that the theory needs correction to take account of the relative amount of land and water, as well as the contour of the continents. These have a controlling influence upon the tides, and this discovery is Thomson's great improvement and correction of the equilibrium theory.

The diurnal tide has been usually explained, in accordance with the equilibrium theory, as a wave existing under nearly static conditions, and following the moon and sun around the earth, but interfered with by friction, and changed in direction by the contour of the land. Though this was the view of Newton, Young, and others, and is incorporated in our ordinary text-books, it is quite inadequate; and the kinetic theory of Laplace must be put in its place, which treats the water as a moving fluid body, subject to the disturbing influence not only of the sun and moon, but of itself also.

The kinetic theory of the tides was to have been developed at length in vol. ii.; and that intended development is more than once referred to by the authors, — as, for instance, on p. 382, where an incidental comparison is made of the results of the two theories.

This part of the theory has been treated by Ferrel in his 'Tidal researches,' published as one of the appendices to the U. S. coast-survey report for 1874, in which work he has put in practical shape all the theoretical work heretofore accomplished, and also deduced therefrom important consequences. Until the publication of this work, it was not possible to apply the correct theory to the discussion and prediction of tides by reason of the unmanageable formulae employed by Laplace; and the discussions were, perforce, made by some modification of the equilibrium theory. Indeed, Laplace himself resorted to that method in his famous discussion of the tidal observations in the harbor of Brest. But, thanks to Ferrel's labors, this most intricate branch of computation has been systematized, and applied to an extensive series of tidal observations in Boston harbor.

The concluding pages, from 422 to 460, treat the question of the rigidity and solidity of the earth as a whole, especially as related to the tides. The final sentence (p. 460) is, "On the whole, we may fairly conclude, that, whilst there is some evidence of a tidal yielding of the earth's mass, that yielding is certainly small, and that the effective rigidity is at least as great as that of steel."

Four important papers on subjects related to those just mentioned are added to the work as appendices. The titles of these papers are, 'Cooling of the earth,' 'Age of the sun's heat,' 'Size of atoms,' 'Tidal friction.' The last three of these were not in the first edition.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Fuchsian functions. — A previous paper by M. Poincaré on this subject has already been noticed in these pages (i. **535**). In the present most important memoir, M. Poincaré assumes the results arrived at in the former memoir, and proceeds to more fully develop them and the consequences flowing from them. In the previous paper the author showed that it was possible to form discontinuous groups by substitutions of the form

$$\left(z, \frac{a_i z + \beta_i}{\gamma_i z + \delta_i}\right)$$

by choosing the coefficients $a_i, \beta_i, \gamma_i, \delta_i$, in such a way that the different substitutions of the group should not alter throughout the interior of a certain circle called the fundamental circle. In the present paper the author assumes that the fundamental circle has its centre at the origin, and its radius unity; so that its equation can be written as mod. $z = 1$.

He then considers one of these discontinuous groups, which he calls Fuchsian groups, and which he denotes by G. To this group corresponds a decomposition of the fundamental circle into an infinite number of normal polygons, R, all congruent among themselves. The author then demonstrates that there always exists a system of uniform functions of z, which remain unaltered by the different substitutions of the group G, and which he calls Fuchsian functions. M. Poincaré's memoir is too long to be reviewed here as it deserves. It is certainly a most important addition to the modern theory of functions, and is rendered particularly valuable by the historical note at the end, in which the author gives a brief account of the labors of Hermite, Fuchs, Klein, Schwarz, and others in this field. The two memoirs, with very little amplification, would constitute a really valuable treatise on this subject, — a subject of great importance, and on which there exists absolutely no text-book or treatise of any kind. — (*Acta math.*, i.) T. C. [**506**

ENGINEERING.

Steam-whistles. — Lloyd and Symes give a statement of experiments with a locomotive whistle having a bell $4\frac{15}{16}$ inches diameter, $3\frac{3}{4}$ inches long inside, and over an annular steam opening $\frac{1}{16}$ of an inch wide. The bell was of cast brass of medium character; and the lip was chamfered to a thin edge, and set exactly over the steam-opening. Sixty pounds press-

ure of steam gave E natural; 80 pounds, F sharp; 90 pounds, G; 110 pounds, A; and 125 to 130 pounds gave C sharp in alt. The distance from steam-opening to edge of whistle was 1½ inches. When it was increased to 2 inches, the power of the sound was sensibly lessened, but the pitch was altered relatively but half a tone. If the distance were decreased to 1 inch, or to ⅞ of an inch, the whistle would sound only supertones. The notes above were clear, even 'reedy,' and could be heard six miles. A bell of brass tubing, annealed, hammered, and then heated again, gave sounds of somewhat greater intensity and pitch. An iron bell was unsatisfactory. — (*Railr. gaz.*, Aug. 31.) C. E. G. [507

