The next two chapters refer to functions which are discontinuous along a line, — Appell's and Tannery's series, and Poincarré's example of a function having an *espace lacunaire*. As preliminary to Cauchy's theorem concerning the number of roots of a polynomial contained in the interior of a contour, the expression is given by a line-integral of roots of an equation contained within a given contour. Then follows Cauchy's theorem, the establishment of Lagrange's series, Eisenstein's theorem upon series whose co-efficients are commensurable, and which satisfy an algebraical equation, and the enunciation of Tchebychef's theorem upon series with rational co-efficients, which may represent functions composed of algebraic, logarithmic, and exponential functions.

The next chapter treats of multiform functions arising from the integration of uniform and of multiform functions, and of the means of reducing them to uniform functions by systems of cuts (*coupures*).

The remaining five chapters treat entirely of the doubly-periodic functions. After first showing the multiple values of the elliptic integrals of the first kind which correspond to the different paths traced out by the variable, and establishing the double periodicity of the inverse functions to this integral, he defines a function, $\Phi(x)$, which conducts to the analytical expressions for the doubly-periodic functions. The function $\Phi(x)$ is defined by the equations, —

$$\Phi(x + a) = \Phi(x)$$

$$\Phi(x + b) = \Phi(x) \exp.\left[-\frac{ki\pi b}{a}(2x + b)\right],$$

where k is an integer. Then follows the investigation of the elliptic functions, including, of course, Jacobi's Θ, H, and Z functions, the definition of Weierstrass's functions, Appell's expression for doubly-periodic uniform functions in the case where they possess essential singular points, and, finally, a demonstration by M. Goursat of Fuch's theorem concerning the definite integrals K and K', considered as functions of the modulus.

It is perhaps to be somewhat regretted that the book is lithographed instead of printed in the usual manner; but this is of comparatively little consequence, as the writing is very clear and legible. Thanks are certainly due to M. Andoyer, the editor, for the trouble which he must have taken in elaborating what would seem to have been merely a set of notes on M. Hermite's lectures. The whole matter has been revised by M. Hermite, and the aggregate result of his and M. Andoyer's labors is a book which is a decided acquisition to mathematical literature. It is to be hoped that M. Hermite will see fit to go more fully into the subject of the functions of a complex variable, and that of elliptic functions, at a future time, and give to the world a treatise which will be more satisfactory than even the present very valuable work. T. CRAIG.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

New measures of Saturn's rings. — O. Struve gives the results of a series of measurements of the rings of Saturn at Pulkowa during August and September, 1882, compared with a similar series, also taken by himself, with the same instrument, and at the same time of the year in 1851. In a memoir on the subject in 1851, he seeks to prove, that, while the outer diameter of the rings remains constant, the inner is continually shortening, basing his conclusions on the observations and drawings from Huygens's time. If the conclusion were correct, and the contraction constant, the measures of 1882 should have given a perceptibly shorter inner diameter than those of 1851. The inner diameter of the dark ring seems to be slightly shorter than in 1851, but the difference is not nearly so large as the theory calls for. The dark ring seems, however, to have changed since 1851. Then it seemed divided by a dark streak, the inner part being entirely separate from the bright ring. In 1882, all trace of this division had disappeared, and the dark ring seemed to be merely a faint continuation of the bright ring. — (*Astr. nachr.*, No. 2498.) M. MCN. [688

Formation of the tails of comets. — Mr. Rumford suggests that the repulsive force which is unmistakably manifested in the formation of comets' tails may be due, not to any electric action, or any imagined impulse of solar radiations, but merely to evaporation. A small particle from which evaporation is taking place on the side next the sun will be driven backward with a velocity continually accelerated; and, when more than half of the mass of the particle has been evaporated, the velocity of the residue may be much greater than the average velocity with which the gaseous molecules are driven off from the heated body. In the case of hydrogen at a temperature of 70° or 80° F., the velocity thus acquired might be greater than a hundred thousand miles a day. If we suppose the evaporating material to be gases which have been liquefied by the cold of space (carbon dioxide and volatile hydrocarbons), it becomes easy to account for a powerful repulsive action at distances from the sun even much greater than that of the earth. The writer suggests that the comet's light may be in part due to the 'bombardment' of precipitated particles by the evaporated molecules in the condition called by Crookes 'the fourth state of matter'; so that, "without electrical discharges,

the whole phenomena of the continuous and bright line spectrum in the neighborhood of the nucleus may be accounted for." He also discusses briefly some of the polarization phenomena of comets, and the envelopes which appear near the nucleus. The article is a very interesting and suggestive one; but in view of the fact that comets' tails sometimes grow, not a hundred thousand, but more than a million miles a day, it is doubtful whether the proposed hypothesis can be regarded as sufficient. — (*Astr. reg.*, March.) C. A. Y. [689

GEODESY.

Altitude of Lake Constance. — Part of the work laid out by the European geodetic commission consists in carrying an accurate series of levels across the country, and a share of this has recently been completed by the royal Prussian geodetic institute. It is published as the *Gradmessungs-nivellement zwischen Swinemünde und Konstanz*, by W. Seibt (Berlin, 1882), and records the altitudes of a large number of points from the Baltic, where the datum plane is the mean water-level from fifty-four years' observations, to Lake Constance, where connection is made with the Swiss triangulation. The railway station in Constance is 399.990 met. above the Baltic. — (*Verh. ges. f. erdk.*, Berlin, 1882, 514, 538.) W. M. D. [690

MATHEMATICS.

Symmetric functions. — Previous mention has been made of Mr. Durfee's tables for the twelfthic. By a curious coincidence, M. Rehorovsky of Prague has, almost simultaneously with Mr. Durfee, computed the same tables. M. Rehorovsky's tables differ from those of Mr. Durfee only in arrangement. The tables as arranged by the former are identical in form with those given by Prof. Cayley for the first ten orders in the *Phil. trans.*, vol. 147; while those of Mr. Durfee are arranged symmetrically, and cannot be included in a half-square, as M. Rehorovsky's are. — (*Sitzungsb. akad. wissensch. Wien*, 1882.) T. C. [691

Maximum value of a determinant. — The elements of a determinant being restricted to lie between $(-a)$ and $(+a)$, Mr. Davis finds, that, for all determinants whose order is greater than 2, a numerical maximum is found by making all the elements of the principal diagonal $= -a$, and all the remaining elements of the determinant $= +a$. In the maximum cubic determinant $D_n^{(3)}\, a^n$, all of the strata are made identical, and equal to $D_n^{(2)}$. The value of this determinant is $\pm\, n!\ D_n^{(2)}\, a^n$. Formulae are also given for hyperspace determinants. — (*Johns Hopk. univ. circ.*, No. 20.) T. C. [692

Functions of several variables. — M. Combescure seeks to develop completely the immediate conditions to be satisfied by an analytic function of several imaginary variables. Assuming $z_1, z_2 \ldots z_n$ as the variables, these are defined by the equations $z_j = x_j + iy_j$, where $j = 1, 2 \ldots n$. Then the function to be considered is $F(z_1, z_2 \ldots z_n) = \phi + i\psi$. The differential co-efficients of ϕ and ψ of the first order are connected by relations precisely similar to those connecting these quantities when there is only one variable, z: so, when one of the functions ϕ or ψ is given, the other may be found by simple quadratures. It is shown that the group of conditions for the determination of ϕ reduces itself to the $\frac{n(n+1)}{2}$ partial differential equations of the second order, $\Delta_{h,k}\,\phi = 0$, where

$$\Delta_{h,k} = \frac{d^2}{dx_h\, dx_k} + \frac{d^2}{dy_h\, dy_k},$$

for $h, k = 1, 2 \ldots n$, and, of course, including the cases where $h = k$. These are the necessary and sufficient conditions to be satisfied by ϕ. A means is given of representing ϕ analytically by an exponential series, the co-efficients of which depend upon the sines and cosines of $(a_1 x_1 + \ldots + a_n x_n)$ and $(\beta_1 y_1 + \ldots + \beta_n y_n)$; $a\ \beta$, as well as the constant co-efficients of these sines and cosines, being indeterminate real quantities, to which we can give any values we please. — (*Comptes rendus*, Jan. 22.) T. C. [693

