

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—The lack of an asteroid or so for the month of March is not to be attributed to the negligence of astronomers, but to the prevailing cloudiness of the sky, which has prevented astronomical observations, notably that of the eclipse of the sun on March 25.

We note, however, in Vol. xlii. of the *Memoirs of the Royal Astronomical Society*, the reports on the total solar eclipse of 1871, December 11, by Tennant, in India, and of that of 1874, April 16, by Stone, of the Cape of Good Hope. Stone's attention was chiefly directed to the *outer corona*, which he considers he has *proved* to be a solar appendage. A discussion of several drawings of the inner corona, and a comparison of these with earlier photographs and drawings, lead him to the conclusion that the inner corona is permanently contracted in the general direction of the sun's axis of rotation, and that it is likely that the whole corona is so contracted.

Trouvelot publishes in the *Proceedings of the American Academy* a memoir on veiled solar spots; while Secchi, in the *Italian Spectroscopic Journal*, discusses the recent researches on solar radiation of Langley, Mayer, and Ericsson. An elaborate drawing of Saturn has been published by Trouvelot, with considerations on the condition of his rings; while the eight satellites of Saturn have been very fully observed by Hall with the Washington Refractor, more than 260 observations of all of them having been secured.

The Royal Astronomical Society's committee on physical observations of Jupiter publish a circular requesting drawings to be made by American observers during the present opposition, as Jupiter will be too far south for European astronomers. It is to be hoped their invitation will be responded to. They offer to send blanks and instructions to any one willing to undertake the work.

Double stars continue to receive attention. Dunér, of Lund, is preparing his measures of double stars for the press (2700 in all), and it is hoped that they will be published by the end of 1876.

Lord Lindsay's observatory at Dun Echt has commenced its publications with a volume (now in press) containing a summary of all F. G. W. Struve's double-star work. It is to comprise all the Dorpat observations, and those in *Mensuræ Micrometricæ*. Wilson and Seabroke, of Rugby, and Gledhill, of Halifax, have published the results of several years' work on double stars, done in concert on a selected list (*Memoirs R. A. S.*, Vol. xlii.), especial attention having been paid to binaries.

Mr. Barclay's observatory at Leyton has also an observing list, comprising all known and suspected binaries, and a special list of double stars requiring observation, communicated by Sir John Herschel just before his death. Dr. Schmidt, of Athens, sends to the *Astronomische Nachrichten* the discussion of his thirty years' observations of *Algol*, the variable star. A comparison of his own work with that of Argelander and Schoenfeld shows that the period of variability is well known. What the cause of the variation in light is, which produces a change from the second to

the fourth magnitude and back to the second every 2 days 20 hours 48 minutes 53.60 seconds, we are as far as ever from knowing. The proper motions of 406 southern stars have been studied by Stone, of the Cape of Good Hope. The materials for this study are less than might have been supposed, as Stone has been obliged to reject all Lacaille's observations with the rhomboidal micrometer, retaining only those made with the altitude instruments.

Bredechin, of Moscow, has lately investigated the spectra of various nebulae, mostly planetary. Most of these have a similar spectrum of three lines, A, B, and C. His mean results for wave lengths are, $A=5003.9 \pm 1.2$, $B=4957 \pm 1.4$, $C=4859 \pm 3.1$. The probable errors are deduced from the discordances of the lines of each nebula with the mean line for all, and not from errors of observation.

Oudemans describes in the *Journal of the Italian Spectroscopic Society* a new method of making heliometer measures in transits of the inferior planets, which was actually employed by him during the last transit of Venus.

Tacchini describes the new observatory founded at Calcutta, under the care of P. Lafont, for spectroscopic observations of the sun.

The University of California has accepted the offer of the fund for the Lick telescope. This is to be erected on Mount Hamilton, and all the surplus of the fund of \$700,000 is to go to the support of the observatory.

In the *Comptes Rendus*, Liais describes a new adaptation of the mural circle, and an arrangement of all his instruments, so that the instrumental errors of each are determinable in several ways.

In Ordnance Notes, No. xlv., Lieutenant Russell, Third Cavalry, describes a new electrical interrupter for the Schultz chronoscope, which may be of use in refined astronomical or physical observations.

The English Loan Collection of Scientific Instruments will be exhibited in London this summer, and is likely to be of great interest. The historical instruments of Galileo, Newton, Von Guericke, Huyghens, Torricelli, Herschel, Tycho Brahe, and others are to be there, and the collection of special apparatus will be enormous.

In the literature of astronomy we note the masterly address of Adams to the Royal Astronomical Society, on delivering its gold medal to Leverrier; correspondence between Piazzzi and Oriani, edited by Schiaparelli; and the memoir and correspondence of Caroline Herschel, edited by Lady Herschel (widow of Sir John).

In *Physics*, we learn that the process of M. De la Bastie for hardening glass has met with a formidable rival. F. Siemens, the well-known Dresden manufacturer, has patented a method of hardening, tempering, and pressing glass all at the same time. Instead of plunging the softened glass in a bath of cold oil, the molten glass is run into suitable moulds, and while still highly heated is squeezed, the moulds—which are generally of metal—having the effect of giving the necessary cooling. For blown glass, shells or casings of platinum are made, and these are transferred to the mould together with the glass.

Mayer has published a preliminary note on two new methods of research in acoustics, in which he asks the privilege of being permitted to develop them. The first is a plan for the determination of the relative intensities of sounds of the same pitch. This is effected by placing a loose membrane any where between the centres of origin of two sounds of the same pitch, and perpendicular to the line joining them, and then by any device determining the position where the membrane ceases to vibrate. The instrument he calls a phonometer. The second is a method for determining the direction of sounds. It consists of a membrane capable of being moved in any azimuth, and which can therefore be placed at right angles to a sonorous wave front. When it reaches this position it can not vibrate, since the impulses are alike on the two sides. To increase the aural parallax, two resonators may be used at the ends of a horizontal rod.

Wallace has made a series of experiments on the Bunsen burner, with a view to utilize it for general heating purposes. In one form of burner devised by him the tube contains a simple strip of metal so folded as to split up the rising currents, and so producing an intimate mixture of the gas and air. Such a burner will not strike down. In another form, called by him the tangent burner, the gas enters a circular chamber tangentially, drawing in the air with it. In this way the two are thoroughly mixed; and if now they pass into the tube of the burner through a piece of gauze at its base, the burner is safe and trustworthy under all variations of pressure and quality of gas. To utilize the burner for heating purposes, the author proposed a stove six feet high and fifteen inches in diameter, with a partition dividing it vertically from the bottom to within six inches of the top. The burner is at the bottom of one division, and the outlet pipe at the bottom of the other.

Puluj has described a simple and easily constructed form of apparatus for determining as a lecture experiment the mechanical equivalent of heat. It consists of two truncated cones of cast iron, one of which is fixed, the other movable, revolving within the first and in contact with it. The power consumed is measured by a kind of Prony brake arrangement, and the rise of temperature by a thermometer placed in mercury in the inner cone. The mean result given by fifty-seven experiments with this machine is 426.7 kilogram-meters.

Puschl has investigated the fact, observed by Schmulewitsch, that caoutchouc when free dilates by heating, but that when stretched it contracts. From the theoretical consideration that the elasticity of a body increases with the temperature when at a maximum of density, and decreases when the density is a minimum, the author concludes that caoutchouc has a minimum density, the temperature of which diminishes as the tension increases. This temperature is above the ordinary temperature for caoutchouc without tension, the co-efficient of dilatation being positive; it is inferior to the ordinary temperature for strongly stretched caoutchouc, the co-efficient being negative.

Marie-Davy has called attention to the agricultural value of meteorological observations. He gives the results of experiments made on growing wheat, in which the rate of transpiration was com-

pared with the temperature and the actinometric power, and also gives statistics to show the connection between meteorology and crops. He believes that at the close of May or early in June, at which time the wheat is in flower, it is possible to deduce from purely meteorological data the value of the future crop.

Gernez has published in full his paper on the evaporation of superheated liquids. Having already shown that evaporation is the only normal mode of vaporization of liquids, he now considers the peculiarities of this mode of producing vapor.

Weber has determined anew with great accuracy the specific heat of carbon, boron, and silicon by means of Bunsen's ice-calorimeter. If the specific heat of these bodies be taken at a temperature where they are constant, that of carbon is 0.467, silicon is 0.203, and boron is 0.500, thus bringing the atomic heats under the law of Dulong and Petit, as 5.6, 5.7, and 5.5 respectively. Three varieties of carbon were employed, their specific heat being the same at the temperature of 225°.

Delachanal and Mermet have given some results obtained by means of their spectro-electric tube which show its value in qualitative analysis. In the ashes of the sporules of the common puff-ball (*Lycoperdon pratense*), after separation of the silica, lines of sodium, calcium, magnesium, zinc, copper, and hydrogen were observed. A specimen of zinc examined in this way showed the presence of both indium and gallium. The estimated amount of indium in ten kilograms of the zinc was 0.050 gram, and of the gallium 0.002 gram.

Wunder has investigated the absorption spectra given by light reflected from different varieties of ultramarine, and gives curves showing the variations of intensity.

Deprez has contrived a new form of electromagnetic register for recording velocities. With the apparatus figured, which is simple in its construction, 600 complete signals can be recorded in a second.

Jamin has published an extended paper on magnetism, in which he gives the laws of magnetic distribution.

Duter has studied the distribution of magnetism in circular and elliptic steel plates, and concludes, 1st, the free magnetism is proportional to the surfaces; 2d, it is distributed in hyperbolic lines, the non-transverse axes of which are in the direction of the axes of symmetry perpendicular to the neutral line.

In *Chemistry*, Meyer has described a lecture experiment for illustrating that vaporization without fusion is due to pressure. Two glass tubes containing iodine are prepared and sealed, one vacuum, the other at nearly the ordinary pressure. If now both tubes be warmed, the iodine in the second tube melts, and may be made to run down the walls of the tube; in the vacuum tube the iodine only volatilizes.

Naumann shows that potassium-alum solutions, when heated to 100° C., are partially decomposed, losing a portion of their sulphuric acid.

Landauer has proposed a very simple form of blow-pipe, which consists simply of two bottles tubulated at bottom, and connected by these tubulures through a rubber tube. The upper opening of one of these is closed by a cork, through which a tube passes going to the jet. This bottle being empty, the other bottle is filled with

water and placed at a convenient height. The hydrostatic pressure forces the air out of the first and lower bottle through the jet.

Mohr has communicated a paper on the nature and origin of meteorites, in which he discusses at length the chemical and astronomical questions involved.

Houzeau has proposed a method for the volumetric determination of carbon dioxide, depending on the absorption of the gas by a graduated solution of alkali, precipitation by barium chloride, and estimation of the free alkali.

Parsons has made a series of experiments at the Woolwich Foundry on a manganese bronze, which, when forged, had a strength of twenty-nine tons to the square inch, an elastic limit of twelve tons, and an elongation of nearly thirty-two per cent.

Zarawkowitch proposes the use of glycerin for reducing platinum solutions in order to form platinum black; 15 c. c. of glycerin of sp. gr. 25° to 27° B., and 10 c. c. potassium hydrate of density 1.08, are gently heated, and 3 to 5 c. c. of platinic chloride is added. The platinum black falls, and is collected and washed.

Guyard has thrown considerable light on the formation of aniline black by the discovery that the salts of vanadium have a marked influence in producing it. This he attributes to the facility with which this metal passes from one state of oxidation to another.

Butlerow has shown that the olefines, like the terpenes, are capable of direct union with water to form alcohols, isobutylene yielding trimethylcarbinol quite readily in this way.

Girard has proposed to mix with dynamites, in order to prevent their congelation in cold weather—a result which seriously interferes with their explosive power—about ten per cent. of methyl nitrate. The volatility of this body he finds to be no inconvenience in practice.

Kuperberg has succeeded in effecting the retransformation of paraoxybenzoic acid into salicylic by heating its sodium salt to 290° C. Over one-half of the theoretical yield was obtained.

Weselsky has shown that phloroglucin is a very delicate test for nitrous acid. Very dilute solutions of phloroglucin and toluidine (or aniline) nitrate become dark orange on the addition of a few drops of a dilute solution of potassium nitrite, and a cinnabar red powder is thrown down.

Wartha has investigated more minutely the coloring matter of litmus, and has shown that the commercial article always contains indigo. He gives directions for preparing the coloring matter pure.

Anthropology.—Principal Dawson read a paper before the Victoria Institute, March 20, on Fossil Agricultural Implements in the United States.

Professor Haldeman is reported to have discovered a cave or rock shelter in Lancaster County, Pennsylvania, and under a foot of *debris* upon its floor stone implements of great variety and beauty.

The subject of pigmy graves in Tennessee and Kentucky is again discussed in the newspapers. The fallacy of such a thing is entirely shown by the communications of Messrs. S. E. Haskin, W. M. Clark, and Dr. Joseph Jones, who all attest to the small slab graves being ossuaries or children's graves. These gentlemen have all made extensive excavations, and have sent bones found in the cists.

The first number of Volume II, Bulletin of the United States Geological and Geographical Surveys of the Territories, contains six papers upon the anthropology and archaeology of the cliff-dwellers of the San Juan and its tributaries. The contributors are Messrs. W. H. Holmes, W. H. Jackson, Dr. Emil Bessels, and E. A. Barber. The first three papers are profusely illustrated.

The Congrès International des Américanistes is to hold its second session at Luxembourg, from the 10th to the 13th of September, 1877. The committee of organization, with M. Wurth-Paquet as president and Dr. Schoetter as secretary, has sent out its circulars. The subjects to be treated are, History, Archaeology, Linguistics, Paleography, Anthropology, and Ethnography.

Silliman's Journal for March contains an article upon flint implements from the stratified drift in the vicinity of Richmond, Virginia. The alleged discoveries, bearing upon a subject which has awakened so much controversy, should be subjected to the most rigid scrutiny before being accepted.

Herr Fritz Müller writes to Mr. Charles Darwin a letter, which appears in *Nature* of February 17, giving an account of the "sambaquis" or shell heaps of the Brazilian coast. They are very numerous and extensive. The skulls found were of immense thickness. Stone axes were often found.

The *International Review* for March contains an interesting article by Aneurion Vardd upon Bardism, or the primitive system of instruction, knowledge, and morals among the Britons.

The annual address of the president of the London Anthropological Institute reviews the papers of the last year. During the last month the Rev. H. H. Howorth read an elaborate paper upon the N. and N. E. frontages of the Indo-Europeans in early times; and Mr. E. W. Brabrook read one upon the ethnography of Scotland.

The January and February numbers of *Matériaux* contain the usual quantity of interesting matter, the drawings in both numbers of stone structures and implements are exceedingly valuable.

M. Édouard Naville, of Geneva, one of the special committee appointed by the last Congress of Orientalists to edit a complete corpus of the "Rituel Funéraire," is visiting all the museums in Europe where hieroglyphic texts are known to exist. The committee appeal to all possessors of fragments to contribute fac-similes, so as to make the redaction as complete as possible.

The whole series of translations from the sacred books of the world, to be edited by Max Müller, will be divided into six sections, viz., Brahmans, Buddhists, Zoroastrians, Confucians, Lao-tseans, and Mohammedans.

The attention of ethnologists is being turned to New Guinea. Little or nothing is known of the natives, the most conflicting accounts coming to us of their Malayan and Papuan characteristics. Captain Moresby tells us of a singular method of scraping acquaintance by dashing out the brains of a dog, and of salutation by mutually pulling each other's noses and navels.

Among the more important general papers on *Zoology* which have recently appeared are two by Professor E. Van Beneden, of Liege. One is on the maturation and fecundation of the egg and earlier embryonic phases of the mammals, from

researches made on the rabbit, and is an extension of Bischoff's famous work on the embryology of the rabbit. A second paper, on the history of the germinative vesicle, is based on studies made on the common star-fish of the European coast (*Asteracanthion rubens*). A paper of a very different sort is a fierce attack on the "gastræa" theory, by M. Moquin-Tandon, in the *Annales des Sciences Naturelles*. He concludes that it does not rest on any fundamental fact, and can not serve as a base of a phylogenetic classification. The theory had previously been attacked in the *American Naturalist* for February by Mr. A. Agassiz. On the other hand, in the April number of the same magazine, Professor Cope, in an article entitled "Progress of Discovery of the Laws of Evolution," welcomes Haeckel's gastræa theory, which we have previously explained. Cope says that this theory has "added the key-stone to the doctrine of evolution in his gastræa theory. Prior to this generalization it had been impossible to determine the true relation existing between the four types of embryonic growth, or to speak otherwise than to the effect that they are inherently distinct from each other. But Haeckel has happily determined the existence of identical stages of growth or segmentation in all the types of eggs, the last of which is the gastrula, and beyond which the identity ceases." Whether, we may add, the gastræa theory of Haeckel is true or not, he and others have shown that animals of all the five types above the protozoa pass through a gastrula stage, disproving Von Baer's statements that four of these types have distinct modes of development, and paving the way for the doctrine of the unity of the mode of development of all animals.

A number of supposed new species of *spongilæ* (the fresh-water sponges) are described in the *Canadian Naturalist* by Mr. G. M. Dawson.

An essay of much interest to naturalists is Dr. W. K. Brooks's "Affinity of the Mollusca and Molluscoïda" (polyzoa and brachiopods). While he, with some others, believes that the tunicates are not mollusks, and that the polyzoa and brachiopods are derived from the worms, he also, as others have suggested, thinks that the mollusks are also derived from the worms. He believes that the polyzoa originated from a type like the brachiopods. Thus it would seem, he says, "not only that the mollusca and molluscoïda (polyzoa and brachiopods) are related, but that they are connected so closely that the advisability of such a division is very doubtful." He does not believe that the lamellibranchs are typical mollusks, but that the gasteropods should be considered so, and that the lamellibranchs are derivations from them.

A very fully illustrated paper on the reproductive organs of the higher crustacea, by M. Brocchi, appears in the *Annales des Sciences Naturelles*.

The brine shrimp *Artemia* has continued to engage the attention of a Russian naturalist (Schmankewitsch), who announces that, by increasing the saltness of the water in which the *Artemia salina* lives, a modification goes on from generation to generation, until the caudal lobes finally disappear, and the form is that in *Artemia mihlhausemii*, and by reversing the process the caudal lobes grow out again, and become those of *A. salina*.

An extensive work on the crustacea of Mexico and Central America, by A. Milne-Edwards, has

been published by the French government. The work is illustrated by twenty excellent plates.

A series of colored drawings of saw-fly larvae, belonging to the genus *Nematus*, accompanied by description, is a useful work lately published in Germany by Messrs. Brischke and Zaddach. It will be of much use to economic entomologists in this country, as these worms are very injurious.

Are potato beetles poisonous? is answered negatively by Messrs. Grote and Kayser in the *American Naturalist* for April.

Mr. Grote contributes an essay on the cotton-worm in the Report of the Geological Survey of Alabama. His observations are based on a study of this insect during a residence of several years in that State.

The embryology of the flea, *Pulex felis*, has been studied anew by Balbiani. So far as the long abstract published of his work is concerned, no mention is made of an essay on this subject, illustrated with numerous figures, by Dr. Packard, published in 1872 in the Memoirs of the Peabody Academy of Science, Salem, wherein a number of facts supposed by Balbiani to be new are mentioned.

A new batrachian from Madagascar is described in the *Annales des Sciences Naturelles*, the same number of which contains notes on the curious tentaculated snake, *Herpeton tentaculatum*, of the East Indies.

The falcons of America are still engaging the attention of Mr. R. Ridgway, who has published in the second number of Hayden's Bulletin of the United States Geological and Geographical Survey of the Territories an additional paper on them. The same number contains an essay on the "Ornithology of Guadalupe Island, based on Notes and Collections made by Dr. Edward Palmer." The collection is very interesting from the fact that every one of the resident species is distinct from any found on the neighboring mainland of California, although each has a continental representative more or less nearly related.

Many interesting and novel facts regarding the prong buck, or "antelope" of the plains, are given in the *American Naturalist* for April by Judge Caton, who has studied the animal in a state of domestication on his estate. The article is illustrated by an excellent figure of the adult, and the kid four months old.

The fossil remains of the *Brontotheoridae*, a group of fossil mammals nearly as large as the elephant, but with shorter limbs, but no proboscis, are figured and described by Professor O. C. Marsh in the *American Journal of Science and Arts* for April. These animals had a very small brain in proportion to the size of the skull. They inhabited the lake basins of Dakota, Nebraska, Wyoming, and Colorado in the miocene tertiary period.

In *Botany*, we have to record in this country notes on the agave by Dr. Engelmann, and an account of the black spruce by Mr. C. H. Peck. In the *Comptes Rendus* Van Tieghem states that he has been studying the development of chætium, and is of the opinion that what De Bary and others have considered the mode of fertilization in several of the ascomycetes is really something quite different.

In the *Botanische Zeitung* Brefeld attacks Van Tieghem, and especially his views recently published on coprinus. In Pringsheim's *Jahrbücher* Reinke gives an interesting account of the secret-

ing organs of the leaves of different plants. In the same journal Tschitstiakoff publishes some contributions to the theory of the vegetable cell, the most recent paper being on the development of the pollen in *Epilobium angustifolium*.

Castracane reports discoveries of diatoms in coal from different localities, and he finds that many of the species are identical with those living at the present day. The species are both marine and of fresh-water, and may serve to throw some light on the conditions under which coal was formed.