Economy of pumping-engines. — Mr. P. A. Korevaer compares the economy of the scoop-wheel, the Archimedean screw, the pump-wheel, the suction or bucket pump, the double-action pump, and the centrifugal pump, and reports the results to the Dutch institute of engineers. In the Netherlands the pump-wheel is used for lifts less than 2.5 metres (8.3 feet), and the screw for about 4.25 metres (12.5 feet); while the lift and volume delivered by the ordinary forms of pump are unlimited. The economical lift for a centrifugal pump is taken to be as a maximum at about 30 or 40 feet. Its cost in Holland is rather greater than that of a scoop-wheel. The latter gives an efficiency of 64 to 69.5 % on lifts varying from 4 to 6 feet (1.2 to 1.8 metres). The double-acting pump gives an efficiency of 67 to 73 % on lifts between 6.66 and 10 feet (2 to 3 metres). The centrifugal pumps tested gave from 17 to 70 % (averaging 45) in one place, and 40 to 49.3 (averaging 44) in another case. The coal used amounted to from 0.9 to 1.2 kilogr. with scoop-wheels for the drainage of one hectare and a lift of one metre, 1 to 1.17 with double-acting pumps, and 1.56 to 2.19 with centrifugal pumps. The author concludes that a decided gain is obtained by the use of other methods of pumping rather than by the use of the centrifugal pumps,— a conclusion which we may be allowed to agree in, with the qualification that the results would bear a somewhat different complexion if the comparison were with efficient centrifugal pumps, which should be capable of giving an efficiency of at least 66 %. — (*Abs. papers inst. civ. eng.*, 1882-83, iii.) R. H. T. [508

Electric head-light for locomotives. — The Sedlaczek head-light was exhibited at Munich at the late exhibition. It was made by Messrs. Sedlaczek & Wilkulill, as a modification of the lamp of Lacassagne & Thiers, of 1856. The current is supplied by a dynamo placed on the top of the boiler behind the smoke-stack, and driven by an independent engine. The lamp is arranged to turn automatically on curves so as to light the track at all times. The light was visible at a distance of 2½ miles (4 kilometres). The report of the committee intrusted with the observation of the action of the lamp states that the intensity (4,000-candle power) was so great that the guards reported that it dazzled their eyes to such an extent that they were unable to make the observations prescribed by the regulations. The committee express a fear that it may frighten horses. Their apprehensions remind us of the same difficulties as they presented themselves to the opponents of the railway itself. A report made on this lamp in 1881, when used on the Northern railway of France, stated that the experiment proved that the lamp was not extinguished by the jar of the train, and that it did not in any way affect the visibility or the appearance of colors in signals. Engineers of trains were not dazzled by it unless by looking at it persistently, and were not prevented, even then, from seeing the signals. It is proposed to apply the same system of lighting to the cars. — (*Railway rev.*, Oct. 6.) R. H. T. [509

CHEMISTRY.

(*Organic.*)

Constituents of petroleum from Galicia. — In the oil from this locality Br. Lachowicz has found a normal, and an iso-pentan, two hexans, one heptan, one nonan, and two decans. Other hydrocarbons of this series were present in smaller quantity. No members of the ethylen series were detected. Of the aromatic hydrocarbons, benzol, toluol, isoxylol, and mesitylen were identified. The quantity of 'Wreden's hydrocarbons' — hexahydrobenzol (C_6H_{12}), hexahydrotoluol (C_7H_{14}), and hexahydro-isoxylol — in the Galicia petroleum lies between that of the Caucasus and the American oils. — (*Ann. chem.*, 220,168.) C. F. M. [510

Compounds of the indigo group. — In the course of his investigations upon the constitution of indigo, A. Baeyer has tried several reactions to determine the position of the hydrogen atom which is not in the benzol ring. If the formula

$$\begin{array}{l} C_6H_4-CO \\ \quad\quad\quad | \\ \quad\quad N=COH \end{array}$$

is assigned to isatin, the isomeric form called by Baeyer pseudo-isatin would have the form

$$\begin{array}{l} C_6H_4-CO \\ \quad\quad\quad | \\ \quad\quad HN-CO \end{array};$$

and the form of pseudo-indoxyl isomeric with indoxyl,

$$\begin{array}{l} C_6H_4-COH \\ \quad\quad\quad\ \| \\ \quad\quad HN-CH \end{array}$$

would be

$$\begin{array}{l} C_6H_4-CO \\ \quad\quad\quad | \\ \quad\quad HN-CH_2 \end{array}$$