Homologies and conics. — If L and M are two fixed points on a conic, K, and P a variable point, then P H, perpendicular to L M, cuts again the circle L M P in a point, H, which describes a conic, K′. If the circle on L M as diameter cuts K again in E F, then L M and E F are the axes, and the point at infinity in the direction P H is the common centre of two of the twelve homologies which two conics in general determine. The ratio of corresponding areas of K and K′ is constant, — a function of the eccentricity of K and of the inclination of L M to the focal axis of K. Given, on the other hand, the centre and axes of the homology, two triply infinite systems of conics, K and K′, can be determined; the conics of each system being similar and similarly placed, and the common points at infinity of one system being orthogonal to those of the other. All the conics of the plane are thus distributed into a doubly infinite number of triply infinite systems. The net of conics determined by three arbitrary points in a plane will give a doubly infinite number of conics, one out of each system, and hence will produce all the homologies of the plane, and each once only. There is therefore a (2,1) correspondence between the doubly pointed plane and the plane of the homologies. The discussion of these points by Luigi Certo is followed by an investigation of the variation of the ratio of corresponding areas, first, with the variation of the eccentricity, and, second, with the variation of the direction of the line L M. He also considers the distribution in the plane of the pairs of similar conics of which the system of conics through four points on a circle is composed. — (*Giorn. mat.*, XX.) C. L. F. [694

PHYSICS.

Optics.

Color of water. — W. Spring reviews the several explanations suggested to account for blue and greenish colors of water in lakes and seas, — Bunsen's idea of inherent color, Tyndall's theory of reflection, and others, — and concludes that some further study of the question is needed. Blue from reflection would imply red by transmission, but this is not observed from diving-bells. The author concludes provisionally that the color depends on the presence of certain salts, especially calcic carbonate in solution. The more complete the solution, the bluer the water. — (*Rev. scient.*, 1883, 161.) W. M. D. [695

(*Photometry.*)

Spectrum photometry. — MM. J. M. de Lépinay and W. Nicati have recently completed an investigation of the relative brilliancy of white surfaces when illuminated by different colored lights and by different portions of the same spectrum. In the preliminary experiments, two lights were employed, — a yellow and a blue one, — the blue light being the fainter. Their intensity was compared by means of a Rumford photometer, casting very small shadows.

Two experiments were tried. In the first, the yellow light remained stationary, and the blue one was moved towards the screen till equality of the shadows was obtained. In the second experiment, the blue light was left in its first position, and the yellow one moved away from the screen till the shadows were equal. On comparing the results obtained, it was found that they differed materially from one another. In another experiment the two shadows were cast so that when the eye was in a certain position they appeared of equal brilliancy. On approaching the screen, the blue shadow was found to appear more brightly lighted than the other; and, on going away from the screen, the reverse effect was observed. To further investigate these results, two methods of measurement were employed: 1. The intensity of the light corresponding to the different wave-lengths of the spectrum was determined by means of a Rumford photometer, as above described; 2. A small figure consisting of three short, broad, black lines, drawn on a white surface, was placed in different portions of the spectrum, and the intensity of the light increased or diminished until its outlines were just distinguishable.

It was found that the results obtained by the two methods agreed almost exactly for the less refrangible portion of the spectrum, as far as wave-length 517; but beyond that point the differences suddenly became very marked; and it was shown that a blue light had to be many times brighter than a yellow one in order to distinguish the same details by its aid; also, that the brighter the lights were, the more marked did this difference become.

Now, for purposes of artificial lighting, whether public or private, the end desired is less to produce a luminous sensation upon the eyes than to enable us to distinguish the objects around us. It is therefore concluded, that, for lights of equal brilliancy, the superiority of yellow sources (such as gas-flames and incandescent electric lamps) to sources richer in the blue rays, as the arc light, is beyond question. — (*Journ. phys.*, Feb.) W. H. P. [696

Electricity.

Transmission of power. — Experiments relating to the electrical transmission of power were made on the 4th of March last, in Paris, at the *Chemin de fer du Nord*, before a commission of the French institute, composed of MM. Bertrand, Cornu, Tresca, de Lesseps, and de Freycinet. The resistance of the line was 160 ohms, — a resistance equivalent to that offered by a copper wire 106 kilometres in length, and 4 mm. in cross-section. The power applied to the generating-machine was equivalent to 4.4 horse-power; and the rotation of the generating armature was varied from 380 to 1,024 revolutions per minute in order to ascertain the effect of speed of rotation upon the mechanical return at the other end of the line. As the general result of the experiments, '*La Lumière électrique*' announces that the available power transmitted was 47.5% of that which actuated the generating-machine. — (*La Lum. électr.*, March 17.) A. G. B. [697

ENGINEERING.

Steel for structures. — Mr. Ewing Matheson discusses at considerable length the important question of the modern use of steel for engineering-works. The author commences by stating the following propositions: 1. Rolled plates and bars of the various forms required for structures are now made of steel with as much certainty, in regard to quality, as iron of the first class; 2. Advantages in regard to size and weight of pieces can be obtained in steel, which in iron are either impossible, or can only be had at very great expense; 3. Steel has a superiority in strength, ranging from once and a half to twice that of iron, and at the same time a more than proportionate superiority in ductility and elasticity; 4. Steel can be bent, straightened, cut, punched, planed, and drilled with the same tools and processes that are used for iron, and, for the most part, without extra force; 5. Protection against rust is of more importance for steel than for iron, but, if treated in the same way as is usual with iron, steel is less liable to waste by rust; 6. Owing to the above advantages, structures of steel are superior to those of iron, but economically it is only in some cases in regard to ships, and in still fewer cases in regard to bridges, that there is at present any pecuniary advantage in using steel; 7. This limit to the application of steel is due partly to official rules, which restrict the working-strains on steel, and partly to exigencies of design, which hinder the reduction in size and weight of members to the extent which its superior strength might otherwise allow; 8. Although, for the above reasons, steel structures may cost more than iron without any immediate compensation, yet, if measured by actual units of strength and durability, steel is cheaper as well as better for all but very small structures; 9. The employment of steel may be encouraged and extended by a fuller knowledge, among those who use it, of its qualities, by facilities for verifying these qualities by exercising a wider choice of the kind of steel suited to the purpose in view, and by such a liberal alteration of the present official rules as will allow fuller advantage to be taken of steel than is usual or permitted at present. The simplicity of manufacture, as compared with that of rolled iron, renders almost certain a nearer approximation in cost, if, by a wider permission, the demand for steel should increase. Each of the above points is taken up in detail and carefully considered, the admiralty specifications for steel plates for ships are given, the question of steel riveting is examined, the important matter of rust is discussed, and an extended comparison is made between the weight and cost of iron and steel for bridges. The whole paper is of great value, and well worth careful study. — (*Proc. inst. civ. eng.*) G. L. V. [698

Recent hydraulic experiments. — At a meeting of the Institution of civil engineers held in London Nov. 14, 1882, Major Allan Cunningham gave an account of an extensive course of experiments on the flow of water in the Ganges canal, extending over four years (1874–1879), the principal object being to find a good mode of discharge measurement for large canals, and to test existing formulae. Not less than fifty thousand measurements for velocity were made, and six hundred for surface slope, while five hundred and eighty-one cubic discharges were measured under very varied conditions. Forty measurements of evaporation from the canal surface were made in a floating pan, during twenty-five months. The results showed the movement of water in such a canal to be in many respects quite different from those before reported. — (*Engineering*, Nov. 17, 1882.) G. L. V. [699

Railroad accidents, and the earth's rotation. — R. Randolph shows that the deflective force arising from the earth's rotation is entirely too small to determine derailments, and also, that, as an excess of right-handed derailments has been credited solely to north and south tracks, this proves it to be wholly imaginary; for the deflective force at any latitude is the same for all directions (*Van Nostrand's engin. mag.*, 1883, 117). The numerical results given are but half

their true value, as two elements of the deflective force are omitted (SCIENCE, p. 98); but this does not affect the author's conclusions, as the deflective force is still insignificant, and, for a fast train in this latitude, amounts to but about $\frac{1}{5000}$ of the weight. — W. M. D. [700