Adolphe Brogniart, the distinguished head of the botanical museum of the Jardin des Plantes, died in Paris on the 18th of February. He was born in Paris in 1801, and at the early age of thirty-three years was chosen member of the French Academy. His principal writings were on fossil plants.

From the *Engineering* works at the mouth of the Mississippi no special report of progress has appeared during the past month, save occasional items confirmatory of the facts published in our last in relation thereto. Reports from the survey of Galveston Harbor, Texas, lately made by Lieutenant Quinn, indicate that the work of improvement in charge of the United States engineers has been quite successfully carried out so far as it has progressed. Without entering into technical details, it may be of interest to remark that the jetty system, as being there applied, will eventually give to Galveston a harbor free of obstructions, with eighteen to twenty feet of water over the bar.

Mr. Crozier has proposed in the *Scientific American* a plan for increasing the capacity of the Erie Canal, by building a second channel separate and distinct from the other, thus separating the upward and downward bound boats. This improvement, although costly, he contends would more than pay for itself, inasmuch as by doubling the speed of the boats it would quadruple the capacity of the canal. He believes the State would be justified in adopting it, at least for a part of the distance—say, from Buffalo to Rochester for the present—and estimates the cost of the work for this distance at \$35,000,000.

Mr. Henry S. Drinker, an accomplished engineer of Philadelphia, is at present busily engaged in the preparation of a work on American tunneling, which is designed "to show both our record in the past, and the present methods in vogue." No such treatise as the one proposed has ever been compiled in America, and English records are meagre. Such a compilation, if accurate and complete, would prove to be invaluable to engineers, and we cheerfully give place to Mr. D.'s call upon the profession for reliable data, whether general or detailed, to aid him in his task.

The Eastern Telegraph Company lately announced the repair of its Suez-Aden cable, by which telegraphic communication is re-established with India and the far East *via* Falmouth. The recovered cable is affirmed to be in excellent condition.

At a recent meeting of the London Society of Civil Engineers a paper was read giving full details of the several schemes for effecting railway communication across the English Channel. These schemes included tunnels, tubes, and ferries, most of which have already been referred to in these columns. As a meritorious rival of the

favorite plan of a tunnel through the lower chalk, the scheme of Mr. Paul J. Bishop was described in detail. This plan involves the laying of a double line of tubes for carrying a railway on the bed of the Channel between Dover and Cape Griznez, the tubes being laid from floating pontoons. The estimated cost is £22,000,000, and time of execution five years. Sir John Hawkshaw's tunnel plan is estimated to cost £10,000,000, and ten years.

The project is seriously entertained in Egypt of building a railway into Soudan. The proposed road would be 2500 kilometers long, proceeding from Alexandria, passing by Cairo, Thebes, Assouan, and other points of less prominence, and terminating at Massoura.

The *Railroad Gazette* reports in its issue of March 31 the construction, to that date, of 304 miles of new railroad in the United States in 1876, against 129 miles reported for the same period of 1875.

The steam street car which has been for some months in use upon the Atlantic Avenue Railroad in Brooklyn is reported to have given the highest satisfaction.

In *Technology*, we may report that Mr. Blair, whose direct process of iron-making we have several times alluded to, affirms that he is about effecting decided improvements in his invention.

Letters patent have just been issued to certain gentlemen of Sheffield, England, for a new process of effecting the purification of iron and steel. The inventors claim to be able by their compound or mixture to eliminate sulphur, phosphorus, antimony, arsenic, and copper from iron and steel, whether crude or in an advanced stage of manufacture.

The experiment of burning coal dust in locomotive boilers is now being tried by the Reading Railroad Company, and one of its largest locomotives is now being altered at Port Richmond for that purpose.

The works of the Loiseau Pressed Fuel Company at Port Richmond, Philadelphia, are in an advanced state of completion, and on an extensive scale, and operations for the production of fuel from the dust heaps at that place, we are informed, will speedily commence. The process of Loiseau, our readers will recall, has been several times alluded to and described.

Dr. William Crookes, whose interesting discovery of the mechanical action of radiation has attracted such attention, lately demonstrated in a lecture before the Royal Institution the adaptability of his discovery for the determination of the luminous intensity of flames, and proposed an apparatus employing the principles of his late discovery as a substitute for the photometers usually employed for the above purpose.

The employment of pulverized fuel with the blast in cupola furnaces has lately been practiced with much success in Philadelphia and elsewhere, and is attracting the attention of metallurgists. It is claimed that "scaffolding" is entirely prevented, the rapidity of operation and production of the furnaces doubled, the quality of castings much improved, and that refuse iron of any quality may be utilized with profit.

The French Academy lately granted the Montyon prize for the improvement of dangerous arts and industries to M. Denayrouze for his invention of the *aérophore*.

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SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—During the month of April three asteroids have been discovered: number 161, by Watson, April 19 (?); 162, by Prosper Henry, April 22; and 163, by Perrotin, April 28: 162 and 163 are both of the twelfth magnitude. We notice that the large transit circle of the Washington Observatory has recently taken up the constant observations of asteroids, and that the computations of their ephemerides by the American Nautical Almanac are continued, so that we may feel that America is bearing her share of the rapidly increasing work in connection with these bodies. André, of Paris, has recently published in the *Comptes Rendus* the results of a research on the diameters of the inferior planets as affected by diffraction, which will be of interest in the reduction of observations of the transit of Venus. The practical result of his discussion is to show that a correction to the times of ingress, etc., of Venus is required in order to reduce observations made with telescopes of various apertures to what they would have been if made with an assumed standard aperture. In the equipment of the American transit of Venus parties this was provided for, by furnishing each of the parties with a telescope of five inches aperture, so that no correction on account of aperture will be required when the American observations come to be compared among themselves.

In connection with the determination of the distance of the sun, the announcement recently made by Professor Henry that it was proposed to attack this question from its physical side is of importance. The necessary funds for the purpose have been promised, and it is understood that Professor Newcomb is to undertake a determination of the velocity of light by a modification of the method of the revolving mirror (used in other forms by Wheatstone and Foucault), in contradistinction to the revolving toothed wheel (used by Fizeau and Cornu).

Professor Wright, of Yale College, continues his researches on the gases contained in meteorites, and in a paper in the last *American Journal of Science* he confirms his former conclusions. Stony meteorites have spectra resembling strongly those of several of the comets, and the nature of their spectra establishes a marked distinction between the stone and the iron meteorites. The Iowa meteorite formerly examined has been re-examined, as well as several others of both kinds, and previous conclusions verified. Professor Wright is still engaged on this subject, but considers the evolution of large volumes of carbon dioxide as characteristic of the stony meteorites, and the relation of these facts to the modern theory of comets is certainly of great interest.

M. Trépiéd has recently taken up a research on the transparency of the atmosphere and on stellar photometry (which was proposed by Arago in 1850, and prosecuted by Laugier), with encouraging though not definitive results.

The expedition sent by the Hydrographic Office, United States Navy, to the Windward Islands for the purpose of determining the telegraphic longitudes of points there, has already determined successfully the longitudes and latitudes of five

stations through the West Indies and at Trinidad, South America. Two more remain to be accomplished by Captain F. M. Green and his assistants. At the recent meeting of the National Academy of Sciences Dr. C. H. F. Peters and Professor Langley were elected members in the section of astronomy. The Dudley Observatory at Albany is to be re-opened under the auspices of Union College, of which it is a part. Mr. Lewis Boss, assistant United States Northern Boundary Survey, is to be in charge.

In *Meteorology*, the most interesting paper that has recently appeared is that by W. C. Ley, published in the *Journal of the Scottish Meteorological Society*. Mr. Ley presents an attempt at a philosophical explanation of the movements of storm centres; but it is his statistical researches that are of especial value, since, like those of Loomis, they pave the way for the correct understanding of the subject. He states that he himself belongs to those who believe that a cyclonic system is not to be treated as an eddy in the prevailing currents, and that its westward or eastward motion is not wholly due to the force of those currents. He finds from his extensive studies that the mean tracks of storm centres show a general coincidence with prevailing winds, and individual depressions show a tendency to travel around temporary local areas of high barometer, keeping the latter on the right hand in the European storms. A suggestion of Mr. Robert Tennent seems to have led him during the past year to examine whether there is any connection between the movement of the storm centre and the position of its steepest barometric gradients. He finds that of 800 storms passing near Great Britain during nine years, the large majority had a tendency to move in directions parallel to the trend of the steepest gradients; thus when the isobars are closest on the southeast side, the tangents trend toward the northeast, and fifty-five per cent. of these storms move in the same direction. He finds also evidences of a less important disturbing force tending to make the depressions move toward the northeast by east. It would be interesting to compare Ley's rules with the behavior of American storms. We can see no reason why they should obtain for the storms occurring between the Rocky Mountains and the Atlantic coast.

To the little that is known of the diurnal variations in the fall of rain and snow, Dr. Hellmann contributes an investigation into the phenomena observed for fifteen years at Zechen, in Silesia. It is found that, on the average of the year, the greatest quantity falls between 4 P.M. and 6 P.M., the least between 8 A.M. and 10 A.M. The greatest number of rains have been recorded between 4 A.M. and 6 A.M., the least number between 10 P.M. and midnight.

Koppen publishes on the frequency of rain in the northern hemisphere an exhaustive summary that goes far to establish the scientific value of a simple record of the number of rainy days or hours in each part of the world. Koppen finds that the frequency of rain depends principally on two points—(1) the relative humidity within ten thousand feet of the earth's surface; (2) the presence of conditions favorable to the production of

ascending currents of air, which conditions are principally determined by the topography of the ground as related to the prevalent winds.

In *Physics*, a noteworthy event has been the presentation to the Royal Society of a paper by C. W. Siemens, describing an instrument to which he gives the name of bathometer, and by which the depth of water at any point in the ocean may be ascertained by simple inspection, without the use of a sounding-line. It consists of a vertical column of mercury inclosed in a steel tube having cup-like extensions at its ends. The lower end is closed by a corrugated steel diaphragm, the weight of mercury resting upon it—which is of course affected by the force of gravitation, being balanced in the centre of the diaphragm by the elastic force of four carefully tempered steel springs—which is independent of any variation of gravity. Being open to the atmosphere both above and below, the instrument is unaffected by variations in the pressure of the air. The peculiar form of the column was given to it in order to render the instrument parathermal, or independent of temperature. The reading is effected either by electric contact or by means of a spiral graduated tube fixed on the top of the instrument, and communicating with the space above the mercury, which contains a liquid of less density partially filling the tube. The graduations are empirical, since this is much easier than calculation. Experiments on the *Faraday* with Sir William Thomson's sounding-line gave 82 fathoms at 12, 204 fathoms at 1.08 P.M., and 69 fathoms at 2.20; the bathometer showed 82, 218, and 78.

Berthelot has examined thermo-chemically the explosion of gunpowder, in order to negative the view expressed by Noble and Abel, that this phenomenon is incapable of exact chemical formulation. He shows most clearly that when powder explodes there is formed all the bodies which are stable in the conditions of the experiment, principally potassium sulphide, sulphate, and carbonate, as well as carbon dioxide, monoxide, nitrogen, and steam. The proportions vary with the conditions of the experiments. These substances, if they remain in contact sufficiently long, suffer reciprocal action which brings them to a single condition, *i. e.*, that which corresponds to the maximum of heat set free. Each of these products is formed according to a regular law nevertheless, and the chemical transformations of the powder are expressed in all cases by a simultaneous system of very simple equations.

Lockyer has made some remarkable observations on the spectrum of calcium at different temperatures and under different conditions. The blue line ordinarily observed in the calcium spectrum given with a Bunsen burner he considers a line of calcium itself, the other lines being those of its chloride, not dissociated. As the dissociation advances by rise of temperature, the blue line becomes more brilliant and the chloride spectrum fades. If now the electric arc be employed, the blue line is intense, and two new lines appear in the violet which occupy the position of the two H lines in the sun spectrum. But while in this spectrum the blue line is the most intense, the reverse is the case in the solar spectrum. Using, however, a large induction coil and battery, and then a small coil and battery, Lockyer found that while in the latter case (the spectra being photographed) the blue line only was appar-

ent, in the former the violet lines appeared, with no trace of the blue one. Varying the intensity of the current, a fac-simile of the three lines in the sun spectrum was obtained. The author queries whether these facts do not teach the dissociation of calcium itself, and suggests solving the problem by photographing the H lines of stellar spectra.

Planté has continued his experiments with secondary batteries, and now shows that the spark taken from the surface of water gives phenomena analogous to those observed in polar auroras.

Bourbouze has proposed to use natural conductors, such as water-courses, and even the earth, as a medium through which to obtain electric signals. Experiments which he has made in Paris seem to have been quite successful.

In *Chemistry*, Scheurer-Kestner has examined the gas which is produced by the combustion of pyrite, in reply to Bode. The sulphurous oxide varies from 6 to 9 per cent., the oxygen from 6 to 9 per cent., and the nitrogen from 84 to 85.5 per cent.

Olivier has given an elaborate paper descriptive of the sodium nitrate regions of South America, illustrated with an excellent map of the region.

Dupré has proposed a modification in Dumas's method for the determination of nitrogen in organic analysis, which consists in a carbonic gas apparatus by which the air and the nitrogen may be removed, and a peculiarly constructed cylinder for receiving and measuring the gas.

Johnson has observed the formation of nitrites in the potash bulbs when bodies containing nitrogen are burned, and as these absorb oxygen and increase in weight, they may cause an error.

Moride has given some statistics of the production of charcoal from algæ on the French coast, which has risen to an important industry; 100,000 kilograms of the fresh plants yield 20,000 kilograms of the dried and 5000 kilograms of charcoal. This, when incinerated, yields from 3500 to 4000 kilograms of saline matter, containing 20 per cent. of potassium salts. The charcoal itself is an excellent disinfectant and decolorizer, and is also used as a fertilizer.

Hartley has examined the liquid which is contained in the cavities of some varieties of rock-crystal, and comes to the conclusion that it is liquid carbon dioxide. Comparing his results with Brewster's, he adds to the list several other minerals. The proof of the fact stated he finds in the fact that the critical point for the inclosed liquid is between 30.75° and 31° C., while that of liquid carbon dioxide, as determined with great care by Andrews, is 30.92°.

Wright has examined several more meteorites for the purpose of determining their gaseous constituents, and finds essentially the same composition for these gases as that given by the Iowa meteorite before published. The present results, however, were obtained at temperatures varying from 350° C. to a full red heat for the stony, and from 500° to a bright red heat for the iron, meteorites. His previous generalization, that stony meteorites differ from iron ones in containing more carbon dioxide and less hydrogen and carbon monoxide, and in evolving their gaseous constituents at a much lower temperature, seems fully confirmed.

Guyard has examined the residue left in the retort after the manufacture of sodium. The

mixture put in consisted of crude salt of soda, 56.5; coal, 18.5; coke, 10.5; chalk, 14.5. The residue, after exposure to the air, consisted of 35 per cent. of soluble matter, 9 of water, 22 of carbon, 18 of carbonate and oxysulphide of calcium, ashes and iron oxide, 15.4. The soluble portion contained 11.9 caustic soda, 44.30 carbonate, 24.10 sulphate, 11.70 sulphite, 0.45 sulphide, 7.05 chloride of sodium, 0.2 silica, 0.3 of alumina, and traces of lime and potash.

Terreil has analyzed the black residue obtained by calcining potassium ferrocyanide, and finds it to consist of metallic iron, 32.05; magnetic oxide of iron, 27.56; uncombined carbon, 27.49; combined carbon, 1.17; carbon as cyanogen, 0.24; potassium, 0.81; nitrogen, 0.29; oxygen, 10.50.

Laspeyres has investigated the chemical constitution of the natural and artificial oxides of manganese, called braunsteins, with a view to determine the equivalence of the metal manganese.

E. von Meyer has studied at length the apparent action of chemical attractions called into play during the slow oxidation of hydrogen and carbonous oxide by means of platinum.

Gladstone and Tribe have continued their researches on the decomposing action of aluminum in presence of its haloid compounds, and have observed that alcohol is readily decomposed on heating with this metal and its iodide, evolving hydrogen and leaving aluminic ethylate in the retort. This latter body is a yellowish-white solid, which is capable of distillation.

Boussingault has published a memoir upon the silicification of platinum and some other metals, showing that they do not unite with carbon at a red heat, that carbon reduces silicon at a high temperature, that platinum heated to whiteness in a siliceous carbon crucible is silicified, and that the silicon is held by the carbonous oxide.

In *Organic Chemistry*, Mallet has published a theoretical paper on the rational formula of urea, uric acid, and their derivatives.

Hill has communicated from the organic laboratory of Harvard College a paper on the ethers of uric acid.

Klimenko has studied the action of bromine on lactic acid, and finds that it yields ethyl bromide and a crystallized substance neutral in its reaction, and containing bromine, apparently formed by the direct union of bromal and lactide.

Kolbe has published a valuable paper entitled "Chemical Hints for the Practical Use of Salicylic Acid," of the synthesis of which substance he is the discoverer, and which has proved so efficacious as an antiseptic.

Bremer and Van't Hoff have examined the succinic acid obtained from active tartaric acid with a view to determine its optical action. According to the latter's view, no substance can rotate a polarized ray which does not contain one or more asymmetrical carbon atoms. Since succinic acid contains no such atom, it should not rotate such a ray; and the authors show that it does not.

Ritthausen has further examined a nitrogenous substance found by him in the juice of the vetch (*Vicia sativa*), and finding it to be new, gives to it the name vicin. It has properties analogous to those of asparagin.

Barth has investigated a product of the action of hydrochloric acid on resorcin observed by him some time ago. He finds it to be soluble in alkalis, and precipitable by acids in bright brown

flocks, which on drying show a magnificent green metallic lustre, and by transmitted light are scarlet. It is an ether of resorcin.

Bindschedler and Busch have described the synthetic process by which the new red color, eosin, is produced artificially. As is well known, eosin is derived from fluorescein, which is a product of the action of phthalic acid on resorcin. The phthalic acid is readily prepared by the oxidation of naphthalene. The resorcin is produced by fusing the sodium salt of benzol-disulphonic acid with soda. Heating the resorcin and phthalic acid together gives fluorescein; and treating this with bromine gives tetrabromfluorescein, of which eosin is the potassium salt. The price of eosin is 100 francs a kilogram.

Renard has studied the action of electrolytic oxygen on glycerin, and finds that there is produced a glyceric aldehyde, which reduces ammonio-silver nitrate, giving a brilliant mirror and also the copper test.

Struve has confirmed the opinion of Lechartier and Bellamy that fruits in the absence of oxygen ferment, evolving carbonic gas and producing alcohol, though there can not be discerned any yeast cells in them by the microscope.

Schmidt has investigated the action of hydrogen sulphide on the alkaloids, and has produced compounds of it with strychnine and brucine.

Hlasivetz and Habermann have examined the chemical characters of gentisin and of gentisic acid, into which and phloroglucin the former is decomposed. This acid by heat yields carbon dioxide and hydroquinone.

Butlerow has made some experiments with the milky juice of *Cynanchum acutum*, L. He finds in it a volatile alkaloid and a white gum-resin, probably a phenol, to which he gives the name cyanhol.

Anthropology.—The Abbé Petitot has published a complete vocabulary of the Esquimaux tribes inhabiting the arctic coast in the neighborhood of the mouth of the Mackenzie River.

The Société Américaine de France has published a volume of archives, 12mo, paper, 400 pages, devoted to investigations in American archaeology, especially that portion which relates to the Mexican and Maya civilizations.

An international convention of archaeologists has been called to meet in Philadelphia on the 4th of September next. The movement is favored by such savants as Dr. Peet, Hon. J. D. Baldwin, Principal J. W. Dawson, and F. W. Putnam.

A great work, "*Demarcacion Política del Peru*, Edicion de la Direccion Estadística," has been committed to Don Antonio Raimondi. Its design is to give a complete *resumé* of the resources of Peru in six volumes. The last will be devoted to ethnology, including architectural remains, pottery, arms, etc., of the different Peruvian tribes.

Archivio per l'Antropologia e l'Etnologia, Fasc. 3 and 4, contains an elaborate article upon the anthropology of idiots, by Enrico Morselli and Augusto Tamburini.

Before the Anthropological Institute, March 28, Mr. E. B. Tylor read a paper upon Japanese mythology. Their legends are Buddhist, Chinese, and aboriginal. The learned author devoted his paper most especially to the last class, which are mostly nature-myths. At the same meeting Mr. Distant read an essay upon the word "Religion" as applied by anthropologists.

The London *Academy* of April 15 has an extract from a letter written by Rev. W. G. Lawes from Port Moresby, New Guinea, to Professor Rolleston, of Oxford, giving an account of the various tribes and dialects of the country, and of their implements, weapons, houses, burial customs, etc.

Among the curious relics found in the Easter Islands are some small tablets of hard wood, with grooves in which figures of animals are carved, together with arbitrary marks in lines running like the boustrophedon. Many formerly existed, but eight only are now known. Several attempts have been made to decipher them by Palmer, Park Harrison, Janssen, etc., but without success.

Dr. Otto Buchner contributes to *Gaea*, 1876, iii., an exhaustive article upon the origin of fire implements.