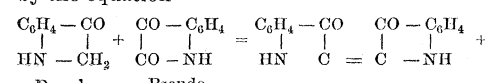
Baeyer draws the following conclusions from his results concerning the structure of indigo: —

1. It contains an imido group.
2. The carbon atoms have the arrangement

$$C_6H_5-C-C-C-C-C_6H_5.$$

3. It is formed only from compounds in which the carbon atom next to the benzol ring has attached to it an oxygen atom.
4. In its formation and properties it is closely related to indirubin and the 'indogenides' of ethyl-pseudo-isatin.
5. The latter results from a union of the α-carbon atom of pseudo-indoxyl with the β-carbon atom of pseudo-isatin.

The formation of indigo may therefore be shown by the equation —



— (*Berichte deutsch. chem. gesellsch.*, xvi. 2188.)
C. F. M. [511

AGRICULTURE.

Maintenance of fattened animals. — Kellner having observed that simple maintenance-fodder was sufficient to prevent fatted sheep from losing weight, Vossler has tried the same proceeding with sheep and oxen, and confirmed Kellner's observation. — (*Biedermann's centr.-blatt.*, xii. 612.) H. P. A. [512

Relation of manure to quantity of seed. — In experiments on the drill-culture of barley, Märcker finds, that, as the distance between the drills is increased, the yield decreases, unless more nitrogenous fertilizer is applied. — (*Ibid.*, xii. 620.) H. P. A. [513

Seed-potatoes. — In an experiment with potatoes at the New-York agricultural experiment-station, single eyes gave better yields in proportion as they were located near the terminal portion (seed-end) of the tuber. — (*N. Y. agric. exp. stat., bull.* lxiv.)
H. P. A. [514

Potato-culture. — Previous experiments having led to the hypothesis that the most favorable conditions for the growth of potatoes are coolness and moisture for the roots, and warmth and dryness for the tubers, an attempt was made to test the hypothesis by planting potatoes on ridges, and mulching the intervals. The season, however, was very wet, so that the desired conditions for the tubers were not attained. As it was, the parallel plots under ordinary culture gave decidedly greater yields. — (*Ibid.*, lxv.)
H. P. A. [515

Fertilizers for tobacco. — Nessler has repeated part of his well-known experiments on the effect of various salts upon the quality of tobacco. The present experiments consisted of a comparison of the chloride, sulphate, and nitrate of potassium in this respect, as well as of a few other fertilizers. The results were essentially the same as those previously reached: the sulphate and nitrate improved the burning qualities, while the chloride, except in one case, caused them to deteriorate. The chloride also increased the percentage of chlorine in the ash. The author recommends applying phosphatic and potassic fertilizers to the preceding crop, and only nitrogenous fertilizers directly to the tobacco. — (*Landw. vers. stat.*, xxix. 309.) H. P. A. [516

Glutamin in beet-juice. — In an earlier investigation, Schulze and Urich obtained glutaminic acid and ammonia by boiling beet-juice with hydrochloric acid, and from this fact concluded that the juice contained glutamin, a substance which had then never been prepared. Schulze and Bosshard have now succeeded in preparing glutamin from beet-juice. The juice is first treated with lead acetate. The filtrate from this precipitate is treated with mercuric nitrate, and the resulting precipitate decomposed by means of hydrogen sulphide.

Glutamin crystallizes from aqueous solution in fine, white, anhydrous needles, soluble in hot water and dilute alcohol. It is readily decomposed by acids or alkalies into glutaminic acid and ammonia, the decomposition taking place gradually, even in the cold or on simple boiling with water. Consequently ammonia cannot be determined in vegetable extracts containing glutamin, either by Schlösing's method or by boiling with magnesia. — (*Ibid.*, xxix. 295.) H. P. A. [517

GEOLOGY.

Correlation of Cambrian rocks. — Mr. Charles D. Walcott, of the U. S. geological survey, has recently reviewed the great Cambrian sections of North America. He defines the Cambrian as the formation characterized by the 'first fauna' of Barrande.