The type of modern marine engines. — Constructing-engineer Albrecht, of the Austrian navy, discusses the various forms of engines and boilers which have been proposed or used, gives data and indicator-diagrams for various ships, shows that the compound engine effects a saving of fifty-seven per cent over the simple, and pronounces the three-cylinder compound engine the most economical and best. — (*Mitth. gebiete seew.*, x. 9.) C. E. M. [701

Torpedo-nets. — Lieut. Sleeman, R.N., proposes to render torpedo-nettings useless as a protection for ships by sending one Lay torpedo after another, in the same path, at short intervals. The first breaches the net; the second passes the breach, and explodes against the ship. — (*Journ. de la flotte*, Feb. 18.) C. E. M. [702

Pendulum-chronograph. — Capt. Caspersen, of the Danish army, has devised a chronograph for ballistic purposes, which consists of a pendulum prolonged above its point of suspension so that it can be arrested at its extremities at will by levers connected with electro-magnets. A horizontal wire is fastened at the point of suspension, with its ends bent so as to dip in cups of mercury; and thus, when the pendulum is oscillating, the contact is made alternately on the two sides, and registered automatically on a dial. The instrument measures with precision the hundredth of a second. — (*Mitth. gebiete seew.*, x. 9.) C. E. M. [703

CHEMISTRY.

(*General, physical, and inorganic.*)

Conduct of moist phosphorus and air towards carbonic oxide. — In repeating the experiments of Leeds and of Baumann, Prof. Ira Remsen and E. H. Kaiser observed a copious precipitate on passing the mixed gases through barium hydrate. When, however, all contact of the gases with corks and connectors was prevented, there was no formation of barium carbonate. — (*Amer. chem. journ.*, iv. 454.) C. F. M. [704

White phosphorus. — A modification of phosphorus, quite different in its properties from the variety hitherto known as white phosphorus, was obtained by Remsen and Kaiser in the distillation of ordinary stick phosphorus. The distillation was conducted in an atmosphere of hydrogen, and the distillate collected in a receiver partly filled with water and ice. At the end of the distillation a thin white cake was found floating on the surface of the water. It dissolved readily in carbonic disulphide, melted at the same temperature as the common form, and, on melting, was transformed into the latter. It withstood the action of sunlight longer than ordinary phosphorus. — (*Amer. chem. journ.*, iv. 459.) C. F. M. [705

Specific heat and valence of thorium. — On further study of the metal thorium, L. F. Nillson finds that it is tetratomic, and that its atomic heat calculated from the mean of several determinations of the specific heat 0.02787 is 6.4. Analogous to silicon, it forms a fusible alloy with platinum ; and the composition of its chlorplatinate corresponds to those of tin and zirconium. — (*Berichte deutsch. chem. gesellsch.*, xvi. 153.) C. F. M. [706

Formation of arsenides by pressure. — When a mixture of zinc filings and arsenic in powder was subjected to a pressure of 6,500 atmospheres, W. Spring observed the formation of an arsenide (Zn_3As_2). Corresponding arsenides of lead (Pb_3As_2), cadmium (Cd_3As_2), and of copper (Cu_3As_2), were also prepared. Varying the proportions of copper, Cu_6As_2 and $Cu_{12}As_2$ were formed. Tin gave Sn_3As_4, and silver Ag_3As and Ag_6As, the latter a brittle mass of metallic lustre and gray color. — (*Berichte deutsch. chem. gesellsch.*, xvi. 324.) C. F. M. [707

Production of apatites and wagnerites containing calcium bromide. — When sodium bromide is heated to a temperature just above fusion, and calcium phosphate is added to it, A. Ditte states that well-developed hexagonal pyramids separate on cooling, which have the composition $CaBr_2 . 3(Ca_3(PO_4)_2)$. On heating calcium bromide and calcium phosphate together, a compound ($CaBr_2 . Ca_3(PO_4)_2$) corresponding to wagnerite crystallizes in long needles. If calcium arseniate is used, instead of the phosphate, in the preceding experiments, in the first case the compound $CaBr_2 . 3(Ca_3(AsO_4)_2)$ crystallizes in hexagonal pyramids, and, in the second case, $CaBr_2 . Ca_3(AsO_4)_2$ is formed. When vanadic acid is fused with sodium bromide and calcium bromide, the chief product is a bromo-vanadate, $CaBr_2 . 3(Ca_3(VO_4)_2)$. The corresponding wagnerite ($CaBr_2 . Ca(VO_4)_2$) results when the acid is fused with pure calcium bromide. Analogous compounds may be formed in which calcium is replaced by other metallic elements. — (*Comptes rendus*, xcvi. 575.) C. F. M. [708

The atomic weight of lanthanum. — Since the atomic weight of lanthanum was reduced by the results of Brauner to 138.28 from 139.15, the value formerly obtained by Cleve, the latter sought to verify or disprove Brauner's result by a more careful preparation of the material from which the atomic weight was determined. From 1.5 kilos. of the mixed oxides of cerium, thorium, lanthanum, and didymium, the first two elements were removed by treating the partially decomposed nitrates with water, and didymium by fractional precipitation with ammonium hydrate. The seventh fraction was converted into the sulphate, and submitted to fractional crystallization. The last mother-liquor contained 10 grms. of the sulphate, which, on analysis, gave 138.69 as the atomic weight. Since a trace of didymium could still be detected by the spectroscope, the fractional crystallization was continued until analysis showed a constant percentage of lanthanum. The mean of several determinations gave 138.22 as the atomic weight. Cleve seeks to explain the difference between his results and those of Brauner by the different methods employed to obtain pure material. He thinks, that, since Brauner depended upon a fractional crystallization of the oxalates, his product may have contained a trace of yttrium. — (*Bull. soc. chim.*, xxxix. 151.) C. F. M. [709

METALLURGY.

Silver-milling at Charleston, Arizona. — According to Mr. W. Lawrence Austin, the ore, as the mine was developed, gradually changed, and was found to carry wulfenite (molybdate of lead). The bullion resulting from milling this changed ore ran down to from 200 to 300 fine. The fineness was again restored to 970 by stamping much finer, and giving up altogether the grinding in the pans; departing from the usual custom of stamping, 35 mesh to the inch, and grinding, and also by the use of lime in cleaning the amalgam. Cerussite and galenite did not cause the same trouble as wulfenite. — (*Eng. min. journ.*, Jan. 27.) R. H. R. [710

Refractory bricks. — The waste liquors from manufacturing potash salts at Stassfurt and Leopoldshall, containing 27 to 30% of chloride of magnesium, are now saved. The evaporated salt is treated, at an elevated temperature, with highly superheated steam in an oxidizing flame; and nearly chemically pure magnesia and hydrochloric acid of 21° Baumè, are obtained. This magnesia is well adapted, not only for making the cement of oxychloride of magnesia, but also for making magnesia firebricks, now so much used. — (*Eng. min. journ.*, Feb. 24.) R. H. R. [711

Proposed modification in copper-smelting. — Paul Johnsson proposes to heat the 35 to 40% copper matte, derived from cupola or other furnace smelting, in a Siemens furnace, and to direct a blast of air upon the surface of the molten metal, in order to oxidize the impurities, and to bring the matte forward to blister copper in one operation of 12 hours. He estimates that 20 tons of matte could be treated in one furnace, with the labor of 10 men, in 24 hours; while, by the old method, 8 calciners, 4 reverberatory furnaces, and 40 men, would be required to do the same work. — (*Eng. min. journ.*, March 3.) R. H. R. [712

Bessemerizing matte in a reverberatory furnace. — H. M. Howe refers to the article of Paul Johnsson (*Eng. min journ.*, March 3), and claims that the credit of the process belongs to the Orford nickel and copper company, and not to Paul Johnsson. —(*Eng. min. journ.*, March 17.) R. H. R. [713

GEOLOGY.

