams the branching mass escapes, leaving the siliceous case quite perceptible, and the diatoms so firmly fused together that severe treatment with acids will not separate them. Professor Leidy considers it sufficiently distinct to represent a genus, and it is certainly a remarkable object. It was, no doubt, a case of encysting of this kind upon which Dr. Bastian, in his *Beginnings of Life*, founds his assertion of the resolution of *Englena* into diatoms.

Our recent *Zoological* literature does not offer any novelties of striking interest, but the work of discovery by no means comes to a stand-still. Professor Huxley sends to *Nature*, of August 19, extracts from a letter dated Jeddo, June 9, 1875, by Professor Wyville Thomson, regarding the soundings of the *Challenger* expedition, and especially the discovery of the animal of the foraminiferous shell called *Globigerina*. This is the animal whose shell enters largely into the formation of green sand, both that now being formed at the depths of the ocean and that of the green sand of the chalk period. Professor Thomson states that "when the living globigerina is examined under very favorable circumstances—that is to say, when it can at once be transferred from the tow-net and placed under a tolerably high power in fresh, still sea-water—the sarcode 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. This external coating of sarcode is rendered very visible by the oil globules, which are oval and of considerable size, and filled with intensely colored secondary globules; they are drawn along by the sarcode, and may be observed, with a little care, following its spreading or contracting movements. At the same time an infinitely delicate sheath of sarcode containing minute transparent granules, but no oil globules, rises on each of the spines to its extremity, and may be seen creeping up on one side and down the other of the spine with the peculiar flowing movement with which we are so familiar in the pseudopodia of *Gromia* and of the radiolarians.

As regards the vexed question as to whether bathybius is a living organism or not, the evi-

dence afforded by the *Challenger* expedition is negative. Professor Wyville Thomson writes that the best efforts of the *Challenger* staff have failed to discover bathybius in a fresh state, while Professor Huxley adds that "it is seriously suspected that the thing to which I gave that name is little more than sulphate of lime, precipitated in a flocculent state from the sea-water by the strong alcohol in which the specimens of the deep-sea soundings which I examined were preserved." This is a frank admission, since Huxley is mainly responsible, as he adds, "for the mistake, if it be one, of introducing this singular substance into the list of living things." So long, however, as we have before remarked in this magazine, as Dr. Bessels's *Protobathybius* is recognized as an animal, and it should be remembered that he observed it in a living state in the arctic seas, it is possible that bathybius may be a living organism.

In the *American Naturalist* for August Dr. Packard gives a summary of the facts now known regarding the life-histories of the *Polyzoa* and *Brachiopoda*. He suggests that there are in these two groups no true molluscan characters, nothing homologous with the foot, the shell gland, or lingual ribbon of the mollusks.

Some interesting facts regarding the distribution of insects in this country are brought forward by Dr. Leconte in his address as president of the Detroit meeting of the American Association for the Advancement of Science. Along the whole of the Atlantic and the greater part of the Pacific coast of the United States is found in great abundance, on sand beaches, a species of tiger beetle (*Cicindela hirticollis*), which also occurs on the great lakes, as well as the elevated plains west of the Mississippi River. "Now," he adds, "this is the part of the continent which, after the division of the great intercontinental gulf in cretaceous times, finally emerged from the bed of the sea, and was in the early and middle tertiary converted into a series of immense fresh-water lakes. As this insect does not occur in the territory extending from the Atlantic to beyond the western boundary of Missouri, nor in the interior of Oregon and California, I think that we should infer that it is an unchanged survivor of the species which lived on the shores of the cretaceous ocean when the intercontinental gulf was still open, and a passage existed, moreover, toward the southwest, which connected with the Pacific." He also points out the fact that several genera of American weevils and other low beetles are represented very closely by Australian genera.

Dr. A. Weismann, of Switzerland, has lately published a memoir on seasonal dimorphism in the butterflies, with results of much interest in their bearing on the theory of descent.

A most elaborate memoir on fossil butterflies has been published by Mr. S. H. Scudder. It forms a quarto pamphlet, with several exquisite plates, printed by the American Association for the Advancement of Science, from funds given by Mrs. Thompson, of New York.