In New York, on one side of Lake Champlain, near Chazy, the formation is constituted by the Potsdam and calciferous; and the biologic transition to the Silurian, as represented by the Chazy, is abrupt. In Nevada there is a gradual passage from the Potsdam fauna to the Silurian; and beneath the Potsdam are rocks containing the Olenellus fauna. In northern Arizona the section exhibited by the Grand Cañon of the Colorado shows at bottom the Grand Cañon and Chu-ár groups, which contain barely fossils enough to characterize them as early Cambrian. These were greatly eroded before the deposition of the Tonto with a profuse fauna equivalent to that of the Potsdam. The Silurian is absent, and the Devonian rests on the Tonto. In Wisconsin the Potsdam is underlain unconformably by the faunaless Keweenawan, and overlain conformably by the Silurian. In Vermont the Potsdam rests on the Georgian group containing the Olenellus fauna. In Tennessee the upper Cambrian is represented by the Knox shale, and the lower by the Chilhowee sandstone and the Ocoee conglomerate. In New Brunswick the St. John's group, and in Massachusetts the Braintree argillites, exhibit the Paradoxides fauna. At the Straits of Belle Isle the section is not continuous, but appears comparable with that of Nevada. The anomalous relations reported at Point Levis, in Canada, are attributed to error in the interpretation of the stratigraphy.

The Tonto group of Arizona and the Knox group of Tennessee are recognized by Mr. Walcott as the equivalents of the Potsdam of New York, Vermont, and Wisconsin. The Olenellus horizon of Nevada is correlated with the Georgian group of Vermont. The Grand Cañon and Chuar groups of Arizona are provisionally correlated with the Keweenawan of Wisconsin, and are regarded as older than the Georgian. The St. John's group of New Brunswick is held to be older than the Georgian, and probably younger than the Keweenawan and Chuar. The Chilhowee and Ocoee groups of Tennessee are provisionally assigned to the horizons of the Georgian and St. John's.

The paper marshals the stratigraphic evidence only, leaving the paleontologic to form the subject of a future communication. — (*Phil. soc. Washington; meeting* Nov. 24, 1883.) [518

PHYSICAL GEOGRAPHY.

Influence of climate on vegetation in Alaska. — In his remarks on glaciers in Alaska, Mr. Thomas Meehan remarked, that, on the top of what are known as 'totem-poles' in some of the Indian villages, trees of very large size would often be seen growing. These poles are thick logs of hemlock or spruce, set up before the doors of Indian lodges, carved all over with queer characters representing living creatures of every description. These inscriptions are supposed to be genealogies, or to tell of some famous event in the family history. The poles are not erected by Indians now, and it is difficult to get any connected accounts of what they really tell. At a very old Indian village, called Kaigan, there are a large number of these poles, with few, or, in some cases, no carvings on them, among many which are wholly covered; and these all had one or more trees of Abies sitkensis growing on them. One tree must have been about twenty years old, and was half as tall as the pole on which it was growing. The pole may have been twenty feet high. The roots of the tree had descended the whole length of the poles, and had gone into the ground from which the larger trees now derived nourishment. In one case the root had grown so large as to split the thick pole on one side from the top to the bottom; and this root projected along the whole length, about two inches beyond the outer circumference of the pole. Only in an atmosphere surcharged with moisture could a seed sprout on the top of a pole twenty feet from the ground, and continue for years to grow almost or quite as well as if it were surrounded by soil. He had seen a bush of Lanicera involucrata which was of immense size as compared with what he had seen in Colorado and elsewhere. The plant was at the back of an Indian lodge, and beside a pathway, cut against the hillside. The stems near the ground were as thick as his arm, and the whole plant was covered with very large blackberries. Stopping in admiration to look at and admire the specimen brought numbers of Indians to see what was the subject; and these smiled indulgently on being made to understand that only the sight of a huge bush had attracted the travellers' attention. — (*Acad. nat. sc. Philad.; meeting* Nov. 6.) [519

BOTANY.

(*Fossil.*)

Australian coal flora. — A memoir prepared with great care by Rev. J. E. Tenison-Woods is valuable to science, not only for the clear and detailed description of the fossil plants, but for the discussion upon the geological distribution of the coal-bearing measures of Australia.

The first notice in regard to the Australian fossil flora was given by Prof. Morris in 1845. In 1847 McCoy gave an elaborate paper on the flora and fauna of the rocks associated with the coal of Australia, and came to the conclusion that a wide geological interval probably occurred between the consolidation of the fossiliferous beds underlying the coal, and the deposits of the coal-measures, as he found no real connection between them, and as they were referable to widely different geological systems.