The news for the month in *Zoological science* begins with a paper in the *Popular Science Review*, by Rev. W. H. Dallinger, on spontaneous generation. He is well entitled, from his investigations in company with Dr. Drysdale, to write upon this subject, as he has traced with much care the life history of a cercomonad (*Heteromita*). The largest difficulty surrounding the question of the mode of origin of septic organisms is that of discovering their life-cycle. "The most refined, delicate, and continuous researches all point to the existence of what are at present ultra-microscopic germs." While Dallinger and Drysdale have shown that the cercomonads develop from extremely minute germs, we have the best experimental evidence pointing clearly to the existence of germs, though the microscope has failed to demonstrate the latter. Happily at this juncture Professor Tyndall has stepped in, and has presented us with a physical demonstration of the existence of immeasurably minute molecules of matter, utterly beyond the reach of the most powerful combination of lenses yet constructed, which are the indispensable precursors of bacteria in sterilized infusions. In short, he has opened up a new and exact method which must lead to a scientific determination of the existence and nature of the bacteria germs. After attacking Bastian in a manner as merciless as successful, he thus tabulates the facts which bear on the question of spontaneous generation: 1, Dr. Tyndall has proved, in connection with a host of others, but in a more definite and precise manner, that in *filtered infusions* five minutes' boiling does kill every form of bacteria; 2, he has further shown that they are propagated by demonstrable germs *only* in such infusions; and 3, this fact removes the probability of their spontaneous generation to an almost infinite distance.

Hon. J. D. Cox describes in the *American Naturalist* the process of division by fission of a large *Stentor mülleri* into two complete individuals. The entire process required but two hours.

An elaborate paper on the development of *Salpa*, an ascidian, has been published by Dr. W. K. Brooks in the last Bulletin of the Museum of Comparative Zoology.

The same publication contains notes and descriptions of some recent corals found by Mr. A. Agassiz at a height of 2900 to 3000 feet above the level of the sea, at a distance in a straight line from the Pacific Ocean of twenty miles.

The young or larvæ of certain cave beetles

from Mammoth and adjoining caves are figured and briefly described by Dr. Packard in the *American Naturalist* for May. It appears that the young as well as the adult beetles are blind, otherwise they do not differ much from the young of allied genera. The beetles are *Adelops* and *Anophthalmus*. Besides these, a blind coleopterous larva belonging to an unknown species was discovered in the Carter caves in Eastern Kentucky. Remarks are also made on the degree of variation in these cave insects, which seems due more to varying means of subsistence than any other cause. The amount of variation, however, is very slight.

The effect of certain poisons on *medusæ* is described by Mr. G. J. Romanes in the Proceedings of the Royal Society. He states that strychnia exerts a very marked influence upon them. "Of the species I have met with, *Cyanea capillata* is the most suitable for showing the effects of this poison, from the fact that in water kept at a constant temperature the normal pulsations of this animal are as regular as are those of a heart. Shortly after a solution of strychnia has been added to the water in which a specimen of *C. capillata* is contained, unmistakable signs of irregularity in the pulsations of the animal supervene. This irregularity then increases more and more, until at last it grows into well-marked convulsions. The convulsions manifest themselves in the form of extreme deviations from the rhythmical character of the normal contractions, amounting, in fact, to nothing less than tonic spasms. It is further of importance to remark that the convulsions are very plainly of a paroxysmal nature, prolonged periods of uninterrupted convulsions being every now and then relieved by shorter periods of repose, during which the medusa remains perfectly motionless in a fully expanded form. *C. capillata* will live for many hours when under the influence of strychnia, but eventually death supervenes. The animal dies in full diastole."

The fishes of Lake Titicaca, in Peru, 12,500 feet above the sea, have been found by Messrs. Agassiz and Garman to be but few in number, and represented by only two genera. A month of search and inquiry discovered but one species of a siluroid and five of *Orestias*—a cyprinodont.

A singular frog-like creature (*Cyclorhampus culleus*) is described by Mr. Garman from Lake Titicaca. It is very abundant in the extensive beds of weeds which occur on the bottom of the lake. They feed on the mollusks, crustacea, worms, etc., and are fed upon by the birds and fishes. It is able to remain under water for great lengths of time without coming up for air. "Hours of watching in clear water, where many could be seen, failed to detect any approaching the surface. It is possible that they are more lively at night, when their enemies are less active. Numbers were brought up in the trawl at more than four miles from the shore. None were found on the land. The natives were positive they never left the water."

Dr. Gunther has recently discovered that the young of the sword-fishes and *Chaetodus* possess structures exceedingly different from that of the adult. In the young *Chaetodus* the front of the body is shielded with large bony plates, which in one species are produced into three long equidistant horns, which diverge ray-like from the body. In the sword-fishes the scapular arch is prolonged

into a horn at the lower part, and the ventral fins are wanting. There is no sword, but the jaws are long, of equal length, and both are furnished with teeth. As the fish grows, the scapular horn disappears, the ventral fins grow, and the upper jaw is developed in excess of the lower. The long teeth disappear, and the upper jaw grows into the toothless sword-like weapon which gives the fish its peculiar character.

In *Engineering*, perhaps the most interesting item of news concerns the progress of the drilling operations at Hell Gate. This work, it is said, is now completed, and the machines have been transferred to Flood Rock. The mine will be sprung next July or August. There are 172 pillars which support the roof of rock, and some 8000 borings have been made for the insertion of explosive material. The work at Flood Rock goes on day and night.

The problem of substituting steam for horses upon street railways is attracting increasing attention. We lately recorded the successful trial of the Baldwin steam-car in Brooklyn, and may supplement that notice with the statement that, since our last, several trials of new steam motors for the above purpose have been made simultaneously in various cities. The so-called Woodbury steam street car, it is worthy of mention, was experimented upon the Market Street Passenger Railway in Philadelphia, and, from all accounts, made an excellent impression. Without entering into details of construction, it will suffice to state that certain of the standing objections to the employment of steam street motors appear in this case to be obviated. The car has certain novelties of construction that permit it to be taken around sharp curves without difficulty or violence, the machinery is compact, and neither smoke nor escaping steam is permitted to be visible.

It is currently reported that the capital required for testing the practicability of the English Channel tunnel project is being rapidly got together.

The London papers announce the opening of a new under-ground railroad in that city on April 5. The new line is called the East London Railway, and extends from Liverpool Street Station, on the north side of the Thames, by an approximately semicircular path through the old Thames Tunnel to a junction with the South London Railway at Peckham—a distance of six and a quarter miles, passing by a tunnel for 600 feet under the London Docks as well as under the Thames itself. The line has cost thus far about £3,200,000, or at the rate of \$2,816,000 currency per mile.

The project for an Indo-European railroad has received fresh interest by the recently announced proposal of M. Cotard made to the French Geographical Society. M. Cotard's project, which enjoys the patronage of M. De Lesseps and other distinguished personages, proposes the construction of a line of railway from Orenburg, through Tashkend and Balkh, to Peshawur, a distance of 3800 kilometers (2360 miles). The total cost is estimated at about \$200,000,000. When constructed, it is said that eleven days will suffice for going from Paris to Calcutta.

The extent to which the under-ground system of telegraphy has been developed in Europe—though in this country we are just beginning to discuss the question of removing the poles from the crowded streets of cities—may be inferred

from the statement that steps have been taken to lay down immediately a subterranean line from Halle to Berlin, and that in future, as per official announcement, all the German telegraphs will be under-ground.

The *Railroad Gazette* announces, up to May 5, the construction of 432 miles of new railroad in the United States in 1876, against 220 miles reported for the same period in 1875, 375 miles in 1874, and 654 miles in 1873.

Mr. J. E. Wooten, of Reading, Pennsylvania, lately read before the American Philosophical Society a paper describing the details of an apparatus by which ordinary anthracite coal waste from the dirt banks at the mines can be successfully and profitably burned in the furnaces of stationary and locomotive boilers. The apparatus, which can be readily applied to existing boilers, consists substantially in forcing air by means of a jet of steam into an inclosed ash-pan, and passing the mingled steam and air through a perforated fire-bed of peculiar construction, on which the fuel is spread out in a layer of about three inches thickness. The device has been applied with considerable success to both stationary and locomotive boilers, and the results appear to indicate that the hitherto neglected and valueless material known as coal dirt, which accumulates in immense quantities near the outlet of the coal mines, can be profitably used for generating steam, and that hereafter it must be regarded as a valuable fuel.

In close connection with the above, it is interesting to remark that the extensive works for some time in course of erection at Port Richmond, Philadelphia, for the manufacture of artificial fuel from anthracite coal dust on the system of Mr. E. F. Loiseau (described in several previous issues of *Harper's Monthly*), are rapidly approaching completion. The factory is calculated, when started in operation, to produce about 150 tons of compressed fuel per day, which, it is affirmed, will be sold for one dollar per ton less than the price of stove coal. Contracts have been made by the company for all the coal dust at the Richmond wharves, the shipping point of the Philadelphia and Reading Railroad, and for an additional supply from the Lehigh region.

A new alloy, called manganese-bronze, has lately been produced by Mr. P. M. Parsons. The new product, which from account promises to play an important part as a constructive material, is formed by incorporating manganese with the various bronze mixtures, the object being to utilize the strong affinity of manganese for oxygen in removing any oxide existing in the metal. The results show that the addition of manganese to the alloy, besides improving its texture, materially increases its strength and tenacity.

A large establishment for the special manufacture of malleable glass by the Bastie process has been commenced in France.

The experiments in electric lighting are being continued at the Northern Railway Station, Paris, and if they prove successful, the system will be largely introduced. In these trials the Gramme machine is employed.

A fog-signal consisting of a reflector of great size and thickness, at the focus of which a small piece of artillery charged with gun-cotton is fired at intervals, is reported to have met with the approval of the British Light-house Commission.

Based upon a recognition of the principle that society as well as physical nature is governed by law, it exhibits the application of this principle in the development of modern civilization. It is quite the best work to afford the reader a clear conception of modern history as interpreted by the modern scientific school of thought.—The second volume of the Comte de Paris's *History of the Civil War in America* (J. H. Coates and Co.) brings down the history to the Emancipation Proclamation, January 1, 1863. It includes a chapter on the financial measures inaugurated by Secretary Chase, and one on emancipation, and the preparatory measures that led to it. The author strongly reprobates the removal of General McClellan, whose previous military course he has not, however, hesitated to criticise. The course of Porter he attributes to confusion in the general management of the army, and he treats as unworthy of consideration the charges of "incapacity, cowardice, and treason" preferred against him. The calmness and candor of the author are strikingly illustrated in his treatment of these controverted points, which an American could hardly write upon without passion or prejudice; and his dominant desire to be always just is exemplified by a correction in a note respecting Mr. Floyd's administration of the War Department under President Buchanan. The second volume only confirms the favorable judgment expressed by all critics upon the first.—Mr.

STIEGER sends us four boxes of "Kindergarten Occupations for the Family," accompanying some pamphlet publications on the practical methods of employing Froebel's admirable system. These boxes contain materials for stick-laying, drawing, perforating, and weaving. We have had occasion to witness some practical exhibitions of Froebel's system in primary schools lately, and we have made in a small way a trial of one of these boxes before a jury of two in our own household, and the only criticism we have to suggest is that no father can safely open one of these boxes for the instruction of his little ones if he is not willing to open it again and give them another lesson very soon. They are admirable as instruments to teach the children both how to observe and how to use their hands with care in delicate operations.—In *Words: Their Use and Abuse* (S. C. Griggs and Co.), Dr. WILLIAM MATHEWS makes very interesting what to most people is unhappily a very dry subject. This is due not merely to his style, which is vivacious and sprightly, nor to his illustrative anecdotes, which are numerous, well selected, and generally fresh, but principally to a certain moral insight which perceives principles in words, and clothes them with a real dignity and importance. Less erudite than the works of some of his predecessors, it is likely to be more useful because more readable. Mechanically, the book is a fine specimen of American art.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—Dr. Vogel, of Leipzig, has just published the determination of the places of 140 nebulae between $+9^{\circ} 30'$ and $+15^{\circ} 10'$ of declination—a work undertaken in connection with Bruhns's zone observations of stars in this zone. Bruhns also proposes to re-observe the double stars in this zone. Vogel's work is on the same general plan as his previous series (1867), and his probable error of a final nebula position is $\pm 0.09''$ in right ascension, $\pm 1.1''$ in declination. Three star clusters have been micrometrically measured. The nebula G. C. 2211 is probably variable in brightness. Holden, of Washington, publishes in *Silliman's Journal* a study of the Omega nebula (G. C. 4403), in which he examines the evidences of change in this nebula as derived from the drawings of Trouvelot and himself and others since 1833. The conclusion arrived at is that the drawings do show strong evidence of a change of interior structure. Attention is called to the proper motion of the Trifid nebula (G. C. 4355), which appears to be marked.

One of the important events of the month of May is the opening of the Centennial Exposition in Philadelphia. A more complete notice of the exhibits in astronomy and geodesy will be given later. A hurried inspection indicates that they are not large. Clark and Sons send no specimens of their optical work; a 6-inch equatorial, beautifully mounted, on the general plans of Cooke, of York, by Fauth and Co., of Washington, has, however, a Clark objective. Feil, of Paris, and Chance, of Birmingham, send optical glass; Voigtlander, of Vienna, has small tele-

scopes and some large photographic objectives; Beck and other English manufacturers and some of the Swiss exhibitors send philosophical instruments; Negus, of New York, and Bond, of Boston, send chronometers to the Naval Observatory exhibit; Frodsham, of England, Fasoldt, of Albany, and Howard, of Boston, send clocks. The Lake Survey sends specimen geodesic and astronomical instruments, as do Lieutenant Wheeler's surveying expedition and the Coast Survey. The base apparatus of the Coast Survey is especially noteworthy. Trouvelot exhibits many exquisite pastel drawings of astronomical subjects in the Art Gallery and some with the Naval Observatory. From the list of jurors we extract the following: Instruments of precision, research, etc.—Professor Joseph Henry, LL.D., Secretary of Smithsonian Institution, Washington, D. C.; Professor F. A. P. Barnard, S.T.D., Columbia College, New York; Professor J. E. Hilgard, Washington, D. C.; Professor J. C. Watson, Ann Arbor, Michigan; H. K. Oliver, Salem, Massachusetts; George F. Bristow, New York; Sir William Thompson, LL.D., D.C.L., F.R.S., Great Britain; Jul. Schiedmayer, Germany; M. Levasseur, France; P. K. Kupka, Austria. The special reports of these gentlemen will be looked forward to with great interest.

In the Monthly Notices of the Royal Astronomical Society for March there are given three drawings of Coggia's comet of 1874—two drawn by Mrs. Newall with the Cooke 25-inch refractor, and one by With with silvered glass specula. Mr. Ranyard has also notes on its structure, in which he expresses his belief that a disruption analogous to that observed in Biela's comet was going on.

The second part of the Annals of the Observatory of Moscow for 1875 has just been published by Bredichin. It contains spectroscopic observations of the sun and nebulae, etc., by the director, meridian observations by Gromadski, and photometric and photographic work by Céraski. Daily photographs of the sun are taken at Moscow.

In the *Astronomical Register* for May, Mr. Sadler gives a list of the colors of the components of sixty-three double stars, as resulting from his own observations and comparisons with the results of other observers. This is a work which American amateurs might well take up, and which, properly conducted, would yield results of interest and value.

The observatory of Brussels has since 1857 been engaged on the observations of stars suspected to have large proper motions. About 12,000 stars have been observed, 40,000 observations in right ascension and 30,000 in declination having been made. The catalogue, which is in course of preparation, will give the star places for 1870.0.

The Proceedings of the Royal Society of Edinburgh for 1874-75 contains several papers by Sang, the computer of a new logarithmic table of fifteen places, on the French Table of Prony (Tables de Cadastre), with remarks on this by M. Lefort, to whom we owe the best account of Prony's work extant.

The publication of Burnham's double-star catalogue has been commenced, a more detailed account of it will be given subsequently.

In a note to the editors of the *American Journal of Science*, Professor T. P. Mendenhall, of Columbus, Ohio, calls attention to some observations made by him, which show that temperature has an important effect on his large spectroscope, so that the readings of his micrometer on the same spectral line vary greatly, according as the apparatus is exposed to a temperature of 32° or the ordinary temperature of a room. This he attributes to a change in the index of refraction of his prisms. The numerical value of the change is closely proportioned to the number of prisms employed. These experiments will be continued.

Mr. Henry C. Lewis, of Germantown, Pennsylvania, is engaged in regular observations of the zodiacal light. He has succeeded, after much practice in viewing so faint an object, in tracing the light quite across the sky, and this on every clear and dark night, and the limits are regularly plotted on a star map. A series of such observations carefully discussed can not fail to be of high value, and it is to be hoped that they may be continued.

Moesta, of Santiago, in the *Astronomische Nachrichten*, No. 2089, gives a thorough comparison of his star positions with those of Taylor and Johnson. It appears that the positions of southern stars require careful revision, particularly those in Taylor's general catalogue.

Lieutenant Greene, U.S.A., has presented to the Philosophical Society of Washington an important paper on the station errors or abnormal deflections of the plumb-line at the forty-one astronomical stations on the forty-ninth parallel of latitude, the boundary between the United States and the British possessions.

M. Eichens, of Paris (the constructor of the large Paris reflector), has proposed to M. Leverrier to construct the refractor from the rough

disks now in the possession of the Paris Observatory, agreeing to finish it in two years and one-half. This offer has been accepted, and 210,000 francs are to be paid for the work.

The Foucault reflector (thirty-one inches aperture) of the observatory of Toulouse has been mounted since February, and M. Tisserand, the director, has already commenced a study of the Orion nebula with especial reference to the variable stars, and of the satellites of Uranus and Jupiter.

Dr. Valentiner, of the observatory of Leyden, has been called to the directorship of the observatory of Mannheim, *vice* Schoenfeld, who has taken Argelander's place at Bonn; Krueger, of Helsingfors, has been appointed to Gotha in the stead of Hansen.

The regular annual meeting of the Chicago Astronomical Society was held May 11. It appears that the observatory is useful in distributing time to various places in and near Chicago. Unfortunately this observatory has no astronomer at present, and its two fine instruments have contributed nothing to astronomy during the past year—a condition of things which requires a remedy.

In the *Meteorological* record we have first to speak of the third annual session of the permanent committee of the Vienna Meteorological Congress. Six members were present. It was reported that almost perfect uniformity had now been attained in the publications for international purposes of the limited number of stations allotted to each country for climatological statistics. It was resolved that barometric gradients may be expressed in millimeters per degree ($69\frac{1}{2}$ statute miles) or tenths of inch per 50 miles. An attempt will be made at the next meeting (in Rome, September, 1877) to bring together from all central offices well-compared standard barometers, and perhaps thermometers, for the purpose of comparison.

The establishment of new stations is diligently prosecuted by the London or British Meteorological Society, which reports twenty-two new ones during the year ending April 22.

An interesting paper, both in a theoretical and practical point of view, is that by Dr. Von Lang, of Vienna, on experiments on the friction between water and air. These experiments were made by measuring the amount of air drawn along after a falling column of water. The friction of air slipping over the surface of water and causing it to slowly follow is one of the important elements in terrestrial physics, and is directly involved in Von Lang's experiments.

The solar radiation has been studied by Violle, who, from observations made on Mont Blanc, concludes the temperature of the solar surface to be about 1500° C.

The origin of the slight quantity of ammonia present in the atmosphere has been further elucidated by Schloesing, who finds that earth mould absorbs ammonia instead of exhaling it, as it is commonly supposed to do.

The presence of some of the common but minor constituents of the atmosphere is ordinarily due to animal and vegetable life, and is the result of processes of diffusion through membranes. The general subject of the laws of diffusion is clearly set forth in an article by J. C. Maxwell reviewing an investigation by Wroblewski on the relation

between the rate of diffusion and the pressure on the two sides of a membrane of caoutchouc which was impervious to air, but not so to carbonic acid gas or to hydrogen.

The subject of atmospheric ozone is further investigated by Marié Davy at Mont Souris.

In regard to meteorological instruments, the month of May has been made notable by reason of the opening of the exhibitions at Philadelphia and at the South Kensington Museum. Although in the former collection science forms but a minor feature, yet the apparatus sent from Sweden and from England is very interesting, while the display of the Weather Bureau of the Army Signal-office is exceedingly attractive and complete. The greatest interest, however, must attach to the unprecedented opportunities now temporarily offered in London for the study of the present state of exact science and its progress during the past two hundred and fifty years. There are placed side by side the barometers of Fahrenheit, Hooke, and Fortin, and the recording barometers of the Kew and numberless other patterns; the thermometers of Galileo and of Casella; the anemometers of Lind, Robinson, Wild; the electrometers of Thomson and of Dellmann; the polarimeters of Arago, Brewster, and Rubenson, etc., etc. An almost exhaustive array of every conceivable form of rain-gauges and other apparatus for atmospherical research is there to instruct the student. The United States has, we regret to say, sent nothing, but it is to be hoped that we may in some way derive benefit from this unique collection. In order to improve these opportunities to the uttermost, a most admirable catalogue and hand-book has been published by the Royal Science Commission, with dissertations by eminent specialists: that on meteorology is by R. H. Scott. A series of scientific conferences has also been begun: that on meteorology occupied three days, ending June 2. Commissioners from most of the European states were present, and it seems desirable that American scientists should have an opportunity to be present at these conferences, as it is understood that the various departments of government have, in reply to the invitation extended to them, felt forced to reply that their whole energies were absorbed by our Centennial.

A very important addition to the rapidly increasing literature relating to anemometers has just been made by the venerable Dr. Robinson, of Armagh, the inventor of the well-known hemispherical cup anemometer, who has, in the Proceedings of the Royal Irish Academy, given us his latest views on the analytical theory of this and similar instruments.