The eggs of the gaviol, of the river Ganges, are laid to the number of forty, in two tiers, with a stratum of sand about one foot deep between the two layers. "Apparently," says Mr. A. Anderson, who publishes a note in the Proceedings of the Zoological Society, "the first batch had

been laid and covered over with sand a day or two before the second installment." He says that when the young break through the eggs they run about with amazing rapidity the moment they are hatched. "Some of them actually bit my fingers before I had time to remove the shell from their bodies."

A new wren, called the Florida wren by Mr. Ridgway, is described in the *American Naturalist*. It was shot on the Miami River by Mr. C. J. Maynard.

In the same journal Professor Snow publishes the names of birds new to the State of Kansas.

The mammals of our country are undergoing revision at the hands of Messrs. Coues, Allen, and Gill. The last paper is "A Study of the Genera *Geomys* and *Thomomys*," by Dr. Coues, separately reprinted from Powell's report on explorations of the Colorado River.

It seems that the upper lip of the manatee has a peculiar prehensile power by which it seizes its food between the two lateral bristle-covered pads with which that organ is provided, and which it can move laterally. The observations were made on the individual living in the London Zoological Gardens.

Dr. Dohrn has just published a work on the origin of the vertebrate animals, which will undoubtedly afford food for discussion.

In our monthly summary of *Engineering* news the steady advance of work upon the jetties at the mouth of the Mississippi is worthy of being recorded. The work was begun by Captain Eads on the 14th of last June, and report says its progress has been so satisfactory that he affirms his belief that the largest ships will be able to enter the river by the South Pass at any tide, and proceed without delay to New Orleans, before the end of the present year. Late advices report that of the preliminary line of piles 9860 feet have already been driven on the east jetty, and 1950 feet on the west jetty, while 4800 feet of the mattress foundation have been securely laid. Letters from the scene of operations report likewise that the channel continues to cut out rapidly, and that its depth is continually increasing, having already gained seven feet at the head of the works. At the time of this writing a board of eminent engineers invited by Captain Eads, with the approval of the President, to examine his plans, and to consult on the location of jetties and the methods of their construction, is in session in New York.

In accordance with the provisions of an ordinance of the councils of the city of Philadelphia, a commission of engineers nominated by the Franklin Institute has been intrusted with the task of examining the question of the present and future water supply of that city and of reporting its views to the councils. The gentlemen appointed have lately entered upon their work, and apparently in the most thorough manner. They have made actual measurements of the pumping capacity of the several existing works, and surveys of several proposed conduit lines. The subject of the pollution of rivers by sewage, etc., especially in its bearings upon the water supply from the Schuylkill and Delaware rivers, is likewise receiving their special attention. The result of their deliberations has not yet transpired.

The new iron bridge across the Missouri River

at Atchison, Kansas, was completed on the 4th of August, and was fully tested on the 11th.

On August 5 another iron steam-ship, the *City of Sydney*, was successfully launched from the yard of the Delaware River Iron Ship Building and Engine Works, at Chester. The new steamer, which was built for the Pacific Mail Steamship Company, is of 3500 tons burden, and a sister ship to the lately launched *City of New York*.

Abroad, the Channel tunnel project is still receiving attention in official quarters. In the French National Assembly a bill relative to the submarine tunnel was lately declared urgent. In England an act empowering the Channel Tunnel Company to acquire certain lands in the county of Kent, and for other purposes in connection with the undertaking, received favorable action at the hands of a committee of the Parliament; and lastly, at a recent meeting of the Southeastern Railway Company a resolution was adopted authorizing the directors to contribute a sum not exceeding £25,000 for the making of a shaft and other preliminary expenses in reference to the proposed undertaking.