In 1848 Rev. Mr. Clarke dissented from the above conclusions, maintaining that there is no break whatever between the various beds containing the remains of plants described. His assertion was based upon his own discoveries, and the researches of Jukes and Dana.

After recording the long discussion between McCoy and Clarke, the progress made on the subject by Daintree, Feistmantel, etc., the author gives a clear exposition of the Australian coal-formations, as far as they are known at the present time, considering not only the remains of plants and animals found in connection with the strata, but the composition of the measures, and the localities where the strata have been examined. He gives the formations in the following series: —

1. Upper Devonian, with three species of plants.
2. Lower carboniferous, six species, among them three of Lepidodendron.
3. Permian (?), five species, among them two of Glossopteris.
4. Newer coal, trias (?) (Newcastle), fourteen species; of these, seven of Glossopteris, of which Glossopteris Browniana is most common, and also found in No. 3.
5. Rhaetic.
6. Upper lias (?), with two species.
7. Jurassic, with twenty-two species.

In recording the plants and their distribution, the author describes ninety-three species: twenty-seven are new. The plates are photographs of specimens. The remains of plants are very indistinctly and insufficiently represented. — (*Proc. Linn. soc. N. S. Wales*, viii. 37.) L. L. [520

ZOÖLOGY.

Reconstruction of objects from microscopic sections. — Born gives an elaborate description of his method of modelling, which is really very simple as well as ingenious. The sections are made with great care, all of the same thickness: they are next drawn with the camera, and the outlines transferred to wax plates, the thickness of which is chosen so as to correspond in relation to the thickness of the sections, as do the outlines to the superficial dimensions of the sections; or, in other words, each wax plate is cut out so as to represent the actual section equally magnified in all three dimensions. — (*Arch. mikrosk. anat.*, xxii. 584.) C. S. M. [521

Preservation of soft tissues. — Dr. Benjamin Sharp called attention to Prof. Semper's mode of preparing dried specimens of soft animals, and exhibited a couple of snails as illustrations of the admirable results of the process. The tissues are first hardened by being steeped in chromic acid, which is afterwards thoroughly washed out in water. The speci-

men is then allowed to remain in absolute alcohol until the water is perfectly extracted, when it is placed in turpentine for three or four days. It may then be dried and mounted. Specimens prepared in this way retain their characters in a very satisfactory degree, and are strong and flexible, the examples shown resembling kid. If the surface be treated, after drying, with a solution of sugar and glycerine, the natural colors will be restored; but the specimens must then be kept in hermetically sealed glass cases to preserve them from the dust. The objection to this mode of treating large specimens is the expense of the absolute alcohol: otherwise there is no reason why the largest animals should not be preserved by this process. — (*Acad. nat. sc. Philad.; meeting* Nov. 21, 1883.) [522

Preservation of protozoa and small larvae. — Hermann Fol recommends an alcoholic solution of ferric perchloride to kill small animals without injury to the tissues. It is diluted with water down to two per cent, and then poured into the vessel holding the animals. These then sink to the bottom. The water is poured off, and seventy per cent alcohol substituted. Change the alcohol, and add to the second dose of it a few drops of sulphuric acid: otherwise the iron may remain in the tissues, and cause them to overstain with coloring-reagents. The alcoholic washing should be thorough. Even larger animals (medusae, Doliolum, etc.) may be perfectly preserved by this method. The tissues may be subsequently stained by adding a few drops of gallic acid (one-per-cent solution) to the alcohol containing the specimens. The nuclei are stained dark, the protoplasm light brown, in twenty-four hours.

Fol also describes some new injection masses, which offer the advantage that they may be readily kept without spoiling. — (*Zeitschr. wiss. zool.*, xxxviii. 491.) C. S. M. [523

Fossils of Pachino. — The Marquis de Gregorio has published a brochure of twenty-five pages on the fossils of this locality. They comprise cretaceous forms of the horizon of Hippurites cornucopiae, and tertiary species of the horizon of Carcharodon megalodon Ag. The work is in octavo, and illustrated by six excellent phototypic plates representing corals, echinoderms, and a few mollusks. Simpulorbites, a new genus of Foraminifera allied to Orbitolites; Escharopsia, a new genus of Polyzoa; and Proteobulla, a form represented by casts, recalling Buccinulus, but with three strong horizontal plaits on the column, — are described and figured. — W. H. D. [524

Mollusks.