Duclaux shows that mixtures in definite proportions of crystallizable salts and water deposit their crystals at very definite temperatures, and thus become excellent thermometers.

The application of the balloon to meteorological study receives a new impetus in the publication of De Fonvielles *Aventures Aériennes*, wherein he has brought his wide experience to bear on the failures of many who have attempted aeronautics. Much of our knowledge of the temperature and currents of the upper atmosphere has been derived from balloon ascensions, but much remains to be done. We note with great regret the abandonment of a plan for a fixed balloon in connection with the Centennial Exposition, and

by means of which Mr. S. A. King hoped to be able to make numerous interesting investigations.

Janssen has, by means of temporary apparatus at Montmartre, been lately taking daily photographs of the solar disk. He finds that during the late cold spell in the first of May the sun had no solar spots whatever—an incident quite in accordance with the most generally accepted view, according to which in high latitudes the colder seasons occur when few spots prevail on the sun.

Baron Wrangell has contributed to Wild's *Repertorium* a short study into certain phenomena of the winds, as exhibited at Novorossisk, on the shores of the Caspian Sea, and which are, as he shows, identical with the bora of the Adriatic Gulf. The description and explanation given by Wrangell apply very perfectly to the phenomena of the northers of our own Western plains. These all consist of currents of dry cold air flowing over descending plains and underrunning the warm moist air that previously occupied the lowlands. The attempt to deduce a formula that shall give approximately the numerical value of the velocity of the descending wind seems quite successful, inasmuch as Wrangell calculates for a very fair average case that the velocity must be at least seventy feet per second, or forty-eight miles per hour, corresponding to a moderate gale. In conclusion, Wrangell makes a bold and apparently very plausible proposition to the effect, namely, that by cutting into the mountain back of Novorossisk the violence of the bora will be very materially abated, and that port be made far safer than at present for the shipping of the Black Sea.

We regret to learn of the very sudden death, on March 29, of Lieutenant J. E. Cornelissen, superintendent for sixteen years of the marine division of the Royal Meteorological Institute of the Netherlands, and whose name we have recently had occasion to mention in connection with his charts of winds, currents, and temperature of the Atlantic.

Chemistry.—During the past month a national chemical society, with the title of the American Chemical Society, was organized in New York. The objects of this body are the encouragement and advancement of chemistry in all its branches, in furtherance of which monthly meetings will be held in New York, and an annual meeting at some selected place. The society starts with a membership of 133, under the presidency of Professor J. W. Draper.

Paper and card-board made from peat were recently presented at a meeting of the Berlin Polytechnic Society, and a factory for its manufacture is about to be erected in Prussia. The paper resembles in quality that made from wood or straw.

The discoverer of the new element, gallium, has succeeded in obtaining a grain and a half of the metal in the pure state, and has determined that it melts at 85.1° F., so that it liquefies when held in the hand. Its specific gravity is 4.7, water being 1.

A new test paper, prepared by Waller, is made by soaking strips of unsized paper in a solution of coralline, and is said to be exceedingly sensitive to the presence of alkalies, turning a beautiful red color, while acids turn it yellow. Waller proposes it as an alkaline reagent in place of litmus.

The ammonia-soda process of Solvay has, according to German accounts, been lately so much improved as to threaten the abandonment of the standard method in Germany.

Microscopy.—Mr. W. H. Walmsley, of Philadelphia, writes to *Science Gossip* recommending glycerine in mounting vegetable and insect preparations. He considers the white zinc cement, when properly prepared, as the most satisfactory. The cells are made with this cement by means of the turn-table, and kept ready for use, only applying a thin coating of the zinc when needed for mounting. The value of glycerine, and also chloride of calcium, as a mounting fluid, arises from the fact that the preparation is not lost, even by considerable leakage, but will remain sufficiently moist to be recovered. We have seen anatomical injections, mounted now over thirty years, in glycerine and water, and which have only had in all this time two or three fresh applications of the cement—in this case, asphalt varnish.

In the April number of the *Monthly Microscopical Journal* Professor Rupert Jones makes some corrections of his paper "On the Variability of Foraminifera," as printed in the February number of the same journal, and he remarks that varieties among foraminifera are of equal value to species, and even genera, as with higher animals, so far as concerns bathymetrical and geographical distribution.

The microscopical study of rocks, which has but recently received much attention, is proving of interest and value, especially as suggesting caution upon coming to conclusions upon mere resemblances. Many things at first sight supposed to be organic, or of ordinary crystalline structure, upon more careful study are found to be more than doubtfully so. Two excellent and well-illustrated papers appear in the April and May numbers of the *Monthly Microscopical Journal*, the former by A. Renéard, "A Study of the Belgian Plutonic Rocks;" the latter by Frank Rutley, F.G.S., "On some Structures in Obsidian, Perlite, and Leucite."

An elaborate article, and excellent and exhaustive in its way, "On Measurements of Müller's Diatomacean Probe-plate," by Professor Edward W. Morley, of Hudson, Ohio, is printed in the *Monthly Microscopical Journal* for May. Among the causes affecting the resolvability of a given diatom the author omits one that, even in tolerably experienced hands, is of no little moment—the difficulty in securing precisely the same perfect illumination upon different occasions: a difficulty so great that Messrs. Dallinger and Drysdale have contrived a special apparatus for this purpose, and the very best attainable results, as they show, depend upon such delicate manipulations of the source of illumination, as well as its character, that it is only in the ordinary way accomplished, as one might say, by accident. Every microscopist who has endeavored to show what he himself, at some fortunate sitting, has seen of a given object, with a given objective, knows how often this has resulted in a failure. The author makes the common mistake of supposing that diatoms grow, increase in size by age. It is time this idea was dropped. The younger frustules—those immediately from the sporangium—are, if there is any difference in size at all, nearly twice the size of the parent frustules, and the oldest frustules are the small-

est—a necessary result from self-division. The measurements of Professor Morley are, no doubt, very accurately made, and will be highly acceptable to those using the diatomaceæ as tests. We may remark here that the two forms figured among the spicules of glass sponges in the May number of this journal, and alluded to as probably foraminiferal, are diatoms, *Campylodiscus*. Foraminifera would scarcely have stood the treatment with acids.

In the *American Naturalist* for May is a list of American microscopical societies, some twenty-seven in number, and we find also in it the following hints from Mr. C. Merriman, of Rochester, on "Polarizing Crystallizations." All solutions must be in distilled water, and carefully filtered. Solution of gum-arabic must be added to the crystalline solution until the drops will dry on the slide without crystallizing. Then the drop on the slide is to be held over steam until one or more points of crystallization appear, then at once dried over an alcohol lamp; then held over the steam again until the crystals have grown a trifle larger, and so on until the specimen is satisfactory. The specimens are to be first varnished over with a film of collodion, and then mounted in old Canada balsam.

That flies have teeth seems now decided—at least what serve for teeth. Quite a discussion of this subject may be found in the Notes and Queries in *Science Gossip* for April.

Anthropology.—Major J. W. Powell has just sent to the National Museum a collection of ethnological specimens from the Pueblo Indians. They represent every class of objects in a museum of culture. Some of the forms are quite new, and bridge over the chasm between the northern and southern part of our country. Among these may be mentioned double and triple vases in pottery, images of the mother-goddess, and implements very similar to mound-builders' materials.

Dr. Edward Palmer sends to the *American Naturalist* a description of a large mound near St. George, South Utah, which he has evidence to believe was built up by the successive burning of the lodge inclosing the corpse, and the addition of new earth to form the foundation for the hut of some survivor. The succeeding layers of ashes and clay give great plausibility to Dr. Palmer's opinion.

In *Ausland* for April 24 commences a series of articles entitled "Zur Geschichte des alten Perus." From the spirit of the opening paper we infer that the author will treat his subject in a very thorough manner.

Sir William R. Wilde, M.D., died April 19, at Dublin, aged sixty-two. He was a devoted student of the antiquities and early history of his country. His most important work was the series of the catalogues of the Royal Irish Museum which bear his name.

The Rev. W. C. Lukis has prepared a "Guide to the Chambered Barrows of Brittany." The object of the manual is to enable tourists to make good use of their time in visiting the dolmens of this interesting district.

The April number of *Matériaux* contains articles by Pigorini, De Caix de Saint-Aymour, Mortillet, Goss, and Lewis. The paper of the latter is an interesting description of the erection of megalithic monuments in the mountain districts of India. The long slabs split from the cliff with

wedges are laid on a frame of logs and bamboo poles so constructed that a hundred men can lift. After being carried to the place of its erection, the frame is tilted up like a ladder, and the stone slid into the hole previously prepared.

Mr. Brabrook in April read a paper before the Anthropological Institute, written by Mr. B. Walker, entitled "Religion, Politics, and Commerce of Old Calabar," which contained an account of the singular institution of Egbo, the principal object of which is to secure mutual protection among the freemen. Admission into the various grades, nine in number, is by purchase. As regards religion, each district has a separate but subordinate divinity.

Sampson Low and Co., of London, have just published a translation of Colonel N. Prejevalsky's *Mongolia, the Tangut Country, and the Solitudes of Northern Tibet*, by E. Delmar Morgan, with an introduction by Colonel Yule. The same intrepid traveler has organized a new company to spend three years in the same field. The ethnology of the district will receive a large share of their attention.

Professor Flower, in closing the Hunterian Lectures on the Relation of Extinct to Existing Mammalia, delivered at the Royal College of Surgeons recently, says: "No actual remains of man have been met with which can be said with certainty to be older than the pleistocene period, though it is asserted that his existence upon the earth in the pliocene and even miocene epoch is proved by works of art found in deposits of those ages. The oldest known remains of man from European caves (with perhaps the exception of the celebrated Neanderthal, the age of which is doubtful) do not differ more from Europeans than do several of the lowest modern races. In other words, no proof of the existence in former times of a race of men inferior in general organization to the Australian, and forming any nearer approach to the lower animals, has yet been discovered."

Zoology.—The zoology of Kerguelen Island has been farther elaborated by Dr. J. H. Kidder in a second series of memoirs by himself with the aid of various authors. The eggs found upon the island are described by Drs. Kidder and Coues. The only mammal on the island is the common mouse. The sea-elephants formerly so abundant on this island are now very rare. They visit the island about the 10th of October, and remain ashore until well into the month of January. "The old bulls, which alone are provided with a proboscis, take charge each of a large number of females, guarding them from the approach of other bulls, and (so the sealers assert) prevent them from returning to the sea before the young are old enough to do so with safety. During the breeding season the bulls are very pugnacious, fighting fiercely with each other, and even attacking the sealers themselves. Although seemingly so unyielding, they are described as getting over the beaches with surprising speed, advancing both flippers at a time, and using them like crutches. The beaches of Royal Sound are fringed by innumerable wallows—cradle-shaped pits—in which the animals lie during the breeding season, recalling the buffalo wallows of our Western prairies." The fish, few in number, have been identified by Professor T. Gill, and the mollusks by Dr. Dall, a new genus of Lamelli-

Dr. Kidder. A few insects and spiders were collected, while the crustacea have been worked up by Professor S. J. Smith, and the annelid worms and echinoderms by Professor A. E. Verrill. The report concluded with "A Study of *Chionis minor*, with Reference to its Structure and Systematic Position," by Drs. Kidder and Coues. They conclude that this bird is a connecting link, closing the narrow gap between the plovers and gulls of the present day. "In our opinion this group represents the survivors of an ancestral type, from which both gulls and plovers have descended."

An interesting article on the habits of the singular fluviatile shell *Io* is contributed to the *American Naturalist* by Dr. Lewis. They live in the rivers of Tennessee, and are so solid and of such bright colors that they might be mistaken for sea-shells. It seems that they were known to the Indians before the advent of European races, as they have been found in their graves.

The last annual report of Professor Hayden's United States Geological Survey contains an excellent account of the snails collected in Colorado by Mr. E. Ingersoll. Six new species were collected, and much interesting information given regarding the vertical distribution of the species found.

A case of the occurrence of the larvæ of a fly (*Anthomyia scalaris*) in the bowels of a boy who had been seized with spasms is noticed in the *American Naturalist* for June. About fifty were expelled after a purgative had been administered, and the worms, uninjured, transformed into flies.

An excellent account of the fishes of Bermuda, by Professor Goode, forms the fifth Bulletin of the United States National Museum. Particular attention is bestowed upon the food fishes. Some new observations on the flight of the flying-fish are of interest. They were seen to fly from six to one hundred yards. "When they leave the water, the pectorals assume a rapid vibration, reminding one of the flight of a grouse, the tail also rapidly vibrating. The fins soon assume a rigid position, and the fish rises over the crests and falls in the trough of the waves, following their motion; sometimes it dashes through the crests, and on re-appearing the fins are again in motion. They seem unable to fly except in a straight line (I afterward saw them veering considerably from a straight line, taking a direction nearly at right angles with their first course), but are not dependent on the direction of the wind."

The earlier phases of the development of the frog are described by Moquin-Tandon in the *Annales des Sciences Naturelles*.

For our knowledge of the pterodactyls of the cretaceous rocks of North America we are indebted to the researches of Professor O. C. Marsh. It will be remembered that these are bird-like lizards, with wings somewhat like those of a bat, and with large teeth. Now a new suborder of *Pterosauria* has been discovered by him which were toothless; hence he terms the new group *Pteranodontia*. It seems that the jaws of *Pteranodon*, the sole representative of the suborder, are more like those of birds than of any known reptiles. All the specimens found were from the upper cretaceous formation of Western Kansas; and it is an interesting fact, says the author, that the localities and geological horizon of these specialized, toothless pterodactyls are precisely the

same as those of the *Odontornithes*, or birds with teeth, and the two doubtless lived together in the same region.

Botany.—At the Royal Agricultural Society of England a paper was read by Professor A. de Bary, of Strasburg, entitled "Researches into the Nature of the Potato Fungus." De Bary makes a new genus for the fungus causing the rot, changing the name from *Peronospora* to *Phytophthora infestans*. He does not admit that the bodies described by Worthington Smith as the oospores of this fungus have any direct connection with it, but suggests that they belong to a new species of *Pythium*, which he calls *Pythium necans*.

Reinke gives a somewhat detailed account in the *Botanische Zeitung* of his experiments on the growth of plants, and Holle describes the structure of the root tip in angiosperms in most points with Janchewski.

In the *Annales des Sciences*, Duchatre gives his observations on the bulbs of lilies, and Julien Vesque a long article on the comparative anatomy of the bark of plants.

At a meeting of the botanical section of the Boston Natural History Society, Mr. Burge stated that he had discovered that the leaves of *Sarracenia* secreted sugar, and Mr. Greenleaf gave an account of the flowers of an apple-tree which is supposed to bear fruit without flowering. The flowers of this tree are very peculiar, the petals being changed to carpels, which lie over the normal ovary, thus making it appear to be two-storied.

In the field of *Engineering*, it is worth while to note the completion, on the 20th of May, of the new basin dry-dock built by Messrs. Cramp and Sons at Philadelphia. The dock is pronounced by competent judges to be a superior piece of workmanship, and will add materially to the value and importance of the port. The capacity of the dock is sufficient to accommodate the largest vessels.

The work on the Bergen Hill Tunnel, it is affirmed, will be finished during the month of June.

A temporary injunction, it appears, was lately issued restraining the Mayors of New York and Brooklyn, the Bridge Company, and others interested from building the bridge "over the East River at the height of 135 feet above mean high water, or at any other height that shall obstruct, impair, or injuriously modify the navigation of said river." It is a curious circumstance that the discovery should only be made at this late day that the great structure so long in course of erection will prove an obstruction to navigation.

The ninth annual Convention of the American Railway Master Mechanics' Association was held in the hall of the Franklin Institute, of Philadelphia, on May 16 and 17. The most valuable report presented was by the Committee on the Best Material, Form, and Proportion of Locomotive Boilers and Fire-Boxes, from which it appeared that the companies using steel fire-boxes most largely gave them undoubted preference.

The event of the month was the opening of the great International Exhibition at Philadelphia on the appointed day, which was done with much *éclat*. The preparations on the part of exhibitors and authorities, although in some respects backward, were, on the whole, much further advanced than has been the case at previous exhibitions, and at the time of writing may be regarded as

practically complete, and the Exhibition itself a magnificent success. The large demand for space has necessitated the erection of numerous annexes to the main buildings, enormous as these are; numerous enterprising trade organizations likewise have erected separate buildings for their special exhibits, while there are other buildings in great number and for every conceivable purpose on the grounds.

With reference to the proposed international exhibition in Paris in 1878, to which allusion has been made in a previous issue, it has been decided that it shall be opened on May 1, and continue until October 31 of the same year. A commission has been appointed to make preliminary preparations; and a subcommittee, charged with the duty of devising a project for the buildings, has reported that it was necessary to have the covered space amount to 2,255,000 square feet.

The twin steamer *Castalia*, which during several months of the past year made daily trips between Dover and Calais, appears to have given satisfaction in every respect save speed. It is now affirmed that the Channel Steamship Company has decided to build another twin steamer upon the general plan of the first, but with certain improvements which experience has suggested, and with engines of such power as to realize a speed of not less than fourteen knots per hour.

The city of New York will doubtless have in operation by the time of the appearance of these lines a system of pneumatic dispatch tubes and subterranean telegraph, which is now being rapidly completed.

The *Railroad Gazette* reports the completion of 542 miles of new railroad in the United States in 1876, up to the close of May, against 260 miles reported for the same period of 1875, and 436 in 1874.

The secretary of the American Iron and Steel Association has just published the official figures giving the statistics of the production of iron and steel in the United States in 1875. The figures are represented as being very reliable, being based upon returns received from every furnace except five, every rolling-mill except two, and every steel-works except one, while the capacity and condition of the eight non-reporting works were tolerably well known. The more important figures are herewith briefly presented. The production of pig-iron in 1875 was 2,266,581 net tons, against 2,689,413 tons in 1874, and 2,868,278 tons in 1873. The decrease in 1875, as compared with 1874, was 422,832 tons, or more than fifteen per cent. The number of completed furnace stacks at the close of 1875 (abandoned stacks excluded) was 713, against 693 at the close of 1874. The total production of all kinds of rolled iron in 1875 was 1,890,379 net tons, against 1,839,560 tons in 1874. The production of iron and steel rails of all sizes in 1875 was 792,512 net tons, against 729,413 tons in 1874; of this total, 290,863 tons were Bessemer steel rails, against 144,944 tons in 1874. Forty-four establishments made steel other than Bessemer during 1875, their aggregate production amounting to 61,058 tons, against 49,681 tons in 1874. The production of open-hearth, or Siemens-Martin steel, amounted to 9050 tons, against 7000 tons in 1874. The total value of our imports of iron and steel during the year 1875 was \$15,273,315, against \$26,600,720 in 1874.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—In solar spectroscopy the important announcement is made by Young (in *Silliman's Journal*) that the line 1474 K is double the distance of the components, being about $\frac{2}{3}$ of the distance of the sodium lines, or $\frac{1}{2}$ of a division of Angström's scale. Young was able to make this very delicate observation best in the eighth order diffraction spectrum from one of Rutherford's gratings (8640 lines to the inch). The separation of the overlapping spectra was accomplished by placing a 45° prism between the grating and the observing telescope. The more refrangible of the two components (which is heavier than the other and hazy at the edges) Young considers to be the corona line. In the same journal M'Farland gives a graphical comparison of the variations in the eccentricity of the earth's orbit according to Croll (Leverrier) and Stockwell. The values for the last 40,000 years and for the next 30,000 are almost identical; beyond these limits the form of the two curves is alike (as it should be), but the ordinates vary.

We learn from *Nature* that the lunar map of Lohrmann (three feet in diameter), of which a part was published in 1824, is now to be published in its complete form by Barth, of Leipsic. Schmidt, of Athens, is to furnish a descriptive letter-press. At the same time Schmidt is editing his own work on the moon (the results of over thirty years' labor), which is to be published by the Prussian government. The map (six French feet in diameter) is now engraving by the draughtsmen of the Prussian Staff College, and will contain over 34,000 craters, besides *rillen*, etc., etc. Trouvelot publishes in *Silliman's Journal* a memoir on the physical aspects of the planet Saturn, accompanied by drawings. Some of his conclusions seem to harmonize former unexplained observations. His principal conclusions are: 1. That the inner margin of the outer ring has for some years past shown angular or jagged forms near the ansæ, which may be attributed to a real irregularity of structure. 2. That the surface of the rings near the ansæ on both sides of the principal division has presented a mottled or cloudy appearance. 3. That the thickness of the whole ring system, from the inner edge of the dusky ring to the principal division, increases gradually, so that a cross section of it would be wedge-shaped. The proof of this comes from the form of the shadow of the planet on the rings, and from the appearance of the dusky ring upon the planet's disk. 7. That the dusky ring is not transparent throughout, but more nearly so nearer the planet. The coming opposition of Saturn will afford a favorable opportunity for testing these conclusions.

Pickering publishes a note on a form of photometer suitable for the determination of the brightness of nebulae, etc. A simple modification of Zollner's photometer for the purpose had already been devised by Abbe.

Doberck publishes in the *Astronomische Nachrichten* the elements of the orbit of the binary *Eta Cassiopeie*. The period is 222 years, and the eighty-eight observations (1782 to 1876) agree well with theory.