Lithology.

Lithology of the Eisengebirge. — The rocks of the Eisengebirge of Bohemia are divided by Helmhacker into three groups, — crystalline schistose rocks, crystalline massive rocks, and clastic (fragmental) rocks. Under the first are described rocks classed as amphibole gneiss, gneissoid granulite, porphyroid, mica schist, and phyllite; under the second group are placed red granite, gray granite, gneissoid granite, syenite, granite porphyry, quartz porphyry, felsite porphyry, diorite, diorite aphanite, diabase, gabbro, uratite diorite, corsite, and troktolite; and of the last, a diorite-tuff-conglomerate only is described.

Under the name 'porphyroid,' a term well known in the early part of this century and previously, Helmhacker places rocks which resemble quartz and felsite porphyry, but have a schistose structure. They possess a felsitic groundmass and crystals arranged in more or less parallel layers. Phyllite is divided into staurolite, andalusite, and ottrelite phyllite, and fruchtschiefer and lydite. In the thin section, the first is seen to possess a groundmass composed of sericite plates, between which biotite scales and magnetite grains were lying. The staurolite lies porphyretically enclosed in this groundmass, and shows aggregate polarization. In the second, the groundmass is principally composed of biotite scales and magnetite or anthracite grains. The andalusite in the thicker sections is of a pale rose tint; in the thinner, colorless. The ottrelite schist or phyllite was formed by the contact metamorphosis of black argillite with granite. This formation of ottrelite schist, by the action of intrusive rocks, agrees with the present writer's observations on Lake Superior (*Bull. mus. comp. zoöl.*, vii. 45). The ottrelite or chlorotoid plates are surrounded by a very fine, granular, scaly groundmass, formed principally of a muscovite-like mineral, which polarizes brilliantly. The irregular polygonal ottrelite plates have a pale grayish-green color, and are plainly dichroic. They are homogeneous, and, excepting some dust-like grains of magnetite, are free from inclusions.

The term 'troktolite' is the equivalent of the more common one 'forellenstein'; and the diabase-tuff-conglomerate belongs to that class of rocks which the present writer named in a briefer way, in 1879, porodite (*l. c.*, v. 280). Our space forbids an adequate idea of an extended paper filled with details. — (*Arch. natur. landesdurchf. Böhmen*, 1882, v. 87.) M. E. W. [714

METEOROLOGY.

Winds on sea and on land. — Mr. Alexander Buchan has recently discussed the observations of the wind made by the Challenger during its cruise of three years and a half, ending with May, 1876. Observations of the force and direction of the wind were made on 1,202 days, at least 12 times each day. Of these, 650 were on the open sea, and 552 near land. The seas were the North and South Atlantic, North and South Pacific, and the Southern Ocean.

Mr. Buchan finds the diurnal range of the wind-velocity on the open sea very small, not varying more than 1 mile, on either side of 17.5 miles per hour, during the 24; while near land the range was very marked, being nearly 15 miles per hour at 2 P.M., and only a little over 11 from 9 P.M. to 8 A.M. This he explains from the fact that the daily range of surface-temperature, for example, on the North Atlantic, is only .7°; and hence over the ocean the atmosphere rests on a floor the temperature of which is all but constant day and night. On approaching the land, however, the daily range of the temperature of the air over the sea becomes materially augmented, and amounts to 4.3°; and we know, from all observations, that on the land the range is still greater. This shows that the phenomena of the daily range of wind-velocity is intimately associated with that of the surface-temperature. Mr. Buchan writes, "So far as concerns any direct influence on the air itself, considered apart from the floor or surface on which it rests, solar and terrestrial radiation do not exercise any influence in causing the diurnal increase of the wind-velocity with the increase of temperature." On nearing land, the wind is everywhere greatly reduced in force, the retardation being due chiefly to friction. The winds were found lightest over the North Pacific (14.5 miles per hour), and strongest over the Southern Ocean (23.5 miles per hour). — (*Nature*, March 1.) H. A. H. [715

Rainfall of New South Wales. — A valuable map by H. C. Russell, for 1881, shows a fall of forty to sixty inches at several points along the coast north and south of Sydney, and diminishing to twenty or even ten inches on the plains of the Darling River, some five hundred miles inland. — (*Journ. roy. soc. N. S. Wales*, xv.) W. M. D. [716

Weather-predictions in Australia. — All the Australian colonies being now connected by telegraph, it is proposed to issue daily, at Melbourne, a weather-chart, showing atmospheric conditions at nine A.M., and attempting predictions for the following day, especially when cyclone disturbances show themselves within the vicinity of the coast. Most of these storms come from the southern Indian Ocean, and move east or north-east, sometimes running ashore, sometimes passing south of Tasmania. As the barometer falls on their approach, warm north winds come down with increasing strength from the heated interior country. Rain is generally heaviest with these winds, but sometimes falls to a considerable amount after the storm-centre has passed, the wind veering through the north-west, as a rule, but some-

times backing through the east when the centre passes inland. Australia sends storm-warnings by cable to New Zealand. Nearly every barometric depression observed in the former region reaches the latter, requiring two or three days for the intermediate ocean-passage. — (*Trans. roy. soc. Victoria*, xviii.) W. M. D. [717

PHYSICAL GEOGRAPHY.

Hawaiian Islands. — Preparatory to his studies of the Cascade range, Capt. Dutton, of the U. S. geological survey, visited the Hawaiian Islands last year. He regards Kilauea formed independently of Mauna Loa, and describes its lava-lake. The colossal eruptions of Mauna Loa were especially remarkable: that of 1855 would have built Vesuvius. The mountain has no cinder-cones; and when in eruption there is no roar of vapors or cloud of steam, but a huge river of fiery lava wells forth like water from a radial fissure on the mountain flank, sometimes beginning as a great fountain several hundred feet high, then swiftly flowing down toward the sea. The lava being very liquid, the volcano is abnormally flat, and, as yet, it has no streams or ravines upon it; but there are many long tunnels in the lava, which lead the drainage underground. Mauna Kea has numerous cinder-cones, which form striking features on its slopes. The difference between the erosion on its windward and leeward sides is very marked. The other islands were also examined. Haleakala, on Maui, presents grand scenery in its deep valleys; Oahu and Kaui are also deeply eroded, implying a cessation of their activity earlier than that of Hawaii, but not necessarily an earlier beginning. — (*Amer. journ. sc.* 1883, 219.) W. M. D. [718

GEOGRAPHY.

(*Arctic.*)

Norwegian arctic fishery in 1882. — The fisheries from Tromsö and Hammerfest employed 575 persons, in 67 vessels of 2,654 tons total burden, and produced, in 1882, 148 walrus, 5,839 seal of all species, 117 beluga, 49 polar-bears, 211 reindeer, 332 kilos eider-down, 65 hectolitres whale-blubber, 261,400 haddock, 369 hectolitres of haddock-livers, and 2,430 of other fish-livers, — having a total value of some 210-,000 kronor, or about $60,000. — (*Deutsch. geogr. bl.*, vi. i. 1883.) W. H. D. [719

Commerce of the White Sea. — In curious contrast with prevalent notions about the arctic regions, are the statistics of trade between the four ports of Norwegian Finmark and the Russian ports of the White Sea, especially Archangel. In 1881 four hundred and seventy vessels, employing over two thousand men, visited the Finmark ports; and in 1882 a still larger number, bringing goods, chiefly the product of the rich fisheries of the White Sea, to the amount of more than $700,000, and receiving cargoes for Russia of nearly equal value. — (*Deutsch. geogr. bl.*, vi. i., 1883.) W. H. D. [720

(*Asia.*)