Spicula amoris of British Helices. — Charles Ashford contributes an interesting and comprehensive paper on the 'darts' found in connection with the reproductive apparatus in certain Helices. The dart is contained in a short ventricose pouch opening into the lower part of the vaginal tube, a little above the common vestibule, on the right side of the neck. There is usually one: if two are present, the second sac is on the opposite side of the tube from the first. The sac may be simple, or bilobate. At the bottom of the cavity of the sac is a conical papilla, which serves as a basis for the dart, which is attached to it by its posterior end. The apparatus is a development of adult life, and especially of pairing-time, but is indifferently present or wanting in species otherwise closely allied. The dart itself is a tubular shaft of carbonate of lime, tapering to a solid, transparent, sharp point, enlarging at or toward the base, where it assumes the form of a subconical cup. The sides of the shaft are sometimes furnished with blade-like longitudinal buttresses, which serve to strengthen it. They are rapidly formed, may be secreted in six days, and differ in form in different species. They are supposed to serve the purpose of inducing, by puncture, the excitement preparatory to pairing. They are too fragile to do more than prick the tough skin of these mollusks, but sometimes penetrate the apertures of the body, and are found within. A new weapon is formed after the loss of the old one. It is best extracted for study by boiling the sac in caustic potash. — (*Journ. conch.*, July, 1883.) W. H. D. [525

Shell-structure of Chonetes. — John Young, in the course of an examination of C. Laguessiana Kon., finds on the ribs a series of wide-set tubular openings, perhaps bases of spines, which do not extend to the interior of the shell; also a row of very minute close-set pores, placed along the central line of each rib, but which disappear after descending a very short distance into the shell-substance; a series of raised tubercles, which appear on the interior surface of the valves arranged between each pair of ribs in single rows, and which send rather distant tubules obliquely outward and backward as far as the middle layer of the shell; lastly, in the thickened cardinal edge of the ventral valve, corresponding to the spines with which it is ornamented, a series of tubes which open with round orifices on the interior, and which converge toward a point near the apex of the beak, but at the surface are continuous with the hollow of the tubular spines which point away from the beak in a direction nearly at right angles with their previous course. In a note on this communication, Mr. Thomas Davidson mentions that in Chonetes plebeia, tenuicostata, sarcinulata, and the Devonian C. armata, Mr. Young finds no trace of the external perforations described above in C. Laguessiana, although small perforations or tubules extended nearly to the middle shell-layer from the interior of the valves, slanting toward the beaks. In Productus (with a doubtful exception in the case of P. mesolobus), also, Mr. Young finds the perforations extending only part way from the interior, and never visible on the unabraded external surface of the shell. The same fact has been determined by him for the genera Strophomena and Streptorhynchus. — (*Geol. mag.*, Aug., 1883.) W. H. D. [526

VERTEBRATES.

Mammals.

Aortic insufficiency and arterial pressure. — Both Rosenbach and Cohnheim have stated that sudden insufficiency of the aortic valves, produced artificially, has no effect on arterial pressure. Goddard,

on the other hand, from experiments made upon rabbits, says, that after perforation of the aortic valves, there is an important fall of pressure. De Jager has repeated these experiments, using both dogs and rabbits. Upon dogs he finds that perforation of the valves has little or no effect on arterial pressure; whereas, with rabbits, a considerable and permanent fall of pressure is the result. It appears from these experiments that the compensatory power of the heart-muscle is greater in the dog than in the rabbit, although de Jager thinks that the results may be partly explained by the fact that the injury to the valves in the case of the rabbits was generally more extensive than in the case of the dogs. — (*Pflüger's archiv*, xxxi. 215.) W. H. H. [527

Structure of the placenta. — Ercolani has renewed the advocacy of his views on the mammalian placenta, according to which, after conception, the mucosa of the uterus falls off, and a new cellular decidual layer is formed, and after delivery the mucosa is re-formed. ports some new observations, particularly on the dormouse and on woman, by which he endeavors to strengthen his position. He writes in the form of letters addressed to Prof. Kölliker at Würzburg. Dr. H. O. Marcy, in the *New York medical journal* (July 28 - Aug. 4), gives an account of these letters, but adds nothing original. The difficulty as to Ercolani's views is threefold: he leaves in obscurity the exact histolytical and histogenetical changes in, 1°, the assumed shedding of the mucosa; 2°, the appearance of the new-formed decidua; 3°, the regeneration of the mucosa. For the present, Kölliker's view, that the maternal decidua is the metamorphosed mucosa, has at least an equal claim for acceptance with Ercolani's theory. — (*Rendic. accad. sc. ist. Bologna*, Jan. 28, 1883.) C. S. M. [528

Touch-corpuscles and other nerve-endings in man and apes. — W. Wolff has investigated the corpuscles of touch in Cercopithecus, the chimpanzee, and man. The corpuscles are essentially the same in all. They have an oval form, and are distinguished by having the connective-tissue envelope thrown into folds parallel with their long axis, the folds being delicate and close together. The content of the capsule is a granular, coherent fluid. According to Wolff, the supposed nerve-filaments seen in gold preparations are really precipitates formed in the folds of the capsule.