From the novelty of the proposition, it is of interest to notice that an influential meeting, presided over by the Lord Mayor, was lately held in London, the purpose of which was to discuss the subject of the opening up of the interior of Africa to commerce. The feature of the meeting was the reading of a paper on this subject by Mr. Donald Mackenzie. The plan proposed by this gentleman is to open a direct commercial highway from a point opposite the Canary Islands to the northern bend of the Niger at Timbuctoo, a distance of 800 miles, by removing a belt of sand and admitting the waters of the Atlantic to a vast depression in the Great Desert having an area of 126,000 square miles. Timbuctoo would thus become a sea-port about 2000 miles from England, and North Central Africa would be brought within available range of European harbors.—A large and influential meeting is likewise reported to have been held lately in Liverpool for the inspection of plans of a new scheme for crossing the Mersey by means of an iron tunnel to be sunk at the bottom of the river in a line between Liverpool and Seacombe. The scheme embraces the excavation of a trench in the bed of the river to contain the iron tube, which will lie at a depth of about two feet below the bed. The tunnel will be connected with the lines of railway on both sides, and its cost, exclusive of station buildings, is estimated at £500,000.—At a sitting of the French Academy, held on the 2d of August, M. De Lesseps reported that the Viceroy of Egypt had recently introduced the metrical system.—A grand circular railway around Paris, to connect the outer fortifications and to facilitate heavy transit, is now in course of construction.

The buildings for the International Exhibition at Philadelphia are advancing rapidly toward completion. At the time of writing, the eastern half of the main Exhibition Building is under roof, and a large portion of the flooring laid. The western half of the frame is up, and the sheathing on the roof; the frame of the transept is yet to be erected. Of Machinery Hall, that portion east of the transept, including the tower, is finished, save a portion of the floor, and is painted and glazed. The portion west of the transept

is erected, and most of the roof on, and the frame of the annex is up. On the Art Building all the masonry is finished, except a part of the two arcades; the roof is on, and the figure on the dome is in place. The iron-work and masonry of Horticultural Hall are finished, and the roof partly on. The foundations of the Government Exhibition Building are laid, and the work thereon is progressing. By those who should be best informed the belief is expressed that all the buildings will be completed within the times specified in the several contracts.

In matters *Technical*, it is worthy of notice that the use of natural gas for industrial purposes is just now receiving a decided impulse. The results attained by the use of this natural fuel in puddling and heating furnaces at Erie, Leechburg, and elsewhere in Pennsylvania have been so satisfactory that the effort is now being made to bring the gas from the great gas well in Butler County, Pennsylvania, to certain iron-works in Pittsburg. For this purpose it is proposed to employ a pipe six inches in diameter and seventeen miles long, which will be carried in a trench three feet deep. The work is affirmed to be under contract, to be finished within a month. At Beaver Falls, Pennsylvania, the gas from a 1100-foot well has lately been successfully introduced into a file-works at that place. In this connection we will likewise record the rumor that a movement is on foot in Pittsburg to purchase all the gas wells in Butler County, and bring their product through a twelve-inch pipe to the manufactories.

It is now affirmed that the much-talked-of tempered glass of M. De la Bastie loses its tenacity when subjected to a succession of shocks or blows, and then fractures like an ordinary glass.

A new pigment possessing a beautiful shade of green is offered as a substitute for the highly poisonous Paris green. The new color, which is much less poisonous than the other, is called Guignet's green, and is said to be a hydrated oxide of chromium prepared in a peculiar manner.

The solubility of salicylic acid, the new antiseptic, is said to be enormously increased by the addition of borax to the water. We owe this observation to Dr. H. Bose, who, in an interesting paper on the subject in the *Berliner Klinische Wochenschrift*, highly recommends the borosalicylic dressing for treatment of wounds, etc.

An instrument called the phonometer has been devised by Captain R. E. Harris, the object of which is to obviate one of the greatest dangers of the navigator, namely, the danger of collision in foggy weather. By this device the navigator is enabled by audible means not only to communicate to a neighboring vessel the fact of the presence of his own, but also to make known her course, thus reducing the risk of accidents to a minimum.

Poor's Manual of Railroads, lately issued, gives the total mileage in operation in the United States at the close of 1874 to be 72,623 miles, which figures are indorsed by the *Railroad Gazette* as "very nearly correct." The figures lately given in these columns, and which were gathered before the publication of the *Manual*, will therefore require to be modified so as to conform to those above given.