Persia. — Stack's 'Six months in Persia' (2 v., New York, *Putnam*, 1882) is an entertaining narrative of an overland journey by one well fitted for it from his knowledge of the language of the country. His descriptions seldom have an especially geographical turn, as most of his route had been fully described before; but one would like to hear more of the burial of the old town of Askizar in drifting sands (ii. 4), of the depth to which the rivers have cut in the alluvial slope at the foot of the mountains, so as to be out of reach for irrigation, and of the ascent of Demavend (ii. 179). The characteristic Persian landscape is desert plains bordered by rugged mountains, with villages along the lower slopes where they can get a supply of water. The accounts of the people's dissatisfaction under Persian misgovernment; of their apparent desire for external control, and their wonder whether it will come from Russia or England, of which they have very indistinct notions; and of the polyglot society in the larger towns, — are all of interest. A chapter is given on the outfit necessary for travelling in comfort; and a number of route-maps illustrate the several parts of the journey from Bushir to Karmán, Ispahan, Tehran, and the Caspian. — W. M. D. [721

Southern Persia. — Persian exploration seems to be attracting much attention in England; and the March number of the Royal geographical society's proceedings is almost entirely occupied with the accounts of recent travellers there, and the discussions their narratives excited. Col. Champain points out the small amount of trade carried on with Persia by British merchants, and shows that Russian wares are superseding British in the Persian markets. This he ascribes to the wretched condition of the roads from the southern coast of the country and in Turkish Arabia, and advocates an attempt to improve them, as well as to build a railroad from Baghdad to Khanakin (100 m.), and to improve the channel of the Karún River where obstructed by rocks at Ahwaz. G. S. Mackenzie, of the house of Gray, Paul, & Co., at Bushir, on the Persian Gulf, described his experience on inland journeys, made some years ago, as far as Ispahan; and, while he considered it too soon to project railroads there, he thought much could be done by improving the rivers and roads. Capt. H. L. Wells gives detailed narrative and surveys of several routes across the mountainous country from Bushir, inland to Ispahan, and from Lake Niris, near Shiraz on the south-east, as far as the Karún River, 300 miles to the north-west. Although far better than the deserts of central Persia, the towns are generally forlorn and dirty, and the roads are very rough. Lake Niris is also quite unlike the flat swamps of the desert regions farther east, as its shore-line is very irregular, its banks are often precipitous, and numerous rocky islands rise from its blue waters. It was found to have a large extension to the east from its north-western end, not previously explored, known as Tasht or Nargis, joining the main lake by a narrow passage. The lake has no outlet, and its waters are bad but drinkable. Ruins and cuneiform inscriptions were found at several points. — W. M. D. [722

Yesso. — This northern Japanese island is described by Dr. Brauns of Halle as even more picturesque than Dai Nippon. Its surface is sharply broken by mountain and valley, and the volcanic peaks and leaping streams give it a most attractive landscape. Volcano Bay, north of Hakodate, with numerous cones rising to six thousand feet around it, is named as one of the most beautiful places in the world. The central part of the island contains a bold and high range of old crystalline rocks, bordered by the heavy miocene lignite formation, and the fossiliferous pliocene strata. The volcanic rocks belong with the latter, and consist of the true eruptive masses (Lyman's 'old volcanic formation') and the later stratified tuffs, which often cover extensive areas. No glacial action is recognized in the quaternary deposits. Brief notes are added on the fauna and flora. — (*Verh. erdk. Berl.*, 1883, 43.) W. M. D. [723

BOTANY.

Cryptogams.

Action of light on Algae. — Berthold has made a minute study of the action of light on seaweeds, especially Florideae, and gives the results of his observations on species growing near Naples, and of his cultures made at the zoölogical station in that city. Under the influence of feeble illumination, the species studied turned towards the light; but, when stronger light was used, they turned from it. He considers, in detail, the effect of light in modifying the growth and branching of different species. Many seaweeds are, at some seasons of the year, covered with colorless hairs, whose function has hitherto been supposed to be connected with absorption of nutritive material. Berthold denies this supposed office of the hairs, and maintains that they act as a protection against too bright light, and states that exposure to light is followed by an increase in the growth of hairs. He also gives an explanation of the iridescence of certain species, which is produced by the formation of small plates on the outer part of the cells, as in Chylocladia, or by globular or irregular bodies in the cells, as in Chondria and Cystoseira. He denies the existence of any true fluorescence in such cases, which he considers to be merely instances of iridescence, and asserts that the plates and globules act as shields against too strong light. He also attributes a similar function to the calcareous incrustation found in Chara and seaweeds like Acetabularia and Corallina. — (*Pringsheim's jahrb.*) W. G. F. [724

Fertilization of red seaweeds. — Professor Fr. Schmitz has published some general observations on red seaweeds, in which he advances the view that the thallus in this group of Algae is always of a filamentous origin, no matter what the cellular character of the mature frond may be, and secondary cell-divisions never include the axis of the primary cells. He considers, in detail, the fertilization and the formation of the carpospores, and is of the opinion that there is no indirect impulse transferred from one cell to another at a distance, even in genera like Dudresnaya and Polyides, but that there is always a direct transfer of cell-contents. The abstract question of the nature of the sexuality in Florideae, as compared with that of other orders, as Ascomycetes and Collemaceae, is treated at length; and he unites the Bangiaceae with Chlorophyceae, rather than with Florideae, as has recently been done by Berthold. — (*Bericht. akad. wiss. Berlin.*) W. G. F. [725

Phenogams.

Influence of sunny and shaded localities on the development of foliage-leaves. — Stahl of Jena has given considerable attention for several years to the effect which light has in the development of the assimilative tissues. It has been held by some that the degree of exposure of a leaf unfolding from the bud can have no influence upon the character of its cells, except so far as etiolation or blanching might produce it. Upon reviewing all the evidence in the light of his recent researches, Stahl thinks that in shaded places the leaves have a less well-marked palisade system, whereas in full sunlight they develop a better palisade system and a less well-characterized spongy parenchyma. The author is convinced that these facts in regard to the partial adaptation of leaves to their surroundings should be borne in mind in the selection of the amount of light in our greenhouses. The paper is well illustrated. — (*Zeitschr. naturwissensch.*, xvi.; N. S., ix. 1, 2.) G. L. G. [726

The largest flower. — Dr. Thurber gives an account of the pollination of Rafflesia, written in an interesting way for young readers. The immense mottled flowers, with an expanse of three feet and a weight of fifteen pounds each, are dioecious. They are fertilized by flesh-flies, attracted by their carrion odor. — (*Amer. agric.*, April.) W. T. [727

ZOÖLOGY.

Coelenterates.

Structure and development of nematophores. — As the result of his study of the nematophores of Aglaophenia, Antennularia, and Plumularia, Merejkowsky concludes that we must abandon the old view that a nematophore is an amoeboid mass of sarcode, since the use of reagents shows that it is made up of distinct nucleated cells. These cells are derived from both layers of the body; the endoderm forming the central axis, and the ectoderm the outer layer. The nematophore is usually divided into two parts, of which one shows no power of motion, and contains a battery of very large lasso-cells; while the second portion is very movable, and exhibits amoeboid changes of form. The active portion is composed entirely of ectoderm, while the immovable portion contains an endodermal axis. The active portion presents a peculiar type of histological structure, since its cells are embedded in and surrounded by a structureless layer of contractile protoplasm, which has in itself the power of active change, and to the contractile power of which the amoeboid movements are due. This protoplasmic layer seems to correspond to that which unites together the cells of labyrinthula; and something similar is found in sponges.

Merejkowsky's investigations of the development of nematophores have led him to believe that these structures are neither organs which have been acquired for a special purpose, nor specialized polymorphic hydranths, but simply degenerated hydranths.

In support of this view, he says, that, when a colony of Plumularia halicioides was kept over night without a supply of running water, the tentacles and oral orifice disappeared, the whole body became reduced in size, and the hydranth thus became converted into something which bore a very close resemblance to a nematophore. The ectoderm gave rise to long pseudopodia, and changed its form continually, exhibiting amoeboid movements which were almost exactly like those of a true nematophore. — (*Arch. zool. exp. gén.*, 1882, 4.) W. K. B. [728

Worms.