The author questions whether the nerves have any terminations in epithelium. His principal objection is, that, if the cornea of small animals is macerated for several hours in weak gold solutions, the epithelium falls off as a distinct membrane. Now, as gold fixes the nerves, if any filaments ran to the membrane, they would hold it down, and the epithelium would not separate. The author confuses fixing the optical form of the nerves and fixing their coherency. There is no reason against, but, on the contrary, many reasons for, assuming a maceration of the nerve-filaments in weak solutions of gold. In view of the very numerous positive observations of nerve-endings in epithelia, Wolff's argumentation is weak, and it appears unnecessary to follow his further deductions; viz., that since glands are modified epithelia, and epithelia have no nerve-endings proper, therefore the gland-cells have no nerve-endings. Such attempts to set aside a vast body of evidence on account of a few imperfect observations ought not to be countenanced. — (*Arch. anat. physiol., anat. abth.*, 1883, 128.) C. S. M. [529

The action of digitaline on the heart and blood-vessels. — The authors of this paper, Donaldson and Stevens, have made a careful and thorough study of the action of digitaline on the heart and blood-vessels, and have arrived at results differing from those usually accepted. The evidence obtained by previous investigators is summarized by them as follows: "Investigations on the frog's heart show an increase of work; investigations on the arterioles have led to contradictory results, with the weight of evidence in favor of a constriction." In their own work they made use of frogs and terrapins. The heart was completely isolated from the rest of the body, and kept alive by defibrinated blood supplied to it from the venous side; while the outflow of blood from the ventricles, in the method used, could easily be determined at any time, and the relative amount of work done by the heart, when pure blood or blood containing digitaline was fed to it, estimated. The conditions under which the heart worked were made, as far as possible, the same as those existing during life. The result of these experiments was that digitaline causes a decrease in the work done by the heart. On the other hand, digitaline injected into the living animal in moderate doses increases the blood-pressure. This increase of blood-pressure cannot be caused by the heart: it must result, therefore, from a constriction of the arterioles. Experiments were made in which the arterial system was supplied with normal salt solution at a constant pressure, and the outflow collected from the large veins emptying into the heart. The heart was thus excluded from the problem. It was then found, that, when digitaline was added to the circulating liquid, there was a diminution in the outflow from the veins; and this diminution could only be caused by a constriction of the arterioles. The result of their work, then, is that digitaline causes a decrease in the work done by the heart, but increases mean blood-pressure by constricting the arterioles. — (*Journ. of physiol.*, iv. 165.) W. H. H. [530

(*Man.*)

Cilia in the human kidney. — That a large portion of the renal tubules in cold-blooded vertebrates is ciliated has been known for some time. It has also been known, from the observations of Bowman and others, that the neck of the Malpighian capsule in mammals is ciliated. A. H. Tuttle found, from the examination of a large number of sections of human kidneys, that the convoluted tubule is very extensively, if not generally, ciliated. Where the flat lining-cells of the capsule approach the neck, they become cuboidal and ciliated also. The cilia in the kidney are from 3.5 to 5 μ long, very fine, numerous, and closely set. Confirmatory observations were made on the kidney of a kitten. The cilia are probably pres-

ent in all mammalia, and serve to propel the urine outwards or towards the ureter. — (*Stud. biol. lab. Johns Hopk. univ.*, ii. 453.) C. S. M. [531

ANTHROPOLOGY.