Appendix III. to the Washington observations

for 1874 (now passing through the press) is Burnham's General Catalogue of Double Stars. This is to contain, first, the current number; second, the specific name of the double, with synonyms; third, the mean right ascension and declination for 1880, with the precession; fourth, the position-angle at a given epoch; fifth, the distance; sixth, the magnitudes and colors; seventh, the observer; and eighth, notes. These last will be a succinct history of the star, with references to authorities, etc. Binaries are separately treated. All points of interest are noted, and the whole form is one suited to the observing astronomer. It will contain about ten thousand stars.

In *Meteorology*, Professor Loomis publishes his fifth paper of contributions to meteorology, and in this he concludes that areas of high barometer are formed from the air which is expelled from areas of low pressure, and that this forming process takes place chiefly on the southeast side of such an area. An area of high barometer may be the result of a storm prevailing at a distance of 1500 or 2000 miles to the north-westward. In oval areas of low pressure the average ratio of the longest and shortest diameters is 1.91, the highest value being 4.6; in similar areas of high pressure the average ratio is 1.82. For Europe the ratios are slightly smaller than America. A decided connection is discovered by him between the amount of rain-fall and the pressure at the centre of the storm, such that the rain-fall is least when the central pressure is increasing, and greatest when the pressure is decreasing—an effect that is most decided during the colder portions of the year. A valuable table is also given of the rain-fall in all known tropical hurricanes.

In some remarks on the criticisms of his theory of storms, Mr. Blasius, of Philadelphia, very properly insists on the importance of considering the areas of high barometer, or cold, heavy air. Mr. Blasius states that in 1851 he advocated the systematic study of weather; and Mr. Blodgett adds that "he proposed the Signal Service in 1851, and himself used the telegraph in the summer of 1852 for two months, and his chart proved then the practicability of determining the form and limits of any storm." Rev. Thomas Hill, ex-president of Harvard College, writes that he urged the use of the telegraph in predicting storms in 1847 and subsequently, and that his labors were entirely independent of those of Mr. Blasius. Redfield, Espy, Loomis, and Henry were also equally with himself active thus early in urging and laying the foundations for a government storm bureau.

Lieutenant-Colonel Stotherd communicated a year ago to the Society of Telegraph Engineers a paper on "Lightning Conductors," which has just been published in their *Journal*; and in the discussion thereon Mr. Preece, the well-known electrician, as well as the other members present, gave abundant data to show that in a majority of cases—perhaps in nine out of ten—the common lightning-rods are so improperly connected with the earth, by not being led into a large spot of moist ground, that their efficiency is wholly destroyed. In such cases the lightning conductors are sources of positive danger. It is very desirable that builders and householders should

have the benefit of the experience of good electricians in regard to these matters.

Meteorological phenomena are so entirely dependent on the configuration of the earth's surface that we shall be justified here in calling attention to the fact that, in the last number of the *Proceedings of the American Philosophical Society*, Mr. C. Allen has given an interesting list of elevations of all points throughout Pennsylvania, as determined by railroad and canal surveys. His lists have been in most cases corrected by careful comparisons, and the whole furnishes the most important contribution to this subject made since the publication of Mr. Gardner's investigations. It is, perhaps, not generally known that the Army Weather Bureau has a large collection of similar data, which was indexed and elaborately discussed some four years ago by Professor Abbe in order to determine the altitudes of the stations occupied by its observers. The contour map of the United States just published by Mr. Gannett, of the Hayden Geological Survey, is a very great advance, in this respect, over any thing of the kind that has hitherto appeared, although it is but a first attempt, and subject to much further revision.

Jordan, of Carlsruhe, contributes to the theory of atmospheric refractions an article in the *Astronomische Nachrichten*, in which he shows that, without making any assumption as to the decrease of temperature with altitude, we may, by a general assumption simply as to the curvature of the ray of light, obtain simpler tables and better results than by any of the tables now in use. Inversely, then, the average temperature of the air can be determined from refraction observations, as others have done from barometric observations, and thus valuable new meteorological results arrived at.

Professor Houston, of the Philadelphia High School, states that he is at work on a proposed improvement of the barometer, in which he hopes, by means of a scale floated on the surface of the mercury, to read with greater care and precision the atmospheric pressure.

The Thorell meteorograph exhibited in the Swedish section of the Centennial Exhibition is well worthy the attention of those desiring a cheap and complete self-recording apparatus.

In a paper read before the London Royal Society, Mr. Broun presents further studies of the simultaneous barometrical variations in India, in which he develops ideas previously hinted at by him, and concludes that the attraction of gravitation is not the only attractive force concerned in the variations of atmospheric pressure.

The observatory of Melbourne has published three fine volumes of meteorological observations made in 1872, 1873, and 1874 throughout the colony of Victoria. It is to be hoped that the extensive meteorological system of the various colonial governments in Australia may soon be continued in such a way as to give us a daily weather map for the whole of that continent. Mr. Cellery writes that he has already joined in the world-wide system of simultaneous observations.

It is stated that already Japan has, through its Bureau of Education, decided upon a national system of weather study, as did China a few years ago through its Department of Customs.

In *Physics*, the month has produced some pa-

pers of note. Dvořák has studied certain attractions and repulsions observed in the vicinity of sonorous bodies when they are vibrating. If, for example, a rod of wood be made to vibrate slowly, and a small square of paper suspended by a silk filament be moved slowly around it, the surface of the paper being preserved vertical, it will be noticed that in certain positions there will be attraction, and in certain others repulsion of the paper. The author attributes these movements to currents of air generated by the vibrating mass, and proves his theory by a number of highly interesting experiments.

The intimate relation between the diffusion, the viscosity, and the conductivity of a gas on the mechanical theory of heat renders interesting some careful experiments of Kundt and Warburg upon the last two properties of gases above given. The results obtained give for the friction co-efficient of air at 15° the number 0.000189, for hydrogen 0.0000923, and for carbon dioxide 0.000152. The value obtained for aqueous vapor was 0.0000975. The correspondence between these numbers obtained in a good vacuum and those of Graham and Maxwell at ordinary pressures, proves that this co-efficient is independent of pressure. The co-efficient of conductivity was determined from the time which a thermometer placed in the gas required to cool. At a certain limit of pressure the influence of convection disappeared, the cooling being due solely to radiation and conduction. By obtaining the most complete vacuum possible, they saw the rapidity of cooling become independent of the form of the vessel, and hence the conductivity is nil. In this way they showed the conductivity of hydrogen to be 7.1 times that of air, while that of carbon dioxide is 0.59. A curious fact observed was that the rapidity of cooling is by far the best test of the perfection of a vacuum.

Julius Thomsen has published a memoir on the heat of neutralization of chemical substances, in which he gives the following conclusions: the differences observed in the results obtained disappear if the substances used be mixed in aqueous solution. The bases soluble in water are thermally divided into two groups: 1st, that of the hydrates, represented by potassium hydrate; and 2d, that of the anhydrides, represented by ammonia, the typical heat of neutralization being for the first group for one molecule of normal sulphate 31,300 calories, and for the second group 28,200 calories, at 18°. For the insoluble bases only the apparent heat of neutralization can be measured, and this is the sum of the true neutralization heat and that of solution of the base. If the former be the same for the bases of the magnesia series (Mg, Mn, Fe, Ni, Co, Zn, Cu) as for the alkali earths, the heat of solution of these bodies will be negative, that of copper, for example, being -12,800 calories.

Heumann has published in full his memoir on the theory of luminous flames, in which the results of an extended investigation are given. He maintains that there are three separate causes which may destroy the luminosity of gas—subtraction of heat, dilution of the gas, and oxidation of the illuminants. Those hydrocarbon flames which lose their luminosity by cooling them, recover it again when they are heated. Those which lose it by dilution with air or with indifferent gases, recover it by raising the tem-

perature of the flame. Those flames which lose their brightness by the moderate introduction of oxygen, which oxidizes the carbon directly, are made bright again upon diluting the oxygen.

Potier has examined mathematically the question of the influence which the motion of matter exerts upon luminous ether waves.

Salet has examined the spectrum of nitrogen and of the alkali metals in Geissler tubes. He observed that sodium sealed with nitrogen in a tube under a slight pressure did not always cause the disappearance of the bands in the nitrogen spectrum, but that it appeared even to absorb the nitrogen and to become black. This nitride, treated with water, gave the reactions of ammonia. In his opinion, therefore, the bands in the nitrogen spectrum are not changed when treated with sodium, unless the nitrogen is actually absorbed by the sodium, when the spectrum changes, of course, to that of sodium vapor, which was the spectrum supposed by Schuster to be that of nitrogen.

Vogel has published additional facts concerning the effect of certain coloring matters upon the sensitiveness of silver bromide to different portions of the spectrum. He finds, for example, that a dilute solution of methylrosaniline picrate increases powerfully this sensitiveness for the red rays between B and C.

Cazin has sought to establish a relation between the heat produced by the magnetization and the demagnetization of iron, the amount of magnetism alternately lost or gained by the core and the position of the poles, and in this way to get an approximate value for the magnetic equivalent of heat.

In *Chemistry*, Janovsky has published a paper on equivalence, in which he maintains with good reason that the only rational basis for this property of atoms, as well as for the correlative one of combining weight, is to be found in the dynamical theory of work.

Zöller has made a series of experiments upon the antiseptic and disinfecting properties of carbon disulphide, from which it appears that this substance is quite remarkable in this direction. Since it appears that mould and putrefaction can not take place in air containing a comparatively small quantity of this vapor, the author especially recommends such an atmosphere for preserving meat and other food during the process of transportation to the consumer.

Suilliot finds that borax is not the excellent antiseptic that has been claimed, though it is equal in this regard to salt. But he gives the results of some experiments with calcium borate, which seem to show that this salt has antiseptic powers of considerable value. He believes that by the action of the meat the salt is decomposed, yielding a simple borate, which preserves from decomposition, while the boric acid thus set free preserves it from mould.

Troost and Hautefeuille have observed that when boron chloride is passed through a heated porcelain tube, silicon chloride and aluminum chloride are formed. Even pure silica and pure alumina are thus attacked. Silicon chloride does not attack porcelain, but is decomposed by alumina. Both chlorides attack zirconia and titanic oxide readily.

Hornberger has attempted to introduce zirconia into organic compounds, and has studied this

earth at length. He concludes, first, that the similarity with silicon which is so striking in inorganic chemistry does not hold in organic; since, second, zirconia can not unite with alcohol radicals to form a sort of ether in which it plays the part of an acid; and third, zirconia plays a decidedly positive part in organic compounds, this element replacing readily only acid hydrogen.

Godefroy has redetermined with care the atomic weights of rubidium and cesium. The metals were separated from each other and from potassium by crystallization as alums, the last traces of rubidium being removed from the cesium salt by precipitation of the latter by means of antimonous chloride. As a mean of four closely accordant determinations, the atomic weight of cesium obtained was 132.627, and that of rubidium 84.525.

Bedson has studied certain compounds formed by ether with anhydrous metallic chlorides, describing those with vanadium oxychloride, titanium tetrachloride, and titanium trichlorhydrin.

Microscopy.—In consequence of the publication by Dr. Bessels, in the *Jenaische Zeitschrift*, Vol. IX., of a description of the animal and test of *Astrothiza* as a new genus, Dr. Carpenter, in the *Quarterly Journal of Microscopical Science* for May, gives an extract from a paper "On the Rhizopodal Fauna of the Deep Sea," presented to the Royal Society June 17, 1869, in which he describes this genus, which was first constituted by Dr. Sandahl in 1847, and has subsequently been considered as new by Bessels under the name *Haeckelina*.

In a paper upon the measurement of the bands of Nobe's test plate, in the Proceedings of the Royal Society, No. 163, Mr. J. A. Brown, F.R.S., arrives at the conclusion that visibility of lines of the same width increases as the distance between them decreases; that parallel lines are least visible when there are only two, and increase in visibility with their number; that Nobe's test lines fail as a test for the microscope, especially in the highest bands, from the incapacity of the machine to make separate lines at less intervals and of less width than $\frac{1}{100000}$ of an inch; they also fail, in all probability, on account of the faintness of the tint or shade of the lines made on the retina.

A very simple method of obtaining the butter globules from recent milk for purpose of comparison or as permanent objects is given by Mr. Brittain in the June number of *Science Gossip*. Drops of milk are placed upon a number of slides, and covered with thin glass as if for examination; after leaving for a few days to dry, the butter globules will be left behind, and several of the slides will be found sufficiently good for permanent use.

In the *Annals and Magazine of Natural History* for April is a translation by Mr. W. S. Dallas of Otto Hahn's "Micro-geological Investigation of *Eozoon canadense*." In this paper Hahn comes to the definite conclusion that the *Eozoon* is a myth founded on a mistaken conclusion as to the micro-geological character of certain serpentine.

Anthropology.—Mr. F. W. Putnam, curator of the Peabody Museum of American Archaeology and Ethnology, has prepared a Centennial volume for the institution, which will include all the reports, together with a complete index, and two steel engravings, the one of Mr. Peabody, the other of Professor Jeffries Wyman.

J. J. Von Tschudi has translated and published, with a splendid commentary and bibliography, *Ollanta*, an old Peruvian drama, originally written in the Quichua language. A translation of the same work was published in 1871 by Clements R. Markham, and entitled "*Ollanta: an Ancient Inca Drama*, translated from the original Quichua."

Professor Rolleston, of Oxford, on the 15th of June, read a paper before the Linnean Society of London upon the prehistoric pig in Britain.

"The Khasi Hill Tribes of Northeast Bengal" is the subject of a pamphlet by Alfred Morgan, the substance of a paper read, June 10, before the Literary and Philosophical Society of Liverpool. The treatise is exceedingly valuable on account of the references to authorities. Some of their customs are worth mentioning. The young men reside apart in a bachelor's hall, where they sleep and take their meals. Cremation is practiced, the ashes being placed in earthen vases, which are deposited in family cemeteries. When a chief or a person of eminence dies, his body is preserved in honey in his coffin. The custom prevails of breaking an egg as a mode of augury. The exorcist throws the egg with all his force upon a board constructed for the purpose. The position of the chips is supposed to indicate the answer. The "Tarroo" is a custom practiced by those alleged to be possessed of demons. It consists in throwing away every thing one possesses and beginning life entirely anew.

Mr. J. C. Galton makes communications to *Nature* for June 1 and 8 upon the ethnology of the Papuans of the Macley coast, founded upon information received from Mr. Macley himself. The paper gives a valuable account of the food, utensils, implements, dwellings, villages, fire-making, plantations, navigation, social habits, etc.

M. Alphonse de Candolle, in his *History of Science and Savants*, has some speculations upon the probable destiny of the human race. He sets out with three axioms: 1. Sentient beings always endeavor to adapt themselves to their environment. 2. Human beings least able so to adapt themselves perish or propagate feebly. 3. Violent contests between nations and individuals accelerate modifications. He concludes from various premises that in the near future the earth will be more thickly inhabited; that there will be a greater mingling of races; that the three great races, the white, the negro, and the Chinese, will predominate; and that the weaker races will disappear.

In the remote future—say, fifty thousand years or more—supposing the present cosmical conditions to continue, the effects of oxidation and human labor will be to diminish metals and coal, and to reduce the race to the greatest misery. The diminution of terrestrial surfaces and the lowering of elevated regions will still more tend to their isolation and discomfort. On the other hand, an increase of intelligence and morality may help man to make a more economical use of the gifts of nature, and thus to prolong his existence. In short, "The human race will describe a curve, the extremes of which escape our powers of observation, while the mean part arrests our serious attention. We know that one of these extremes has already existed. We foresee the time when man will occupy all the habitable part of the world, and will have consumed that which

is now found accumulated by a vast series of geological events. Without much imagination, we can thence foresee the other part of the curve tending to some final point in the far future. Such are the probabilities according to the existing state of things; but the longer the time considered, the more it is necessary to admit the possibility of events unknown, unforeseen, impossible even to be foreseen, which may introduce entirely different conditions."

In *Zoology*, the appearance of the *Zoological Record* for 1874, containing a full bibliography of all works on systematic zoology, is an event of interest, as this annual record is indispensable to the working naturalist, especially when situated away from scientific libraries.

After a voyage of three years and a half around the world, the *Challenger* returned to England May 24. Our readers have been informed, from time to time, of the interesting deep-sea discoveries made by the party under Professor Wyville Thompson. The expedition has been thoroughly successful, the only drawback being the untimely death of Dr. Willemoes-Suhm. The *Challenger* traversed a track of 69,000 miles, and established 362 observing stations, at all of which the depth has been ascertained with the greatest possible accuracy, and at nearly all the bottom temperature has been taken, a sample of the bottom water has been brought up for physical examination and chemical analysis, a sufficient specimen of the bottom has been procured, and the trawl or dredge has been lowered to ascertain the nature of the fauna. At most of these stations serial soundings have been taken with specially devised instruments to ascertain, by the determinations of intermediate temperatures and by the analysis and physical examination of samples of water from intermediate depths, the directions and rate of movement of deep-sea currents. Explorations of Juan Fernandez, a week's visit at Montevideo, were made before the vessel sailed for home by way of the Cape Verd Islands. A *Narrative of the Cruise of the Challenger*, by Professor Thompson, in two volumes, is announced by *Nature* as in an advanced stage of preparation.

That sea-urchins are sometimes viviparous, not passing through a metamorphosis, was first shown by Philippi (1845) in a South American species of *Hemiaster*. He found young sea-urchins in a sunken ambulacral area of the adult, and regarded them as the young of the *Hemiaster*. Lately it has been discovered by Grube that the young of *Anochanus*, a genus of sea-urchins occurring in the East Indies, live under similar conditions. During the present year Mr. A. Agassiz has examined some *Hemiaster* brought home by Dr. J. H. Kidder, the naturalist of the transit of Venus expedition, from Kerguelen Island, and finds that they are viviparous, the eggs (or the imperfectly developed pluteus or larva) probably escaping from the genital openings, readily finding their way into the artificial cavity formed by the spines which conceal the presence of the sunken areas, which serve as brood cavities.

A very fully illustrated memoir on the development of the fresh-water mussels (*Unio* and *Anodonta*) of Europe, by W. Flemming, is published in the Proceedings of the Royal Academy of Science of Vienna for 1875. The paper will interest American students, since these mussels so abound in our rivers. Similar but less extend-

ed researches have been carried on in this country by Dr. W. K. Brooks, but we believe they are as yet unpublished.

The great work of Mr. F. B. Meek on the *Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri* is illustrated by forty-five plates, and treats principally of fossil mollusks. It will be indispensable to the geologist of the far West, as the different divisions of the cretaceous and tertiary ages were originally established by the invertebrate remains therein described, and it therefore forms the basis of our knowledge of the two most important formations in the West.

Mr. Riley's eighth report on the noxious and beneficial insects of Missouri contains much valuable information regarding the common and more injurious insects of the Western States, particularly the Colorado potato beetle, canker-worm, army-worm, the Rocky Mountain locust, and the grape phylloxera. Public attention is annually turned to these destructive pests; and the careful studies of Mr. Riley, set forth in clear, forcible language, will do much toward enlightening the agricultural mind. If the other States were as intelligent and liberal in providing for the publication of such reports, co-operation could be secured between the inhabitants of different States, and the more injurious insects combated and held at bay.

Among other new entomological tracts are Baron Osten-Sacken's "Prodrôme of a Monograph of the Tabanidæ of the United States," in which it is stated that there are 102 species of horse-fly (*Tabanus*) in America north of Mexico, of which twenty are new to science.

Mr. Scudder publishes in the Bulletin of the Buffalo Society of Sciences the second part of his synonymic list of the butterflies of North America, and in the *Canadian Naturalist* figures and describes the hind body of the larva of a dragon-fly and a part of the wing of a cockroach from the carboniferous formation of Cape Breton.

Dr. Hagen describes some curious insect deformities, such as butterflies with caterpillar heads, etc., in the Memoirs of the Museum of Comparative Zoology.

In a study of the axolotl (*Siredon mexicanus*), Dr. Weismann maintains that this creature is the result of a reversion to an Amblystoma or ordinary salamander, which latter came from larval or siredon-like forms. The occasional transformation of siredon to Amblystoma may be explained as a reversion, but this view is opposed by facts we have already stated regarding the transformations of species in the brine shrimps, due directly to physical causes.

Engineering.—The civil engineers of the country, as represented by the American Society of Civil Engineers, held their eighth annual convention at Philadelphia during the month of June, under the presidency of Mr. C. Clarke. A number of technical papers were read and discussed, a number of interesting excursions were made, including an examination of the operation of the gunpowder pile-driver, and a committee was appointed to memorialize Congress in favor of a continuance of the tests of iron and steel. The convention adjourned on the 15th of June.

The following is a record of the leading points in connection with the late extraordinary achievement in fast railroad traveling across the continent from New York to San Francisco. The

train consisted of an engine, a baggage-car, a combined commissary and smoking car, and a palace-car.

Distance from New York to San Francisco	3334 miles.
Time from New York to San Francisco	... 83 h. 34 m.
Average speed per hour to San Francisco	... 39.66 miles.
Distance from New York to Pittsburg	... 444 miles.
Time from New York to Pittsburg	... 9 h. 50 m.
Average speed per hour to Pittsburg	... 45.17 miles.
Maximum speed on Penn. R. R. per hour	... 62 miles.
Minimum " " " "	... 25 miles.

The American Institute of Mining Engineers held a series of sessions at the hall of the Franklin Institute during June, which were numerous attended, and at which many important technical papers were read and discussed.