Haplobranchus, a new serpulid. — A. G. Bourne describes Haplobranchus aestuarinus, a new species of serpulid, belonging, apparently, to the Sabellidae, but differing from all known forms. A description, including a few anatomical notes, is given. The worm was found on both the Irish and English coasts. — (*Quart. journ. micr. sc.*, 1883, 168.) C. S. M. [729

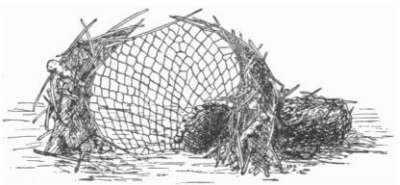
The species of branchiobdella on cray-fish. — Oustroumoff has found a species near Kasan on the gills of Astacus leptodactylus, but which is nearer to B. parasita than to B. astaci, and for which he proposes the name B. astaci leptodactyli. — (*Zool. anz.*, vi. 76.) C. S. M. [730

The teeth and synonymy of Dochmius. — Megnin discusses the synonymy of the genera Dochmius, Strongylus, and Ankylostoma. Dujardin separated Dochmius as toothless forms: but Megnin finds teeth in the Dochmius of the dog; and, believing that they will be found in the other members of the genus, he maintains that the name ought to be re-

placed by Ankylostoma, which has priority for toothed forms of Strongylids. The teeth have been previously overlooked. — (*Bull. soc. zool. France*, 1882, 282.) C. S. M. [73

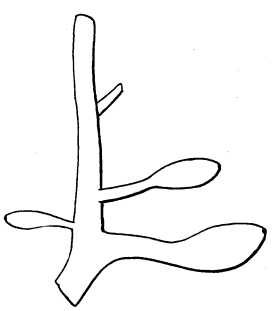
Insects.

Caddis-fly cases. — Miss C. H. Clarke figures and describes two interesting new forms of larval cases of Hydropsychidae from Massachusetts. One of them, that of a Hydropsyche, resembles a tunnel,



loosely attached to a stone by its lower edges, the stone forming the bottom. It may be composed entirely of sand or of vegetable fragments, or of both, and is peculiar for having at its mouth a vertical framework, with a net stretched across it, as in the figure, to catch its prey. The case is built in swiftly running water, and the supporting framework of the net is occasionally stayed by silken cords stretching to suitable points on the stone.

The other, that of a Plectrocnemia, is a tall cylindrical chimney, with lateral tubes expanding into chambers. The chambers usually end with a small aperture, but sometimes extend into another short piece of cylindrical tube with an aperture at its end. The upper end of the main tube has occasionally two openings, though commonly one. These tubes are found erect in the muddy bottoms of brooks, and, but for the apical opening, look like the twigs one may see stranded in such places. Miss Clarke was unable to discover in which part of the case the larva lived; but the pupa was always found in the upright shaft, its place usually indicated by an enlargement. — (*Proc. Bost. soc. nat. hist.*, xxii. 67.) [732



VERTEBRATES.

Origin of the vertebrate mesoderm. — Romiti discusses His's view, that the mesoderm has a double origin, in part from the primitive streak, and in part from independent cells, which His calls parablastic, and thinks derived from the yolk, and destined to form the connective and vascular tissues. Romiti admits the double origin, but maintains that the independent cells are derived from the germinal portion. The cells in the periphery of the mesoderm are derived "from the proliferation of some large cells which have emigrated from the segmented germ, and lie between the primitive layers." — (*Arch. ital. biol.*, ii. 277.) C. S. M. [733

Formation of serum albumen in gastric digestion. — It is generally believed that proteids, when digested in the stomach or small intestine, are transformed into peptones, and absorbed in that form; but there has always been the objection to this view, that peptone cannot be found (or, if found, then only in minute quantity) in the blood of the portal vein, or in the chyle. Hence, if the proteids eaten were turned into peptone, and absorbed in that form, they must very quickly be converted into the albumens of the blood, lymph, or chyle. Von Ott now claims that he has proved that serum albumen is produced in the stomach and intestines during digestion. But his proof consists, 1°, in assuming that Martius was correct when he stated that no proteid but serum albumen will cause the heart of a frog, which has been brought to a standstill by washing with salt solution, to beat again; and, 2°, in showing, that, from the contents of the stomach or intestine of a digesting animal, a solution can be prepared which will make the heart recommence beating. As numerous intermediate and by-products are known to be formed during the digestion of albumens, and as Martius did not experiment with several of these, it is clearly necessary that the action of each on the heart be studied before we are justified in concluding that a heart which is fed by a liquid containing them is nourished by serum albumen, and not by them or some one of them. Von Ott finds that milk is an excellent food for the frog's heart, but that it loses this power when all proteids are removed from it. — (*Du Bois' archiv*, 1883, 1.) H. N. M. [734

Excitation of vascular nerve-centres by the summation of electrical stimuli. — Kronecker and Nicolaides have examined the influence of successive stimuli upon the vaso-motor system, in order to see if the vascular nerve-centres obey the laws which have been established in this regard for the reflex movements of the limbs. They find a general agreement. Single induction shocks applied to vaso-motor centres in the medulla or spinal cord have no influence upon arterial pressure. Moderately strong stimuli first begin to act by summation when they follow at not greater intervals than half a second. Increasing the rate of stimulation increases the effect up to a rate of from twenty to thirty per second: increase of rate beyond this has no effect. Keeping the rate quite slow and constant, but increasing the intensity of the stimuli, increases the effect, but never so much as quickening the rate. The maximum of blood-pressure can be obtained either with powerful shocks at $\frac{1}{10}$–$\frac{1}{12}''$ intervals, or moderately powerful induction shocks at $\frac{1}{20}$–$\frac{1}{25}''$ intervals. It takes longer to attain the maximum result with slow, powerful stimuli, than with weaker, but more rapid; also with slow stimulation the absolute number which must be given before the maximum result is attained is greater. The conclusion is therefore reached, that the cells of the vascular nerve-centres agree essentially with the proper motor cells of the spinal cord in having an inherent tendency (in the dog) to vibrate at a rate of about twenty times a second. — (*Du Bois' archiv*, 1883, 27.) H. N. M. [735

Tetanic stimulation of frogs' nerves by a constant current. — Von Frey has lately carried on a series of investigations as to why a frog's muscle is sometimes tetanised — though usually only giving a single twitch — when a constant galvanic current is sent through its nerve. He points out some of the conditions under which the long-continued contraction is observed, and shows that it is a true tetanus, and not merely a very prolonged twitch. — (*Du Bois' archiv*, 1883, 43.) H. N. M. [736

Fish.

Spawning-habits of Ceratodus. — Mr. Haswell has stated before the Linnaean society of New South Wales, that Mr. Morton, of the museum, had ascer-

tained that the so-called 'Ceratodus' of Queensland spawns during the months of June, July, and August, in the Burnett River. A slight excavation is made by the fish in the bed of the river, in water about eight to ten feet deep; and the male and female guard the nest till the eggs are hatched. Hope is held out that a supply of fertilized eggs may be procured next season, and the embryology of the type studied. Thus a great gap in our knowledge of the ancient fish-types may be filled up. — (*Nature*, March 15.) T. G. [737

Development of the pike's skull. — An important memoir on the development of the membrane-bones of the pike's skull has been published by Dr. Johannes Walther. The observations were chiefly made on the young, representing two stages of development, — one 11 and the other 22 mm. long. The author recognizes five categories of ossifications; viz., 'hautknochen,' including 'cementknochen,' 'bindegewebsknochen,' and 'perichondralknochen (centrifugal wachsend)'; and 'knorpelknochen,' including 'perichondral (centripedal wachsend)' and 'enchondral.' For his generalizations, we must refer to the memoir itself (*Jena. zeitschr.*, xvi. 59, pl. 3, 4). In this connection, we may also call attention to a monograph on the development of the pike's shoulder-girdle and pectoral-fin, published by Dr. G. Swirski at Dorpat in 1880. — T. G. [738

Isaak Walton, and the river Lea. — An interesting article on the little river Lea, as it is at present, has been published under the above caption by R. B. Croft. A list of the fishes, with notes as to their occurrence (whether abundant or rare), will enable the Waltonian to compare the past and present of the river immortalized by the 'father of angling.' It supplements a paper some time previously published by Mr. Littleboy in the transactions of the Watford natural history society (ii. 113). — (*Trans. Hertf. nat. hist. soc.*, ii. 9.) [739

Mammals.

American sirenians. — The discovery of a new fossil sirenian in South Carolina brings the number of known existing and extinct forms in North America to eight (Cope. *Proc. acad. nat. sc. Philad.*, 1883, 52). The Florida manatee is still extant in that state, and it is probable that the South American manatee may yet be found in Texas. Two extinct forms (Anoplonassa forcipata, from Georgia; and Hemicaulodon effodiens, from New Jersey) have been previously described by Cope. The type of Owen's Prorastomus was from the West Indies. Two other extinct species of manatee, founded upon teeth, and the new generic form, Dioplotherium Manigaulti, all from South Carolina, complete the number. From recent remarks by Mr. W. H. Dall (*Biol. soc. Wash.; meeting* March 30), it would appear certain that Rhytina has not existed on the coast of the Alaskan peninsula since the advent of man, and probably never. It cannot, therefore, be added to the list of American sirenians. — F. W. T. [740

Foetus of a seal. — Camerano, in vol. xxxv. of the Memorie of the academy of Turin, describes the anatomy of a nearly mature foetus of Otaria jubata Forst. Its length, with the hind-limbs extended, was 51 cm.; its structure showed a close affinity with other carnivora. The author gives a description of the thoracic girdle with measurements. It is noteworthy that the scapula and the coracoid apophysis are relatively more developed than in the adult. The comparison of the cranium with that of the adult shows that variations occur here similar to those observed in the gorilla, especially in the proportion between the cranium proper and the facial region. The brain differs in the usual manner from that of the adult. The right ventricle of the heart is shorter than the left: in the adult they are about equal. The same difference with age exists in lions. The coronary vein is very large. From the aortic arch arise only two vessels, — the innominate trunk and the left subclavian, — not three, as in the adult: the young, therefore, resembles in this respect the aquatic carnivora, with which it is probably phylogenetically related. — (*Arch. ital. biol.*, ii. 285.) C. S. M. [741

(*Man.*)

Duration of fecundity in man. — The generally accepted notion that the period of fecundity for the male does not extend beyond the sixtieth year, and for the female the fortieth year, is shown by M. Mignot to be to a certain degree incorrect. He cites numerous cases which show that the period may extend to the seventieth year in the male, and to the fifty-sixth or fifty-eighth in the female. — (*Soc. sc. med. Gannet*, xxxvi. 19.) F. W. T. [742

The intermedius of the carpus in man and other mammals. — Leboucq has re-examined this bone by aid of microscopic sections, with a view of determining its relations to the other bones of the wrist. It first shows itself with distinctness in human embryos, of which the hand has a length of 2 mm., appearing as a cartilaginous nodule inserted between the scaphoid and the first three bones of the drital row. In hands 2.5 mm. long it appears as a polyhedral nodule attached to the scaphoid at one point near the palmar surface, but otherwise free. In hands 4.5 to 5 mm. long the cartilaginous attachment is broader, but the intermedius is still distinguishable. With the growth of the foetus, the boundaries become less and less distinct, and finally disappear. Leboucq, therefore, decides that the intermedius does not disappear by atrophy, but by fusion with the scaphoid. He does not agree with Rosenberg, that the space supposedly left vacant by atrophy of the intermedius is filled with *tissu à vacuoles*, with large nuclei (?) in its walls, but by simple ligamentary fasciculi.

Although having no new facts to contribute, regarding the chimpanzee and gorilla, in which the intermedius disappears in the adult, he believes that it combines with the scaphoid as in man. In the dog and the cat, the intermedius is also as in man, but extends less in the dorselumbar direction. In embryo bats (notably in Vespertilio murinus) the intermedius is distinctly visible. Its presence in marsupials needs further confirmation. In conclusion, Leboucq states his belief that the intermedius is present in the embryos of all pentadactyle mammals. — (*Bull. acad. sc. Belg.*, (3), iv. 220.) F. W. T. [743

ANTHROPOLOGY.

Resources of anthropology. — The student of any branch of human knowledge is always grateful to those who will show him the results of other men's labors. The surgeon-general's office in Washington has undertaken to be the guide of anthropologists in this respect. Under the direction of Dr. J. S. Billings and Dr. Robert Fletcher, aided by a force of accomplished assistants, are issued the Index medicus and the Index-catalogue of the surgeon-general's office. The former is a monthly catalogue of medical literature, classified so as to be most serviceable to the practitioner, as well as to the student of human biology. Through a system of exchanges and purchases, all the creditable medical anthropological journals of the world are promptly received, and their contents indicated through the Index medicus.

The anthropologist will always find useful information under the words bibliography, anatomy, physiology of the brain and nervous system, biology, abnormalities, anthropology, and craniology. The second-named publication appears in quarto volumes, in which every subject upon which any thing contained in the surgeon-general's library has been written is catalogued with conscientious minuteness, and with reference to the ready convenience of the student. Three volumes have already appeared. — O. T. M. [744

(*Old world.*)

Anthropology of Caffraria. — The anthropological documents collected in Caffraria by M. Delegorgue in the years 1838-44 are made the text of a paper by M. Hamy. He begins with a *résumé* of the writings upon Caffraria prior to the travels of M. Delegorgue, commencing with the 25th of December, 1497, when Vasco da Gama named the country of Natal from the Nativity. To those making a study of the tribes so prominent for their bravery in the face of British soldiers, this chapter will be eminently useful. The documents for which we are indebted to M. Delegorgue relate especially to the Amazulus, although other members of the Bantu group and the Bushmen are not overlooked. In the third chapter of his monograph M. Hamy brings together what is known concerning the craniology of the Caffir tribes, with a table of measurements. — (*Nouv. arch. mus. hist. nat. Paris*, 1881.) J. W. P. [745

Corea. — Mr. William Elliot Griffis is the author of a work upon 'Corea, the hermit nation,' just published by Charles Scribner's Sons. The author made good use of his opportunities, while connected with the imperial university of Tokio, to collect all that could be ascertained concerning the exclusive peninsula. Mr. Griffis makes it very clear that Japan received its first impulses to art and civilization through Corea. Around this favored spot have contended a thousand influences for the mastery, — Mongolians, Cossacks, Japanese; Buddhism, Confucianism, ancestral worship, and Christianity; exclusivism and liberalism. From these bloody conflicts the people have suffered untold miseries, and have been kept back in the progressive march of civilization. A great deal of the space in the volume is devoted to the sociology of the Coreans, a subject in which anthropologists will be especially interested. The unsuccessful endeavors to effect commercial treaties with the Coreans are narrated at length, as well as those which met with a more favorable reception in 1882. — J. W. P. [746

Craniology of the Mongoloids. — Dr. Frederik Carel ten Kate, jun., made the craniology of the Mongoloids the subject of an inaugural dissertation at Heidelberg, and L. Schumacher of Berlin has published his researches in a pamphlet of fifty-eight pages. Several pages are devoted to a minute bibliography of the subject, which makes the paper all the more valuable. Fifty-three crania are minutely measured and described, as follows: Chinese, 10; mixed Chinese, 7; Japanese, 5; Berings people, 4; Yukagir, 1; Tunguses, 5; Bureats, 5; Calmuks, 5; Tatars, 4; Yakut, 1; Baschkirs, 2; Lapps, 4. — J. W. P. [747

(*New world.*)

Peruvian stone-quarrying. — A short paper by Boussingault contains some information with regard to the ancient working of stone in Peru, which is of general interest. An old quarry exists in the environs of Quito. In the trachyte and among the refuse was found a chisel which had evidently been used in quarrying. Its surface was scratched and worn, its edge indented, and its head bruised by the blows of the hammer. Its specific gravity was 8.83, or a little more than that of melted copper. A chemical analysis made by Damour showed that it was composed of 95 % of copper, 4½ % of tin, .2 % of lead, .3 % of iron, and traces of silver.