The Pittsburg *American Manufacturer*, on the subject of mechanical puddling, ventures the opinion that after all the trials made and in course of being made with mechanical puddlers, Danks is still ahead. Various changes in proportions and in the form of certain parts have been made abroad, but the Danks furnace is not so radically altered as to be any thing but the Danks furnace yet.

Mr. Britten has lately taken out English patents for the manufacture of glass from blast-furnace slag, and a company is now in course of organization to work the process on an extensive scale. The details of the process are exceedingly simple, and the product is affirmed to be acid-proof, and capable of use for all purposes for which the best bottle glass is suitable. It cuts readily with the diamond, and is available as rough plate for roofings, sky-lights, greenhouses, and for many other uses from which glass as heretofore manufactured is excluded on account of its cost. Excellent specimens of brilliantly colored glass have likewise been produced.

An explosive material or mixture bearing the name of heraklin, represented as being cheaper, safer, and more convenient than any of the explosives now used for blasting in mines, quarries, etc., is being extensively employed in the Austrian dominions, where it was invented and patented.

The steam-ship *Amérique*, of the General Transatlantic Steam-ship Company, has been provided with a new electric light for the purpose of illumination at sea. The apparatus used is one of M. Gramme's electro-magnetic machines designed for illuminating purposes. The propelling power is a small but powerful engine. The lamp consists of two pointed coke pencils, four or five inches in length and one-half inch square, kept at the proper distance from each other by a clock-work arrangement, and which will last some four hours. The light, it is affirmed, is visible at sea at a distance of fifteen miles, and lights the ship so perfectly that all the details of her equipment and rigging can be plainly seen at a distance of over a mile. The especial design of the lamp is to afford light for working the ship. The *Amérique* is the first vessel that has been equipped with the light, and the system is said to work with the greatest satisfaction.

The Sherman process of steel conversion in the Martin furnace is attracting much attention on the part of French metallurgists, in whose hands the process is said to have lately yielded surprising results. The Sherman process, it appears, is based on the addition of a small quantity of the iodide of potassium to the melted pig-

in novels so thoroughly dramatic in their character. In brief, we should characterize this story as exceptionally strong, stimulating, and healthy; strong without being heavy, stimulating without being sensational, and healthy without being prosy.—*Helen's Babies* (Loring) is a jolly little extravaganza, which the mothers will read with unalloyed enjoyment, and their bachelor brothers with a keen appreciation of Uncle Harry's purgatory, which ends, as purgatory always should, in bliss. It is the record of the experiences of a bachelor uncle left in charge of two healthy, genuine, but mischievous little folks, and of the various scrapes into which their unwonted liberty and his ignorance and inexperience brought both children and guardian. The writer has studied life, especially child life, to good purpose, and either has a quick observation or a fertile fancy, and certainly a keen sense of the humorous.—In

turning over the pile of novels which every month accumulates on our table, we are always attracted when we come upon one by F. W. ROBINSON; for though not a great novelist, he is always a pleasing and entertaining story-teller. His latest story, *As Long as She Lived* (Harper and Brothers), is hardly up to his general average. The characters are strongly drawn, and this is especially true of the two principal ones, Brian and Mabel. The plot, too, though it turns upon love and fortune, is novel in construction, and involves some singular and well-wrought-out situations; but the author relies upon melodramatic incidents for effects which he is quite able to produce without them; and while single incidents are not incredible, their combination so far surpasses credibility as to weaken the interest with which the reader traces through them the thread of the narrative to its happy conclusion.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—The discovery has been reported of asteroid number 164, on the 12th of July, at Paris, by Paul Henry.

Tacchini continues the publication of his observations relative to magnesium in the sun's atmosphere, a second memoir having appeared in the *Comptes Rendus*.

Janssen communicates to the *Comptes Rendus* an account of photographs of the sun which are daily taken under his direction at the Observatory for Physical Astronomy at Montmartre. These are $0.22' = 8.6$ inches (nearly) in diameter, and are said to show in great detail the features of the spots, faculae, etc.

Lockyer has likewise been photographing the sun daily at South Kensington, where he makes use of the long-focused lenses of Huyghens, now at the loan collection, obtaining at the principal focus images more than a foot in diameter.

Vol. XLI. of the *Memoirs of the Royal Astronomical Society* is now in the press, and will be issued in September next. Its 600 pages are devoted to an exhaustive discussion (by A. C. Ran- yard, secretary of the Royal Astronomical Society) of the recorded phenomena of solar eclipses. All published accounts are analyzed and classified, and it is intended to present a full history and discussion of all work on this subject.

The normal map of the solar spectrum, proposed by Lockyer to the Royal Society, is in full progress. The space from H to G is undertaken by Lockyer; from G to F, at Owens College; from F to D, at Berlin; and below D, by Captain Abney, whose photographs show the line A and below with distinctness.

Forbes is determining experimentally the velocity of light.

A commission has been appointed by Leverrier to examine and report upon the four-foot reflector of the Paris Observatory. The mounting is said to be fully satisfactory, but the mirror itself is considered to be susceptible of improvement.

The very sudden death of Oppenheim, a Parisian banker and benefactor of the Paris Observatory, is noted in the daily papers.

Newcomb communicates to the Royal Astro-

nomical Society a paper on his discovery of a new inequality in the longitude of the moon. It was discovered in the course of an investigation undertaken in connection with the transit of Venus reductions, and it is confirmed both by the Greenwich and the Washington observations. The period of the inequality in longitude is 27.43 days. Leverrier's tables of Jupiter and Saturn are printed in Vol. XII. of the *Annales* of the Paris Observatory.

The appointment of J. C. Houzeau to succeed Quetelet as director of the observatory at Brussels is announced.

In the *Comptes Rendus* for June 5, Angot gives the preliminary results of experiments upon photographic diffraction.

Fischer, in the *Astronomische Nachrichten*, publishes the results of an examination of pendulum observations with the object of determining the figure of the earth. His value of the compression agrees well with Bessel's, and he comes to the conclusion that the results of pendulum observations properly conducted will agree with the concluded elements from geodetic measures. The disturbing influences of local attraction should be eliminated, wherever possible, by means of geologic surveys.

Dr. Doberck, of Markree, is now engaged in investigating the orbits of several binaries, among which are *Mu Boöte*, *Sigma Corona*, *Tau Ophiuchi*, *Gamma Leonis*, *36 Andromeda*, *Zeta Aquarii*, *Iota and Omega Leonis*, *44 Boöte*, *Eta Cassiopea*, *Mu Draconis*, *Gamma Cor. Borealis*, *12 Lyncis*, Σ 1757 and 1819.

Huggins, in the *Comptes Rendus* and *Philosophical Magazine*, has replied to the strictures of Secchi upon the method used by him in obtaining the velocity of motion of stars toward or from the earth by means of the spectroscopic. It appears that the sources of error pointed out by Secchi were known, and that no work was done until these had been eliminated. The later Greenwich observations of this nature confirm Huggins's earlier researches, not only as to direction of motion, but as to amount, as is shown by a paper by Christie, of Greenwich, in the *Monthly Notices*, Royal Astronomical Society.

Mr. E. B. Knobel, F.R.A.S., has lately been making a reference catalogue of all books, papers, and notes relating to the following branches of stellar astronomy: Double Stars, Variable Stars, Red Stars, Nebulæ and Clusters, Proper Motions of Stars, Parallax and Distance of Stars, Star Spectra. The author has attempted to make this bibliographical work exhaustive of scientific literature. We understand the catalogue will shortly appear in the publications of the Royal Astronomical Society of London.

In *Physics*, the month has witnessed some considerable advance. Cailletet, who has been working upon the problem of chemical action under high pressures, has contrived a simple form of pressure gauge, founded on the compressibility of glass. By experiment he proved that a cylindrical glass reservoir suffers, when compressed, a diminution of volume exactly proportional to the pressure exerted. The new manometer consists, therefore, of a large glass thermometer, with a cylindrical bulb containing either a colored liquid or mercury, and inclosed in a cavity in a steel reservoir, communicating by a brass tube with the apparatus in which the pressure is to be measured. To maintain the temperature constant, the whole apparatus is placed in melting ice during use. The indications are reliable.

Kimball has studied the changes produced in the physical properties of steel by tempering. He finds (1) that the modulus of elasticity decreases as the hardness of the steel increases; (2) that the increase of deflection in a given time is greater the harder the steel; (3) that the immediate set increases with the hardness of the steel; and (4) that a bar recovers from a temporary set with greater rapidity the harder it is.

Professor Foster has exhibited to the Physical Society of London the apparatus devised by Mach for sound reflection. It consists of a mathematically exact elliptic tray, highly polished, and provided with a tightly fitting glass cover. The tray is covered with precipitated silica well dried. Upon repeatedly discharging a Leyden-jar between two small knobs placed in one of the foci, the finely divided silica is seen to arrange itself in curves around the other focus.

Violle has experimentally investigated anew the question of the sun's temperature. He used a thermometer, carefully made, reading to one-fifth of one degree, and blackened, placed within a copper sphere, also blackened. A second sphere of copper, externally polished, surrounds the first, the space between them being so arranged as to have a constant current of water of any desired temperature conveyed through it. On opposite sides of these concentric spheres are tubulures by which the solar radiation enters, closed by a plate having several openings of different sizes. His results, when reduced, show that every square centimeter of the earth's surface at the places named receives the number of units of heat (gram-degrees C.) placed opposite:

Summit of Mont Blanc.....	2.392
Grands Mulets.....	2.262
Glacier des Bossons.....	2.022
At the level of Paris.....	1.745

Assuming the correctness of Dulong and Petit's law, calculation from these numbers gives 1500° C. as the temperature of the sun. But not desiring to assume this, Violle made direct experiments with his apparatus upon the heat radiated

from Siemens-Martin steel when running into the moulds. From the data obtained, he gives 1300° C. as the temperature of the metal. This increases only a little the previous value; and after making all the allowances fairly demanded, the author maintains stoutly that the mean temperature of the sun does not sensibly differ from 2500° C.

Jannetaz has studied the propagation of heat in crystallized bodies in an ingenious manner. Instead of perforating the crystal plate, as has been done by previous experimenters, he used a small truncated cone of platinum, having on each side of its base a platinum wire leading to the battery. The crystal plate is previously covered with some easily fusible substance (the author prefers lard), the little cone is brought upon its centre, and the circular or elliptical form of the liquefied portion of the covering material becomes very soon apparent. By this means Jannetaz has obtained some very curious results.

Krüss has studied the question of the depth of the images in optical instruments, and has given the results of the application of his principles to the human eye.

In *Chemistry*, Muir has given his views of the present system of chemical notation and its complete significance, arguing that its symbols actually do mean far more than they are usually made to in ordinary usage, and hence that the newer dynamical views now arising may find it best to retain them.

Spirgatis has given some facts which appear to prove the existence of arsenic in antique bronzes. Four bronzes were analyzed, two of them earlier than the Christian era, the other two of the fourteenth and fifteenth centuries. Of the earlier ones one contained 0.12 and the other 3.52 per cent. of arsenic; of the later the quantities were 0.96 and 0.32 per cent. respectively.

Grünzweig and Hoffmann have conclusively sustained their statement of the crystalline character of ultramarine, against Büchner, who had maintained that the crystals observed under the microscope were those of quartz. They now bring forward the testimony of additional experts, who have seen and examined the crystals, and of Vogelsang, who has determined them to belong to the cubic system.

Lecoq de Boisbaudran, the discoverer of the new element gallium, has given laboratory methods for the extraction of this metal from the blendes in which it occurs. A list of blendes is given, together with their relative values as sources of gallium. The best one is that called the black blende of Bensberg.

Terreil has communicated to the French Chemical Society the analysis of the magnetic platinum of Nischne-Tagilsk. The magnetic metals present are iron (8.18 per cent.) and nickel (0.75 per cent.). There is also given in the analysis 3.13 per cent. chrome iron.

Bedson has made a series of experiments on compounds formed by the union of ether with certain chlorides of the metals. He has succeeded in forming such compounds with vanadium oxychloride and with titanium tetrachloride. Titanium trichlorohydrin is also formed.

Dr. Van Hamel Roos has examined carefully the condition under which glycerine crystallizes, having had fifty-six pounds of crystals to work with. The crystals are monoclinic. The only

requisite in their production is the freedom of the glycerine from water. Crystals are the best test of purity, and also the best means of purification.

Microscopy.—Mr. Sorby's address, at the annual meeting of the Royal Microscopical Society, on the ultimate limits of the microscope, as shown by the formula of Helmholtz, has elicited a reply from Count Castracane, which is printed in the July number of the *Monthly Microscopical Journal*. It is there stated that the resolution of the nineteenth band of Nobert's test plate exceeds the limit determined by the formula, and Mr. Sorby is called upon to explain the discrepancy. Mr. Sorby does not perceive any serious difficulty in explaining on Helmholtz's principles the resolution of the band in question, and he states that it is probable, with such an illumination as that adopted by Count Castracane, that the interference fringes would so far coincide with the true lines as not to prevent satisfactory definition; and he suggests, for the purpose of testing the theory of Helmholtz, the study of fine lines at very close but unequal intervals, with one or two missed out here and there. Theory indicates that such tests would be far more difficult to see correctly than lines ruled at regular and equal intervals. A translation of Helmholtz's paper on the limits of the optical capacity of the microscope is reprinted in this July number of the *Monthly Microscopical Journal* from the Proceedings of the Bristol Naturalists' Society, new series, Vol. I, Part 3. In this paper it is stated that diffraction of the rays is beyond doubt the principal cause of the limitation of sharpness of the microscopical image. In comparison with diffraction, chromatic and spherical aberration appear to exert but an inconsiderable influence, in spite of the very large angles of incidence and divergence of rays. Considering the extreme care expended on calculation and execution of lenses for telescopes and the photographic camera, it is justly a matter of surprise that with the lenses of the microscope, which are so much more difficult to construct according to the prescribed dimensions, and which have so large an aperture, spherical aberration makes itself so little felt. We may add that while undoubtedly theory has very largely contributed to the perfection of the lenses for telescopes and cameras, it has hitherto done little, and, indeed, from the very nature of the case, can do comparatively little, for the perfection of the microscopical objectives. Almost all the makers of such lenses—we might say all of any note—depend upon acquired skill in the use of certain tests, e. g., the artificial star, as indicating the necessary changes, in laboring toward perfection; and very seldom, we venture to say, has such perfection been the result of a rigid adherence to curves, thicknesses, apertures, etc., previously indicated by theory. Indeed, Helmholtz himself relates the failure of an attempted improvement which he thought himself justified in inferring theoretically. The whole paper is worthy of careful study, and certainly every thing which theory can give us to aid in arriving at more satisfactory conclusions should be cordially welcomed.

Anthropology.—Mr. Hyde Clarke read before the London Anthropological Institute, June 27, a paper on Serpent and Siva Worship and Mythology in America, Africa, and Asia. An attempt was made to bring the Bri-Bris and other

Central American tribes into ethnic relation with those of Western Africa. The Central American one god, Sibū, and his mythology were traced to the Old World. This word, as Sowo and Nebo, is found in company with *Kali* in West and Central Africa, over a wide area, representing god, speed, idol, navel, etc. It was then compared with Siva and Kali, and the cosmogony and serpent worship of India, and with Nebo in Babylonia, Seb in Egypt, Seba in Arabia and Phrygia.

Dr. Karl Berg, inspector of the Museum of Buenos Ayres, in 1874 conducted an expedition to that portion of Patagonia which borders on the Rio Negro. Many skulls and stone relics were collected. The Indians belong to the Tehuichte or Teg-huelche race, from *Theghul*, a bird, in Araucanian, and *che*, people. They are affable in disposition, and live upon the product of the chase. They are very skillful with their arms and horses.

The Anthropological Society of Paris has removed to its new rooms at the École Pratique of the Faculty of Medicine. The city of Paris contributes 20,000 francs, and the members the remaining sum, toward fitting up the meeting-room, laboratories, library, and museum. A fine collection of skulls and other anthropological material has already been made.

In the Transactions of the New Zealand Institute for 1875, several discussions will be found relating to the relations of the present Maori race of New Zealand to the moa hunters. By some it is supposed that the moa became extinct many centuries ago, and that the bones in the caves and the hearths indicate a prehistoric race in no way related to the Maoris. By others the moa are thought to have existed quite down to our day, and that the moa hunters and Maoris are one and the same race. Most of the writers in the last journal lean to the latter view.

The Rev. J. S. Whitmee, in discussing the question of the decrease of aboriginal populations, especially of Polynesia, thinks that the mistake has been universally made of overrating them in the first place. He also shows that under missionary influence the native populations of many islands are increasing.

The second number of the *Revue d'Anthropologie* is nearly all taken up with a discussion of cranio-cerebral topography and reviews of works upon the same subject. Beginning with the labors of Arnold and Gratiolet, it is proposed to no longer base phrenology upon the examination of the exterior skull, but upon the brain itself, and its relation to certain fixed points upon the skull. The methods of examining the brain are given in detail, and compared with regard to accuracy and facility. The author, after reviewing the graphic methods of his predecessors, prefers the insertion of pegs at certain points, practiced by himself and Bischoff. It is impossible to give even a sketch of the discussion here, but we refer with pleasure to the original memoir.

Zoology.—Beginners in the study of zoology will be interested in Professor Orton's *Comparative Zoology, Structural and Systematic*, just published by Harper and Brothers. The first half of the work is devoted to the physiology, and the second half to the classification, of animals; and though it does not claim to be the work of an expert, the first portion of the book is a fresh and attractive presentation of the relations of animals

to plants, to each other, and how they eat, breathe, move, and reproduce their kind.

Microscopists will find a useful summary of recent German works on rhizopods, compiled by Mr. W. Archer, in the July number of the *Quarterly Journal of Microscopical Science*. It gives the results of the researches of Hertwig and Lesser, who regard the lowly organisms comprehended under the general name "Rhizopoda" as wanting in those definite characters which would connect them on one or other side either to the animal or vegetable kingdom, and hence must be relegated to the "Protista." In these forms nowhere can we say *absolutely* that this or that part (and *no other*) subserves to nutrition, to perception, to movement, to reproduction, but any portion of the body may perform these functions. That motion and contractility are properties of the entire body mass of protoplasm is rendered evident by the internal circulation of granules imbedded in the plasma, and externally by a change of place and of the form of the body. The authors adopt Haeckel's term "Monera" for still simpler organisms than these, and for the rhizopoda propose, somewhat unnecessarily, a new term, *Sarcodina* (sarcode organisms).

The first part of an article by Mr. Seudder on a cosmopolitan butterfly appears in the *American Naturalist* for July. It is the Painted Lady, or *Vanessa cardui*, which, with the exception of the arctic regions and South America, is distributed over the entire extent of every continent.

Dr. Hagen discusses in the same journal the probable danger to houses, bridges, libraries, etc., from white ants. It appears that considerable damage has already been done by them in Salem, Boston, and Cambridge, Massachusetts. He suggests as a preventive the removal of pieces of boards and old stumps about dwellings, which attract the ants.

The geometrid moths, numbering in the United States some 400 species already known, have been monographed by Dr. A. S. Packard, Jun., in a quarto work of over 600 pages, with thirteen plates, forming Vol. X. of Hayden's reports of the United States Geological and Geographical Survey of the Territories. The descriptive portion is preceded by chapters on the anatomy of the head and thorax, on secondary sexual characters, etc., while the volume closes with an essay on the geographical distribution of the species in this country.

As a further contribution to the sexual, individual, and geographical variation in birds may be cited Mr. J. A. Allen's remarks on *Leucosticte tephrocotis*, in Hayden's Bulletin of the United States Geological and Geographical Survey of the Territories. The same Bulletin contains a series of facts regarding geographical variation among North American mammals, especially in respect to size, based on a study of the magnificent series of skulls belonging to the National Museum, sometimes containing eighty or a hundred specimens of a single species. The variation in size, for instance, with latitude, in the wolves and foxes, is surprisingly great, amounting in some species to twenty-five per cent. of the average size of the species, while in other species of the *Ferax* it is almost nothing. Mr. Allen finds, contrary to the general supposition, that the variation in size among representatives of the same species is not always a decrease with the decrease of the latitude of the

locality, but is in some cases exactly the reverse, in some species there being a very considerable and indisputable *increase southward*; consequently the very generally received impression that in North America the species of mammalia diminish in size southward, or with the decrease in the latitude (and altitude) of the locality, requires modification. While such is generally the case, the reverse of this, too, often occurs, with occasional instances, also, of a total absence of variation in size with locality, to be considered as forming "the exceptions" necessary to "prove the rule." Such exceptions are seen in families and genera which are mainly developed in the tropics and there reach their maximum development, as opposed to those which have their greatest development in the temperate or colder portions of the northern hemisphere.

In a collection of fossil bones from the Ashley phosphate beds near Charleston, South Carolina, Dr. Leidy identifies a complete tusk of the walrus, indicating a still further point south for the extension of this animal than had been previously known—Virginia having been, we believe, the farthest point southward where it had previously been found. Associated with this tusk were the skull of a manatee, a tooth of the megatherium, and the bones of a number of new species of cetaceans—among them a huge tooth of a form allied to the sperm-whale, and probably the same as those from the crag beds of Antwerp, ascribed to *Dinoziphius*.