This bronze was not sensibly harder than common copper; and Boussingault suggests that it was owing to the rock possessing less hardness through its 'quarry water,' that it could be worked by such instruments. By the same cause he endeavors to explain the preparation of the granite monuments observed in Peru by La Condamine, adding thereto the skill and dexterity which the Indian race possessed in the use of their bronze tools. Boussingault's conclusions will probably be questioned by many until the strongest proof is given of their correctness.

He calls attention to the fact, that a chisel found in a silver-mine near Cuzco, and carried to Europe by Humboldt, gave, by Vauquelin's analysis, 94 % of copper and 6 % of tin. — (*Comptes rendus*, xcvi. 545.) M. E. W. [748

Chili. — The *Times* printing-house of Philadelphia has published a pamphlet of forty-eight pages upon Chili. Some information is conveyed concerning the forty thousand Indians within her borders. From the alliance of the Spaniards with the Araucanians, known under thirty or forty tribal names, from the Changos of Atacama to the Cuicos of Osorno, have come two million inhabitants, known severally as *huasos* (horsemen) and *rotos* (ragpickers). There are about forty thousand indigenes remote from civilization. The Araucanians proper are divided into three tribes, — Pehuenches, in the pine-groves (pehuen) of the Andes; Llanistas, in the plains (llanos); and the Costinos, in the cordilleras of the coast. A brief history of the founding of Chili is given, commencing with the famous quarrel between Don Diego de Almagro and Don Francisco Pizarro. — J. W. P. [749

Errors in Waldeck's drawings. — Professor Cyrus Thomas, who has studied the Palenqué tablet of the cross with considerable care, expresses the opinion, that the drawing of the inscription on the left slab as given in the plates of Waldeck's 'Palenqué et autres ruines,' edited by Brasseur de Bourbourg, is almost wholly copied from Catherwood's drawing as published in Stephens's Central America.

He bases this opinion upon the demonstrable fact, that a number of errors which can be pointed out in Catherwood's drawing are all faithfully copied in the Waldeck plate.

This applies only to the six columns of the left inscription, and not to the rest of the plate, which he thinks is more correctly rendered by Waldeck, except as to the human figures, than is Catherwood's drawing.

Is this opinion correct? If so, is the original of Waldeck's drawing yet in existence? These are questions we should be glad to have the French archeologist answer. Prof. Thomas is now preparing a paper for the Bureau of ethnology in which he will give more fully his reasons for this opinion. — J. W. P. [750

Indian music. — In every collection of American antiquities will be found gourd rattles, strings of shells, bones, hoofs, and seed-pods, drums, whistles of clay, wood, and bone, and frequently a stringed instrument, or a pan-pipe. These, "for the most part, are capable of nothing but inexplicable dumb shows and noise." Mr. E. A. Barber, however, has given the subject some attention, and has discovered instruments capable of a rude scale, from which the

fourth and the seventh are excluded, to which the name *pentatonic* has been given. The ancient Peruvians had music very difficult to learn, which expressed, with great compass and pathos, the agreeable and disagreeable emotions of their daily lives. Mr. Barber repeats an account, given by Don Fred. Blume, of the wails of a Peruvian woman on hearing the news of the death of a brother. "The announcement came, it seems, unexpectedly, and the explosion was that of a volcano of grief, — terrible jets from time to time; then a quiet interval; and then, again, a great outburst; and so on. . . . Thus I came to understand how their 'operas' originated, and how natural a mode of expression they are." — (*Amer. nat.*, March.) J. W. P. [751

Aztec music. — While arranging the Poinsett and Keating collections of antiquities in the museum of the academy, Mr. H. S. Cresson noticed some Aztec flageolets and whistles, or pitch-pipes of terra-cotta, an investigation of which had yielded some facts which might be of importance to the ethnologist. Most authorities upon the subject have arrived at the conclusion that the musical knowledge of barbarian tribes is confined to the limits of the so-called pentatonic scale, in which the fourth and seventh tones of the scale, as known to us, are wanting. Upon trying the four-holed Aztec flageolets in question, he had found, that, by closing the bell with the little finger, they could be lowered a full tone, and, from the tonic note thus obtained, the octave could be produced, including the fourth and seventh notes as known to us. Five of the flageolets in question were exhibited, — two in the key of C natural, one in the key of B natural, and the other two in F sharp and B flat respectively. The last-named instrument was chosen to produce the fourth and seventh tones, upon which an expert performer on the Boehm flute ran the diatonic and chromatic scales with but little difficulty. The pitch-pipes, or whistles, were next exhibited; and the same performer demonstrated that a full octave could be produced thereon, together with the ninth, eleventh, and twelfth notes, the tenth being missing. The whistle producing this tenth note must have existed, as it is preposterous to suppose that a people capable of manufacturing the instruments in our possession (several of which are duplicated in the collection), which may be played in trio or quartette, were not more thoroughly acquainted with the principles of music than to content themselves with the narrow limits of the pentatonic scale. This is proven by their ability to manufacture instruments capable of producing, not only the fourth and seventh tones of the diatonic scale, but also the entire chromatic scale. — (*Acad. nat. sc. Philad.; meeting* April 3.) [752

EARLY INSTITUTIONS.

New-England towns. — The student of early institutions in America will be interested in the recent 'History of Great Barrington' (Berks County, Mass.), by Charles J. Taylor. The upper township was distributed in forty proprietary rights. James Bowdoin had seven and a half; other persons had six, five, four, two and a half, or one apiece. These rights were fixed by the settling committee at four hundred acres each. Allotments were made accordingly. We are struck by the resemblance between these proprietary rights with equivalents, and the *mansi, cum campis, pratis, pascuis silvis*, in the German colonies of the early and middle ages. The free colonies, like most of our New-England towns, were associations of proprietors, with defined rights in the land; in recognition of which, each man received certain home-lots and arable lots, together with meadow, pasture, and forest lands; the latter being, very often, held in common. Mr. Taylor confines himself strictly to the history of his own town; but this history embraces many interesting facts, and is suggestive in many ways. The words of Burke, 'People will not look forward to posterity who never look backward to their ancestors,' are printed upon the titlepage. — D. W. R. [753

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

Peabody museum of American archaeology, Cambridge, Mass.

Altar-mounds in Anderson township, Ohio. — Several of the mounds explored the past summer by Dr. Metz and the curator contained 'altars,' or basins, of burnt clay, on two of which there were literally thousands of objects of interest. Two of these altars, each about four feet square, were cut out, and brought to the museum. Among the objects from the altars are numerous ornaments and carvings unlike any thing heretofore found.

One altar contained about two bushels of ornaments made of stone, copper, mica, shells, the canine teeth of bears and other animals, and thousands of pearls. Nearly all of these objects are perforated in various ways for suspension. Several of the copper ornaments are covered with native silver, which had been hammered out into thin sheets, and folded over the copper. Among these are several of the spool-shaped objects (which I now regard as ear-ornaments), a bracelet, and a bead. One small copper pendant seems to have been covered with a thin sheet of gold. This is the first time that native gold has been found in the mounds, and the small amount found here shows that its use was exceptional. The ornaments cut out of mica are very interesting, and embrace many forms. Among them are a grotesque human profile, and the heads of animals, whose features are emphasized by a red color. Many of the copper ornaments are large and of peculiar shape. There are about thirty of the singular spool-shaped earrings made of copper. Three large sheets of mica were also found; and several finely chipped points of obsidian, chalcedony, and chert, were in the mass of materials. Several pendants, cut from a micaceous schist, are of a unique style of work. Three masses of native copper were found on the altar.

But by far the most important things found on this altar were the several masses of meteoric iron and the ornaments made from this metal. One of these is half of a spool-shaped object, or ear-ornament, like those made of copper, with which it was associated. Another of these ear-ornaments is covered with a thin plating of the iron, in the same manner as others were covered with silver. There is also a folded and corrugated band of iron of the same shape, and nearly the same size, as the band of copper found in a mound in Tennessee, and figured in the last report of the museum (fig. 16). Three of the masses of iron have been more or less hammered into bars, as if for the purpose of making some ornament or implement, and