Professor O. C. Marsh publishes in the *American Naturalist* a *résumé* of his discoveries of extinct animals in the West, and brings out the following remarkable law, bearing so forcibly on the evolution hypothesis. He concludes (1) that all tertiary mammals had small brains; (2) that there was a gradual increase in the size of the brain during this period; (3) this increase was mainly confined to the cerebral hemispheres or higher portion of the brain; (4) in some groups the convolutions of the brain have gradually become more complicated; (5) in some the cerebellum and olfactory lobes have even diminished in size. There is some evidence that the same general law of brain growth holds good for birds and reptiles from the cretaceous to the present time.

Agriculture.—Some interesting experiments on the effects of composting in rendering soluble the phosphoric acid of mineral phosphates have been made by Holdefleiss at the experiment station at Halle, Germany. Nassau phosphorite was composted with peat, earth, urine, dung, salts of ammonia and of potash, separately and mixed in various ways. In the first series of trials it was noticed that nearly fifty per cent. of the phosphoric acid of the phosphate mixed with peat was rendered soluble in citrate of ammonia. In subsequent trials, however, with peat of a different sort, scarcely enough phosphoric acid was rendered soluble to pay for composting. The explanation of this variation was found in the fact that the peat of the first trials contained sulphur, which by oxidation produced sulphuric acid, which in its turn rendered the phosphoric acid of the phosphate soluble. With the other materials used in composting but comparatively little of the phosphoric acid was made soluble.

In the above experiments determinations were made of total nitrogen, nitric acid, and ammonia, with a view to discovering the effects of the va-

rious mixtures on nitrification. In general the nitrogen of the animal compounds evinced a very marked tendency to become oxidized to nitric acid, stronger than has been previously noticed, from one-half to two-thirds of the whole nitrogen being in some cases oxidized. The nitrification was directly proportional to the amount of carbonate of lime present. The nitrogen of the ammonia salts became oxidized with extreme slowness, but was still oxidized to some extent, in presence of carbonate of lime. Potash salts prevented nitrification completely. It is suggested that the failure of ammonia salts as manures in soils poor in lime may be owing to the slow oxidation of the ammonia to nitric acid, and that the poor effects sometimes observed with potash salts may in some cases be due to their hindering the nitrification of nitrogenous organic materials in the soil.

Of interest in this connection are some experiments on the same subject, lately reported by Boussingault, whose varied researches on the nitrogen of the atmosphere and soil in its relation to the nourishment of plants are already classic. The especial object of these last experiments was to test and compare the effects of sand and lime (as carbonate), each by itself with a soil (loam), upon the formation of nitric acid from the nitrogen of organic substances of animal origin used as manure. Neither sand nor lime seemed by itself to favor especially the formation of nitric acid, while a "sandy-clayey" soil, with only 0.02 per cent. of lime, promoted the oxidation of nitrogen very decidedly.

At first sight the results of Boussingault's experiments would seem to be quite at variance with those of Holdefeiss, and with the common belief that lime in soils favors nitrification; but it will be observed that Boussingault's results refer to lime when used alone, as carbonate of lime, while Holdefeiss worked with soils containing lime, that is, under circumstances which approach more nearly to those which actually exist in cultivated soils.

In the field of *Engineering*, we may report that, certain legal difficulties that have obstructed the progress of the work having been removed, active preparations are now in progress for the construction of the Hudson River Tunnel on the Jersey shore. The entrance to the tunnel is located on Jersey Avenue, near Fifteenth Street, and the excavation will be carried in a northeasterly direction, terminating in Washington Square, New York. The tunnel will be two miles in length. The road-bed will be twenty-three feet in width. The shaft at the foot of Fifteenth Street, Jersey City, has been sunk, at the time of writing, to the depth of twenty feet, and will be further excavated to the depth of sixty-two feet, when the excavation beneath the river will be commenced. Without entering further into details, it may be added that the cost of this enterprise is estimated at \$15,000,000.

The reports of recent soundings at the South Pass, where the jetty works are being pushed forward assiduously under the direction of Captain Eads, show the average depth of the channel between the jetties to be considerably above twenty feet, the greatest depth being twenty-five and a half feet, and the least nineteen feet. The above figures give the average of twenty-eight soundings. The jetties appear to be steadily and

rapidly deepening the water within their influence, and every thing points to the ultimate and complete success of the great undertaking.

Mr. Spaulding, an American engineer, announces a project for the restoration of the ancient water level of the Caspian Sea to its condition in prehistoric times, by the cutting of a canal some 170 miles in length, by which the waters of the Black Sea shall be drained into the basin of the Caspian.

Mr. Donald Mackenzie has left London at the head of an expedition to demonstrate the feasibility of his plan of flooding the Desert of Sahara, and thus opening the interior of Africa to European commerce.

Mr. Thomas S. Speakman has advanced a project for crossing the Delaware at some suitable point by means of a combined bridge and tunnel, the design being to avoid the obstruction of the navigation of the Philadelphia side of the river. He proposes to bridge the eastern side of the channel, and to leave the west side free to navigation by carrying the line of travel through a subaqueous tunnel.

The Poughkeepsie Bridge, to the projection of which we have several times referred, has at last been commenced. Its length will be about a mile; height above mean tide, 135 feet. It will be completed about January, 1879, and will cost \$5,000,000. The builders are the American Bridge Company, Pittsburg.

Mr. Henry Meiggs proposes to the Peruvian government to build, in three years from date of contract, the unfinished section of the Lima and Oroya Railroad to the Oroya, and to extend it from that point to the great silver mines of Cerro de Pasco; also to build a tunnel which shall drain these mines below the level of the present drainage tunnel, which now limits the workings.

A Russian Congress is to meet at Warsaw next September, at which the question of adopting the Gregorian calendar in Russia will be considered.

The Swedish Diet lately voted the adoption of the French system of weights and measures, with the French nomenclature. Its obligatory use is to date from 1889.

Mr. Roy estimates the available coal in the Alleghany coal-field at 743,424,000,000 tons.

M. Fernand Hamoir's process for refining cast iron previous to puddling has lately attracted much attention. It consists in submitting the cast iron, at the instant of tapping it from the furnace, to a current of air. The process is said to be rapid, and so effectual that the pig-iron is so far refined as to permit of one charge more being worked per day in the puddling furnace.

The Sherman process of steel conversion is attracting much attention from French metallurgists.

M. Garnier has produced a new alloy of iron and nickel, which may prove to be of value in the arts.

Lewin has published a paper on the antiseptic properties of thymol, in which he pronounces this substance to be highly valuable.

The Rumford medal has just been awarded to Professor John W. Draper by the American Academy of Science and Arts for his researches in radiant energy.

Phylocyanin, a new coloring matter, is affirmed to be more sensitive to acids and alkalis than litmus. It is obtained from the violet.

even to some careful students, has seemed a mere heterogeneous and bewildering maze of laws, the product of many minds, and even of different stages of human progress. It is quite needless to say that no man on either side of the ocean is more competent to this task than Heinrich Ewald. —Rev. G. W. Cox begins a series of epochs of ancient history, uniform with the epochs of modern history, by a volume on *The Greeks and the Persians* (Scribner, Armstrong, and Co.). A history of that great struggle between the despotism of the East and the freedom of the West which came practically to an end with the discomfiture of the Persian army at Plataia and the ruin of the Persian army at Mykale. Mr. Cox's reputation is an assurance to the reader that the book is well done, and the execution of the work justifies his reasonable expectations. The story is a very dramatic one, and is told in a way to be full of interest to even the youthful reader, if a thoughtful one.—From the same author we have *A General History of Greece* (Harper and Brothers), one of the admirable Student's Series. In this volume Mr. Cox traces the history of Greece from the earliest period to the death of Alexander the Great, with a sketch of the subsequent history to the present time. For the general reader, as well as for the student, there is no brief history of Greece to compare with this. An erudite student, Mr. Cox is an authority on Grecian history. He separates with great skill the real from the mythological; and he possesses a peculiar power in graphic and dramatic narrative, preserving the poetic and the heroic in history without sacrificing the truth. We could wish that his plan had included a somewhat fuller treatment of art and literature; and yet it is doubtful whether he could have added this important element without impairing the unity of his design, and detracting from the continuity, and so from the interest, of the narrative.—The most captious critic can not deny that Professor CHARLES DUKE YONGE's *Life of Marie Antoinette* (Harper and Brothers) is peculiarly fascinating; the most enthusiastic critic will not claim for it that it is impartial. It begins with a eulogy of the unhappy queen; it ends with her canonization. No Roman Catholic devotee ever worshiped the Virgin Mary with greater devotion than Mr. Yonge shows to the royal martyr. This enthusiasm im-

parts to the history a warmth and fervor that give to it its fascination. Nor can we wonder at the admiration for the one person whose character and reputation survived the general wreck which the Revolution made of men, and apparently even of principles, as well as of property and lives. Nevertheless the impartial critic is compelled to acknowledge, when he escapes the fascination of the dramatic narrative, and tests it, not by the standards of the drama, but by those of history, that Mr. Yonge has made far too little allowance for the long years of brutalizing training to which the common people of France had been subjected, and the accumulated wrongs which they revenged. It is doubtful whether any careful student will agree with the bitter judgment which the author pronounces against Madame Roland, and it is almost certain that no American critic will consent to that which he renders against Lafayette. A more fascinating story, however, we have rarely, if ever, read.

The Lord's Land, by the Rev. HENRY B. RIDGWAY (Nelson and Phillips), is an attractive and instructive record of the author's extensive four through the Sinaitic peninsula and Syria. Dr. Ridgway is well known as a clergyman of great ability and success; in the present work, however, we find him excelling in a new department—as a careful observer, a thoughtful and patient traveler, and a diligent student of the history and associations of the Biblical territory. His volume betrays a just appreciation of the recent explorers in the same countries, and is at once fresh, sparkling, and critical. The illustrations are of a high order, and some of them are from the author's original sketches. The one feature of the work which is of highest value is the portion treating of the trans-Jordanic or Moabite region. Here is a comparatively new field of exploration, hardly safe as yet except to large and well-guarded companies. The descriptions of Petra, Kerak, and other seldom-visited places of great interest are extremely fascinating. The same may be said of the beautiful Samaritan province. The work, as a whole, combines in good proportion the results of accurate observation and careful preparatory study. The copious index and table of Scripture texts form a very proper conclusion to the volume.

Editor's Scientific Record.

SUMMARY OF SCIENTIFIC PROGRESS.

Astronomy.—We learn from the *Comptes Rendus* that daily solar photographs are taken in Paris, not only by M. Janssen, but by M. Cornu, at the National Observatory.

The second volume of Engelmann's "Bessel" has appeared. It is devoted to essays on the theory of instruments, stellar astronomy, and mathematics, and, with the first volume, brings the number of Bessel's papers now reprinted up to 124. A third volume is to follow.

Forbes, of Edinburgh, is now engaged upon the preliminaries to a series of experiments upon the velocity of light, which it is hoped to complete within the present year.

It is understood that the glass for a new mirror

for the Paris four-foot reflector has been ordered by M. Leverrier from the manufactory at St. Gobain, so that this telescope may have two mirrors, one always in reserve. From Feil, of Paris, a set of glass disks for the new refractor (twenty-nine inches aperture) has been ordered, so that this refractor, when finished, may have also two objectives, one from the new disks to be furnished by Feil, and one from the old disks, long in the possession of the observatory. A new refractor of large size (eighteen inches aperture) has been ordered by Colonel Campbell from A. Hilger, optician, of London. The Strasburg meridian circle, by Repsold (six inches aperture), is now nearly ready for delivery. While on the subject of instruments, a new and ingenious bright-line micrometer for spectroscopic (and other) work may

be mentioned, which has been fitted to the Greenwich spectroscope by Hilger, of London.

A commission, composed of Professor Tait, Lord Lindsay, and others, has examined into and is about to report upon the present condition of the Royal Observatory, Edinburgh. There can be no doubt such an inquiry is called for, its principal astronomical activity being the observations necessary for the dropping of the time-ball. The observations made at the observatory since its foundation to 1870 are being united into one catalogue of stars. It is proposed in this catalogue to determine the proper motions from all available observations which are on record. The Greenwich Observatory is also preparing a new nine-year catalogue. All the past work will be corrected for the lately discovered wear of the micrometer screws of the transit circle microscopes.

Trouvelot, of Cambridge, has secured no less than thirty-four drawings of Jupiter up to the end of June, and it is to be hoped that other American observers have succeeded in obtaining drawings of this planet, which is unfavorably situated for observations by European astronomers. Blanks for the purpose may be had from the secretary of the Royal Astronomical Society, London.

The *Astronomische Nachrichten* contains an elaborate ephemeris of the satellites of Saturn for the present opposition, by Marth, of London. The ephemeris gives not only the *position angle* and *distance* of the satellites with respect to the planet's centre, but it also gives the times of conjunction, etc., of the satellites. It is believed by Marth, who has given much attention to this subject, that the observations of conjunctions, etc., according to his ephemeris, are equally valuable with those made by the micrometer; and the former have the advantage that they can be made by amateurs, the only requisite being a telescope and a time-piece whose correction is known. It is to be hoped that these may be observed in the United States during this year.

Meteorology.—The most important publication that has come to hand since the beginning of the year is the fine volume issued by the Smithsonian Institution under the title *Tables, Distribution, and Variations of the Atmospheric Temperature in the United States*. These temperature tables are based upon all available thermometric observations made in the United States and Canada previous to the year 1871, the estimated number of which will not fall below 11,000,000. The labor of discussing this great mass of observations and of deducing some general results has been ably performed by Mr. Charles A. Schott, of the Coast Survey Office, to whom science has also been indebted for the Smithsonian Rain Tables and for many other special works in meteorology. Three large charts accompany this work, showing the distribution of surface temperature for the summer, the winter, and the year. Numerous smaller plates illustrate the daily and annual fluctuations of temperature. Mr. Schott finds no perceptible secular change in the temperature of the country, nor any decided connection between our temperatures and the variations in solar spots. For ten stations the mean temperatures have been computed for every day of the year, and it appears from these that changes in the normal temperature of any day extend over large tracts of country, and progress in an easterly direction.

All the stations agree in showing a rapid rise in temperature about the 20th of February. There are also indications that the hottest and coldest epochs change somewhat from year to year, making a complete circuit in seventy years through a range of about six weeks. On comparing the average direction of the wind with the average temperature, it appears evident that for years of northerly winds the temperature is lower, and for southerly winds is higher, so that secular changes in local temperature are attributable to corresponding changes in the direction of the wind. These latter changes, on the other hand, must be a part of a system of oscillations in the general currents of the atmosphere, which may possibly be ultimately due to slight variations in solar radiation.

Although the Smithsonian Tables approach so nearly to being an exhaustive compilation, yet there are continually being brought to light hitherto unknown series of observations, some of which will be worthy of future publication. Of this character is the extensive work done by Engelmann in 1859, as meteorologist to Simpson's explorations in Utah. His report on the hypsometric results of these observations has just been published by the Army Engineer Bureau, and forms one of the best contributions that the army has made to the subject. In this report Engelmann gives a very lucid explanation of the influence that vapor exerts in affecting the diurnal variations of temperature on the Western plateaus.

The meeting of the French Association for the Advancement of Science, at Clermont, near the Puy-de-Dôme, calls forth a note with reference to the first demonstration of the fact that the air had weight. It was in 1644 that Pascal made his famous experiments, first at Paris and subsequently at the Puy-de-Dôme. Continuous observations of the barometer were made at Clermont during the years 1649, 1650, and 1651, and simultaneously at Paris and Stockholm. With these began the development of the modern science of meteorology.

Professor C. F. Hart, formerly of Cornell University, but now chief of the Geological Commission of Brazil, writes that he has endeavored to do something for meteorology in that empire, where the field of operations is second only to that which is found in the United States. The publication of the archives of the museum of Rio Janeiro has been begun, and communications relative to meteorology may soon be expected from Professor Hart and his assistants.

Ricco publishes in the *Memoirs of the Italian Spectroscopic Society* a review of our knowledge in reference to the transparency of the atmosphere. He gives an instructive collation of the co-efficients of transmission of the total radiation of the sun, and also the co-efficients of transmission for the purely luminous radiations. Some observations made with the lucimeter by Provenzani, at Rome, are here published for the first time.

Mr. R. W. M'Farland states that on account of the interest felt by geologists in the calculations of Croll, Stockwell, Hopkins, and others relative to the changes in the climate of the earth that may be caused by the varying eccentricity of the earth's orbit, he has recomputed this eccentricity for the space of over one million of years; and

his results agree substantially with those of Mr. Stockwell.

Among the papers relating to the climate of past geological ages, Professor Dana, of New Haven, has contributed not a little important matter. He has made a special study of the valley of the Connecticut River, and in the last number of the *American Journal of Science and Art*, in a short appendix to his previous memoir, he gives additional details relative to the formation of drift deposits around New Haven.

Mr. Osborne, of Washington, has prepared a scale of terms and corresponding numbers expressive of the atmospheric condition, whether as to heat or cold, moisture or dryness, and hopes to be able thereby by means of a single number to express the peculiarities of the climates of every portion of the globe, instead of being obliged to consult the separate figures relating to temperature, moisture, coldness, etc.

It appears from reports brought from Iceland and the northern part of the Atlantic Ocean that unusually boisterous weather has been experienced within the whole navigable portion of the arctic circle, the high winds driving the field ice southward in large quantities. These reports, taken in connection with the unusually hot summer of the United States and Europe, and the unusually cold winter both in America and Asia, suggest the importance of extending our study of atmospheric changes so as to include at least the whole hemisphere, in order that we may understand the relations that exist between the changes in the climates.

The study of the dust found in the atmosphere has received new impetus of late by reason of Tyndall's striking experiments on the optical analysis of the atmosphere. He shows that it is possible, by simple optical means, to reveal instantly the presence or absence of dust in what would otherwise be considered as perfectly pure air.

The heavy storm that occurred on the British coast on the 3d of August is generally remarked upon by English journals as one deserving of very careful investigation, in order to ascertain whether it might not have been possible to give some intimation beforehand of its peculiarly destructive character.

The progress of the month in *Physics* has been moderate. Mercadier has published the results of his experiments on the vibration of steel forks, from which he concludes, first, that the number of vibrations of such forks, other things being equal, is independent of their breadth; second, that the number of vibrations is directly as the thickness; and third, that this number is inversely as the square of the length. These results are in complete accordance with those calculated from the theory of elasticity in solids. With regard to the amplitude of the vibration as affecting its isochronism, the author concludes, first, that the vibrations of a fork are not absolutely isochronous, the duration of its period varying with the amplitude and the temperature; second, that consequently any chronographic instrument can give comparable results at different times only if the temperature and the amplitude remain the same; and third, that if the amplitude does not exceed three or four millimeters, and if the temperature varies but slightly, the number of periods per second may be exact to .0001 nearly.

Mayer has given in *Nature* some notes of

remarkable experiments in acoustics on the obliteration of one sound by another. He finds that the ticking of a clock, for example, completely obliterates the ticking of a watch at the periods of coincidence, the intensity of the clock ticks which effect this obliteration being three times that of the watch ticks. Moreover, he observes that a sound can not obliterate another lower in pitch than itself—a result of great physiological significance. These facts the author applies to orchestral music, and shows that this obliteration of higher by lower sounds should and does seriously mar the intended effect of the music, and hence that the study of its conditions is necessarily in musical composition.

The radiometer continues to be the subject of extensive experimentation. Böttger, using a Geissler instrument, could not obtain the slightest rotation with the full moon or with phosphorescent tubes. A candle flame twenty-four centimeters distant, with an alum plate interposed, gave a weak rotation; but with a water cell, no motion was detectable. If the instrument be placed in a room at 15° C., in presence of a gas flame, there is rotation as usual; but if immersed in water at 45°, the rotation is reversed. Lippmann has given a very complete list of the theories which have been advanced to explain the motion of this instrument, the general conclusion being that the energy effective is heat.

Von Wartha has made a series of experiments on the influence of pressure on combustion. For pressures greater than that of the atmosphere, the experiments were made in the caisson of a bridge crossing the Danube at Buda-Pesth, the manometer there indicating 1.95 atmospheres. Six standard candles were burned for a definite time in the open air and then in the caisson, being weighed both before and after each experiment. The result showed the consumption, as a maximum, of 17.4 per cent. more combustible in air at the ordinary pressure. In a receiver exhausted to 90 mm. a candle burns with a scarcely visible flame, the cause of which the author believes to be the fact that as the pressure diminishes, the temperature of dissociation constantly increases.

Nipher has communicated to *Nature* some ingenious optical experiments, essentially physiological in character. Roll up a sheet of paper, look through it, with one eye focused on some object beyond. On placing the hand by the side of the distant end of the tube, it will seem as if the hand were perforated and the sides of the tube transparent. If a drop of ink be placed on the hand, it will appear in the inside of the tube, but the hand itself will be invisible. This tube arrangement, used with both eyes, is excellent for viewing complementary colors.

Some experiments have been made in Paris upon dividing the electric light, under the direction of M. Baron. A single Gramme machine has fed in this way not less than eighteen lamps, each of which gave a light equal to 100 gas jets.

Mouton has proposed a simplified method of determining the internal resistance of a battery without complicated apparatus and the sacrifice of much time. It gives the resistance in terms of that of a certain shunt wire introduced into the circuit.

Collard has published an extended research on the effect of lightning on trees, in which he

gives the results of investigations on poplars, oaks, elms, pears, firs, grape-vines, chestnuts, and walnuts. The conductivity of poplar, he observes, is such as to make it of service as a lightning-rod, and he recommends connecting the base of these and of other tall trees with permanently moist earth—if possible a water-course—by means of a metallic rod.

Wilson has contrived an ingenious method of attaching a mirror to a galvanometer needle so that the angular motion of the beam of light reflected from it shall be the same as that of the needle. For this purpose the light passes vertically upward to the mirror, which is fastened directly below the needle, and at an angle of 45° to its plane of oscillation.

In *Chemistry*, Wright has continued his studies upon the gases contained in meteorites, and now gives the results of his examination of the Kold Bokkeveld meteorite, which, though stony, contains considerable carbon and some bituminous matters. It yielded 25.23 volumes of gas, of which 93.11 per cent. was carbon dioxide, the remainder being carbon monoxide, marsh gas, hydrogen, and nitrogen, the two latter in minute quantity. It also yielded ten per cent. of water, in which chlorine and sulphurous oxide were detected. The manner of occurrence of the gases within the meteorite is also discussed.

Berthelot has studied the thermic conditions attending the formation of ozone. He finds that in the production of one molecule of ozone from oxygen there is an absorption of 29.6 calories. Being therefore a body formed with the absorption of heat, its activity chemically is accounted for; it is a magazine of energy stored up under the influence of electricity.

Frankland has published a paper on water analysis, in which he examines the value of the albuminoid-ammonia process, and concludes that it is "entirely useless in the examination of waters for sanitary purposes." He claims, however, for the combustion process, that it is the only one which gives trustworthy information concerning the organic matter present, the only one which can determine the carbon, and the only one which shows the ratio of nitrogen and carbon.

Jacquemin has examined the methods proposed for the detection of fuchsin in wine, founded on its tinctorial power. As is well known, this substance is extensively used for this purpose. Pyroxylin and wool may be dyed directly in the wine, but to prove the presence of fuchsin finally, the ammonia process is necessary.

Hesse has communicated a preliminary note, in which he says he has found in a rare cusco bark an alkaloid which appears to agree with the cusconine of Leverkusohn, and to be closely allied to the aricine of Howard.

Glenard has investigated the alkaloid of ipecacuanha, emetine. It was obtained in small hemispherical warty crystalline masses, which, on purification, gave milk-white crystals. From the analysis of the alkaloid itself and of its chlorhydrate, the formula $C_{15}H_{22}NO_2$ is assigned to it.

Brunner and Brandenburg have succeeded in detecting succinic acid in the juice of unripe grapes. They were led to examine for it by the fact that nascent hydrogen, acting on ethyl oxalate, produced tartaric acid and glycolic acid. The same reduction process the authors believe, therefore, to go on in the plant.

Microscopy.—At the recent meeting of the American Association for the Advancement of Science, a permanent sub-section of Microscopy was organized. Dr. R. H. Ward, of Troy, who has taken special interest in effecting this object, was appointed chairman. Several interesting papers were read and discussed by Professor E. W. Morley, Dr. Leo C. Mees, Professor H. L. Smith, and others; and at an informal meeting, the Spencers—father and son—exhibited their recent improvements in objectives and stands. Mr. Gundlach was also present with his excellent work.

We can but briefly notice Mr. Worthington Smith's interesting paper on the resting spores of the potato-disease fungus, which is copied from the "Gardener's Chronicle" in the August number of *Hardwicke's Science Gossip*. These spores, found last July in diseased potatoes, after nearly a whole year's rest, germinated and reproduced the fungus which causes the potato disease, effectually disposing of De Bary's unfriendly criticism, that the resting spores observed and figured by Mr. Smith belonged to any thing except *Peronospora infestans*.

In the *Quarterly Journal of Microscopical Science* for July, Mr. F. Jeffrey Bell gives an account of recent researches in the history of the Bacteria made by and under direction of Professor Colin.

In the May number of the *Journal of the Quekett Club* is the description of a new *Aulacodiscus*, by A. Cottam, F.R.A.S. It is unquestionably a variety of the well-known *A. kittonii*, and only remarkable for the locality—Banana Creek, Congo River, West Africa—and for the great purity and abundance of a gathering of what has been hitherto a somewhat rare diatom.

Dr. Bastian has recently read before the Royal Society a paper giving an account of some further researches "illustrative of the physico-chemical theory of fermentation, and the condition favoring archeobiosis in previously boiled liquids," summing up as follows: The experiments show, as others have done, that an exclusive germ theory of fermentation is untenable, and that living matter may and does originate independently during the progress of fermentation in previously germless fluids; insoluble products reveal themselves as specks of protoplasm, "living" matter, emerging gradually into the region of the visible, and speedily assuming the well-known forms of one or other variety of Bacteria, thus bridging, as he conceives, the narrow gulf between certain kinds of "living" and "dead" matter, and affording the long-sought-for illustration of the transition from chemical to so-called "vital" combinations!

At a recent meeting of the Linnæan Society, Mr. Francis Darwin read an account of some microscopic researches on the glandular bodies on *Acacia sphaerocephala* and *Cecropia peltata*, serving as food for ants, and first mentioned by Mr. Belt in his *Naturalist in Nicaragua*. In *Acacia* were two kinds of glands—(a) nectar-secreting glands at base of the petiole; (b) small, flattened, pear-shaped bodies, which tip six or seven of the lowermost leaflets of the bipinnate leaves. In *Cecropia* cylindrical bodies are developed in flat cushions at the base of the leaf-stalk. The structures are homologous in kind—cellular protoplasm, and containing oil globules, stores of nutriment which undoubtedly the ants live on,

and in their turn protect the trees from the ravages of the leaf-cutting ants.

Anthropology.—In *Revue Scientifique* for July 15, M. Paul Bert discusses the question of the relation of atmospheric pressure to living beings. The same subject, under the title, "The Influence of Vertical Position on the Earth's Surface upon Human Settlements," is exhaustively treated in Nos. 1 and 2 of the *Mittheilungen der Anthropologischen Gesellschaft in Wien*, for 1876.

Nos. 6 and 7 of *Matériaux* contain archaeological articles upon stations in Sweden, Russia, France, and Italy. M. Mortillet gives a table of the stations, grottoes, and dolmens in the different departments of France.

In a pamphlet published by the Société de Géographie de Lyon, M. Émile Guimet discusses the origin of the ancient Mexicans. The author combats certain theories of the relation of art forms in Mexico to those existing in Egypt, and argues strenuously their Asiatic origin.

The first quarterly part of *Archiv für Anthropologie*, in addition to the usual amount of reviews and descriptions purely local, contains the following articles of interest to the general student: Upon the Leveling of the Human Skull, Dr. Schmidt; Upon the Influence of Cranial Deformity upon Volume, Position, and Shape of the Brain, A. Ecker; Have we found in the Interglacial Strata of Switzerland veritable Traces of Human Beings, or only the Work of Beavers? J. Steenstrup; The Wetzikon Sticks, A. Von Frautzius.

In the Transactions of the Royal Academy of Berlin for 1875, Virchow has a very able article, fully illustrated with tables and plates, upon some remarkable low races of men as regards the skull.

Mr. Hyde Clarke contributes to the *Athenæum* for August 5 a short communication upon the prehistoric names for man and monkey. He does not tell us the bearing of his investigation upon the doctrine of descent.

The subject of anthropology was quite well represented at the American Association, held in Buffalo, August 23. Mr. Lewis H. Morgan was chairman of the sub-section, and Mr. Otis T. Mason secretary. Papers covering a wide field of research were read by Messrs. E. A. Barber, Alessandro Castellani, Isaac B. Choate, Henry Gillman, Otis T. Mason, Lewis H. Morgan, S. L. Peet, G. H. Perkins, Major J. W. Powell, Daniel Wilson, and E. H. Von Baumhauer.

In *Nature*, for August 10, Rev. A. H. Sayce reviews Hovelacque's work, entitled *La Linguistique*, in which the author discusses language upon a purely physiological basis. The learned reviewer takes the ground that the mind gives forms to words quite as often as it receives them.

Richard Andree publishes in the *Mittheilungen der Anthropologischen Gesellschaft*, 1876, Nos. 1 and 2, an article upon Lucky Days, Lucky Meetings and Auspices. In the same numbers will be found prehistoric notices of Dalmatia. Among the objects described is an antique wagon, which is also figured. It is built of wood entirely, not a particle of metal of any kind being used in its construction.

Professor Paoli Mantegazza contributes to the first part of the Italian archives for anthropology and ethnology an article upon the expression of grief. The author observes and classifies the movements of the face and other parts of the body which accompany the expression of grief.

Mr. Alfred W. Howitt, writing from Baunsdale Victoria, to *Nature*, gives an account of the boomerang, founded upon personal observation. There are two kinds of the weapon. The straight variety is by far the more effective. The crooked boomerang, with which we are better familiar, is not the weapon we have been taught to believe. It does not return to the thrower's hand. It can not be thrown with precision. If it strikes an object, it falls perpendicularly. If it grazes a twig, or such slight object, it changes its plane of flight.

Zoology.—The advance in zoology is well sustained in publications received the past few weeks. First, we have additional discoveries regarding the nature of monads, by the Russian naturalist Cienkowski. These organisms are on the border-land of the plant world, and in some cases form protoplasmic nets (plasmodia), like the plant *Mycomyces*. These plasmodia have the function of falling apart into amœba-like forms, which have hitherto been regarded as independent animal organisms; hence he thinks that many amœbæ do not represent independent forms, but belong to the developmental cycle of other and plant-like organisms. Among the monads, Cienkowski, according to a German correspondent of *Nature*, has observed forms in various stages of encystment, self-division, and formation of colonies. But the most remarkable series of changes was observed in *Diplophrys stercorea*, an extremely small cell-like organism with a yellow spot, and pseudopodia at two opposite ends of the body. These little bodies, observed in moist horse-dung, multiply by division, and form, by union of the pseudopodia, long strings in which separate individuals can glide to and fro. "Thus the boundary lines which it has so long been usual to draw between plant and animal organisms, and between the individual groups of those lowest forms of life, appear more and more illusory, and the supposition is recommended of a common lowest kingdom of organisms, that of Protista (Haeckel), out of which animals and plants have by degrees been differentiated."

Professor Loven, of Stockholm, has just published in the Transactions of the Swedish Academy an elaborate work, in quarto, on the sea-urchins (echinoids), which is illustrated by an atlas of fifty-three plates. The work is mostly taken up with an account of the hard parts forming the shell of the *echinus*, but also contains an account of certain bodies called *sphaeridia*, and an elaborate drawing and explanation of the nervous and water-vascular systems of *Brissopsis lyrifera*, greatly advancing our knowledge of the anatomy of these animals.

In an essay on the pliocene fresh-water shells of Southern Austria, by Dr. Neumayr and Herr Paul, the authors describe numerous modifications of the genus *Vivipara*, or *Paludina*, which occur in prodigious abundance throughout the whole series of fresh-water strata. Of this genus there are forty distinct forms (Dr. Neumayr very properly hesitates to call them all species), which are named and described in this monograph, and between which, as the authors show, many connecting links, clearly illustrating the mode of derivation of the newer from the older types, have been detected. The authors, remarks Mr. J. W. Judd, in *Nature*, have demonstrated that the species with highly complicated ornamentation were variously derived by descent—the lines

of which are in most cases perfectly clear and obvious—from the simple and unornamented *Vivipara achatinoides* of the Congerien-schichten, which underlies the Paludina beds. Some of these forms have been regarded as types of a distinct genus (*Tulotoma*) by Sandberger. "And hence we are led to the conclusion that a vast number of forms certainly exhibiting specific distinctions, and, according to some naturalists, differences even entitled to be regarded as of generic value, have all a common ancestry."

The mites and spiders of Kerguelen Island have been described and figured by Rev. O. P. Cambridge in the Proceedings of the Zoological Society of London. A new "order" is proposed for a certain mite, but it is doubtful whether it is the type of a higher division than a family.

The anatomy and histology of the aphides and bark lice form the subject of an inaugural dissertation for the degree of Ph.D. in the University of Leipzig, by E. L. Mack, of Hamlet, New York.

A synopsis of the two-winged gall-flies (*Cecidomyiidae*), by Messrs. Bergenstamm and Löw, of Vienna, appears in the Transactions of the Zoological and Botanical Society of Vienna. It seems from the numerous citations of German writers that the Hessian fly is common in various parts of Europe, and is probably indigenous.

The second part of Mr. A. R. Grote's check list of the Noctuidæ of America north of Mexico has appeared, and will prove of much use to entomologists in arranging their collections.

Ascending to the vertebrates, we have in the Proceedings of the Zoological Society of London an elaborate essay on the strange fish of Australia, *Ceratodus*, by Professor Huxley, in which he dwells on some points in the morphology of the limbs of vertebrates and of the classification of the fishes. He finds, with Gegenbaur, that the fin of *Ceratodus* presents the nearest known approximation to the fundamental form of vertebrate limb, though he differs from Gegenbaur in many respects as to the application of his theory of limbs to the higher vertebrates.

An important work by Dr. C. F. Lütken, on the fresh-water fishes of Brazil, appears in the Memoirs of the Royal Academy of Science, of Copenhagen. A number of new genera and species are described from collections made by Professor J. Reinhardt, and illustrated by wood-cuts and exquisitely drawn plates.

The lizards of the Galapagos Islands have been described by Dr. Steindachner, and particular attention paid to the large iguana-like forms, three or four feet in length, which characterize these islands. The plates are beautifully drawn by Konopicki. This and other memoirs, such as one by Brunner von Wattenwyl on the morphology of the segments of the body (chiefly of the abdomen), and an article on the geographical distribution of the mammals of Malay, illustrated with a map, appear in a ponderous quarto volume, an intellectual monument of the twenty-fifth anniversary of the foundation of the Zoological and Botanical Society of Vienna. This is a most sensible way, now the fashion in Germany, of celebrating the anniversaries of learned societies.

Botany.—An important contribution to the botany of the United States has just appeared in the reports of the California Geological Survey. The present volume contains the Polypetalæ, by Professor W. H. Brewer and Mr. Sereno Watson,

and the Gamopetalæ by Professor Asa Gray. The typography and general appearance of the volume are excellent, and the above-mentioned names are guarantees of its scientific excellence. A monograph of the oaks of the United States, by Dr. George Engelmann, published in the Transactions of the Academy of Science of St. Louis, gives the results of the author's large experience with the species of this difficult and hitherto somewhat confused genus. Leaving out of consideration the somewhat anomalous *Quercus densiflora* of California, the oaks are divided into two groups, black oaks and white oaks, of which a brief analysis is given by the author. A valuable portion of Dr. Engelmann's paper is that relating to hybrid oaks.

In the *Annales des Sciences*, M. Contejean gives some remarks on the influence of the soil on vegetation. He considers that the chemical nature of the soil has much more to do with the distribution of plants than its physical character alone. He divides plants into *maritime* and *terrestrial*. The latter he divides into *calcicoles*, which prefer a calcareous soil, *calcifuges*, which avoid it, and those which are *indifferent* to the calcareous element. Each of these three groups he divides into *xerophiles*, which prefer dryness, and *hygrophiles*, which prefer moist soils. Reports from different parts of France seem to confirm M. Contejean's view of the predominant influence of the chemical nature of the soil. In the same journal is an article on the internal glands of leaves, by M. Chatin, and an interesting biography of the late Gustave Thuret, by Dr. Bornet.

In the London *Journal of Botany* an account is given by Hance of a grass described as a new species, under the name of *Stipa inebrians*, which has an intoxicating effect upon the cattle in Mongolia.

The later numbers of the *Botanische Zeitung* are almost entirely filled with an account, by Dr. Ernst Reuther, of the development of flowers. The orders which are more especially used for illustration are the Cucurbitaceæ and Plumbaginaceæ.

Agriculture.—Fremy and Deherain have conducted a series of experiments to test the reasons of the decrease of richness of sugar-beets grown several years in succession on the same soil. They find two chief causes of the deterioration—the bad selection of stock or variety, and excess of nitrogenous manures. They conclude that argillaceous, siliceous, and calcareous soils differ but little in their effects upon the sugar in beets. A sterile soil, with no other manure than phosphate of lime and nitrate of potash, was able to produce normal roots weighing 700–800 grams ($1\frac{1}{2}$ – $1\frac{3}{4}$ pounds), and containing a large amount of sugar (16 per cent.). Excess of nitrogenous manures injured the formation of sugar.

The outlook for the sugar-beet industry in this country seems to be quite promising. It has already attained great importance in California, is reported as successful in Illinois, and is engaging earnest attention in Maine. The Governor of the latter State devoted considerable attention to the matter in his last message to the Legislature, and a company near Portland has already begun a thorough investigation of the probabilities of successful sugar-beet culture in that State.

Boehm gives, in the *Berichte der Deutschen Chemischen Gesellschaft*, accounts of experiments

on the formation of starch in the chlorophyll granules, in leaves of scarlet-runner beans, and cotyledons of cress, radish, and flax. He concludes that the view commonly held—that all starch which appears in the chlorophyll grains free from starch when they are exposed to light is a product of direct assimilation of carbonic acid—is wrong; that it may come from transfer of starch from other regions, or from transformation of pre-existent nutritious matter.

Boehm concludes further that young plants do not take up from the soil either organic compounds or carbonic acid. He considers it not improbable that the carbon of the carbonic acid decomposed by plants unites directly with water to form starch.

Fremy and Deherain have made in the experiments alluded to above some interesting observations on the growth of beets in solutions of the ingredients of plant food. A solution containing one grain each of chloride of ammonium, superphosphate of lime, and chloride of potassium in 1000 c. c. of water was applied in varying quantities to fifty liters of sand (in earthen pots) in which a single beet was grown; 100 c. c. of the solution daily proved insufficient, 500 c. c. gave satisfactory results, while 1000 c. c. proved too much. Beets grown in saline solutions, instead of sand moistened with the same, lived, but instead of producing one large central sugar-forming root, they simply formed a mass of nearly equal rootlets.

Engineering, etc.—The Chesapeake and Ohio Canal Company has completed its new outlet locks from the canal to the Potomac. The method of operating this outlet is quite novel. The elevation to be overcome is forty feet, which, under the old system, would require eight locks and about fifty minutes to pass a boat through. With the present arrangement, the boat is passed directly from the canal into a large caisson filled with water; the caisson, resting on trucks, is run down an inclined plane to the river in less than six minutes. The weight of caisson and boat is about 350 tons.

A company has been formed to construct a pontoon railway and wagon bridge across the Mississippi at Clinton, Iowa.

Appropos of the question of under-ground telegraph lines, which is now being agitated in this country, it may be of interest to record, on the authority of C. Bontemps, that the total length of under-ground lines in Paris is 116 miles. Of this total, 35½ miles are laid in trenches, and 80½ in the sewers.

The Colombian government has made a contract with M. Gogorza for the survey of a route for an interoceanic canal by way of the rivers Atrato and Tuysa. The work of survey will be shortly undertaken. Commenting upon this statement, Mr. John C. Trautwine, the engineer of the Panama Railroad, and an eminent authority upon all engineering matters pertaining to the American isthmus, has no hesitation in predicting that the survey will result in disappointment. In a recent article on the Darien interoceanic ship-canal the same authority estimates the cost of a canal upon this route, with two tide locks, at about \$300,000,000, or about three times the cost of the Suez Canal.

Measures have been taken for the laying down of a second telegraphic cable between Australia and Europe.

The electric light has been introduced into several Belgian collieries.

Pieper's method of hardening glass, by submitting it, while at a red heat, to the action of superheated steam, is very favorably spoken of.

Reichardtite, a new mineral, having the same constitution as Epsom salt, has been found in the Stassfurt potash mines.

It is estimated that the value of the diamonds found at the Cape, from the opening of the mines to December 31, 1875, exceeds twelve millions of pounds sterling.

A new coal-cutting machine has lately been put to work in a mine at New Straitsville, Ohio. The machine is the invention of Mr. Litchner. It is claimed for this machine that three men can "bear in" and drill the holes for a blast that would require the work of four men for a whole day; or, to put it differently, three men and the machine can do as much as thirty miners can in a given time.

The number of tanks in the oil region employed for the storage of crude petroleum is placed by Mr. Henry E. Ungley, of Titusville, at 370, and their aggregate capacity 6,077,225 barrels. The largest tank is owned by Lockhart and Frew, at Pittsburg, the capacity of which is 43,000 barrels. There are no less than 133 tanks, holding from 20,000 barrels upward, and the average capacity of the whole tankage is 16,425 barrels.

The Lowe water-gas process has been introduced during the past month at Manayunk, a suburb of Philadelphia, and the town in question, as well as a number of surrounding villages, is lighted from the new works exclusively. The operation of the Manayunk plant has thus far been quite satisfactory.

Editor's Historical Record.

POLITICAL.

OUR Record is closed on the 25th of September.

The September elections in Vermont (on the 5th) and in Maine (on the 11th) resulted in the choice of the Republican candidates by majorities nearly equal to those of 1872, the last Presidential year. In Vermont, Mr. Fairbanks received a majority of nearly 24,000, in a total vote of over 65,000. In 1872 the Republican majority in that State was 25,333, in a total vote of 58,559. In

Maine, Mr. Connor's plurality over Mr. Talbot was 15,459, in a total vote of 136,490. In 1872 the Republican majority in that State was 17,216, in a total vote of 126,618.

The State election in Arkansas resulted in an overwhelming Democratic majority.

Arkansas, New Jersey, Connecticut, Missouri, and Indiana have already in the field an electoral ticket for the Greenback Presidential candidate.

The Colorado Republican State Convention, at