Man's place in nature. — One hears now and then the assertion that man is not the highest animal. In proof of this assertion, it is urged that this animal is far more specialized in one direction, and that animal in another. Mr. Lockington takes the ground that specialization is not in itself any proof of advance. Now, the real progress is not to be sought in the specialized offshoots of any series, but in the growing stem from which it is parted. The highest specialization is that based upon perfection of the greatest number of parts, not upon the great development of one part at the expense of others. "We need not ask morphologists or embryologists whether man is the highest animal: we have the proof of it every hour before our eyes. His powers of mind are the resultant of his structure, and have enabled him to conquer all other beings in the struggle of life. That animal is highest which possesses the widest range of faculties. This man undoubtedly does. No other animal has the power, by voice or pen, to exaggerate or depreciate its own importance; no other animal can use the powers of nature as he; no other can produce works which are proportionately comparable to his: and if, therefore, morphology or embryology contradict the facts of life, then are those sciences unsafe guides, as they certainly are only partial ones." — (*Amer. naturalist*, Oct.) J. W. P. [532

Notation of kinship. — In the study of kinship many schemes of graphic representation have been devised. A perfect system should exhibit three ideas: It should, 1. Identify each place in the series; 2. Classify kindred for each people; 3. Exhibit affinity or marriage, as well as kinship. Mr. Francis Galton presents us with a new scheme, identifying the members of the series and sex, in which arithmetical notation takes the place of letters or pictographs. — (*Nature*, Sept. 6.) J. W. P. [533

Curare. — M. Couty has made extended observations and experiments on the curare poison, and has given the benefit of his studies in a course of lectures in the museum of Rio Janeiro. The investigation closes with a modest confession of ignorance. "The *curare*," says M. Couty, "demands fresh physiological studies to comprehend the nature of its relation to the muscles and the nerves, and also the real significance of the various phenomena of excitement and paralysis which it occasions, before we should attempt to comprehend the intimate mechanism of its intoxicating influence." — (*Rev. scient.*, 1882, 587, etc.) J. W. P. [534

Color-words in the Rig Veda. — Geiger wrote, 'The men of that time [of the Rig Veda] did not and could not call any thing blue.' Mr. Edward W. Hopkins reviews the deductions of Geiger, and not only questions the facts adduced by him, but also doubts whether his application of the statements be admissible, even if proved to be facts. The use of color-words is not unlike that in other poetic literatures. Mr. Hopkins concludes: 1°. Non-mention of the colors green and blue is not proved for the Rig Veda literature; 2°. That the sky is not called blue, nor the fields green, rests on reasons which have nothing to do with the development of the retina; 3°. We cannot admit that either color-words or color-perception of those who composed the Rig Veda were inexact or imperfect; for the cause of the apparently inexact employment of words lies in the variable and uncertain color of the objects to which the color-terms are applied.

If the Vedic literature fail to support the theory of the late development of the color-sense, one of the strongest of the negative proofs is withdrawn; and even the absence of certain colors in Homer may be deemed, perhaps, of less significance than has been claimed when we consider that the Niebelungenlied exhibits, twenty centuries later, the same absence of corresponding colors, and a like ratio in the greater use of terms denoting red and yellow. — (*Amer. journ. phil.*, iv. 166.) J. W. P. [535

The Yuma linguistic stock. — In the year 1877 Mr. A. S. Gatschet brought together in two papers all that was then known with reference to the Yuma stock of languages spoken around the mouth of the Colorado of the west. Recently he has come into possession, through the Bureau of ethnology and private correspondence, of new and important material, and has been compelled to publish an appendix to his former papers. This consists of information respecting the names and characteristics of the tribes belonging to this stem; comparative vocabularies of the Yavapai, Ni Mai, and the Seri; the Yavapai vocabulary of Dr. W. H. Corbusier; and the Tonto vocabulary of Dr. John B. White. — (*Zeitschr. ethnol.*, xv. 123.) J. W. P. [536

The tempering of bronze. — No doubt, native copper attracted the attention of primitive man before any of its alloys; but the difficulty of working it for a long time prevented its general use. How the metal came to be associated with tin in various forms is entirely unknown to us. Arms and implements of bronze in Egypt, Greece, and Gaul, present a constant proportion of tin, — twelve per cent. The bronze of cannons is eight to eleven per cent; of bells, twenty to thirty per cent. Recently, at Réalon (Hautes-Alpes), a peddler's pack of bronze objects has been unearthed, showing eighteen per cent of tin.

The founders of prehistoric times seem to have had three methods of procedure: —

1°. The alloy was poured into a mould of stone or metal in two pieces. The ridge formed by the junction was afterwards hammered down.

2°. A model of wood was pressed upon a layer of sand in a box, to obtain a negative of one side: a corresponding operation gave a mould of the other side. The two boxes fitted together completed the mould. There were still seams requiring to be hammered.

3°. A model of wax was surrounded with soft clay. The clay was then heated to harden it and to melt

the wax. The metal was introduced at the opening left for the escape of the wax.

Soldering was unknown to the men of the bronze age: mending was done by riveting. The art of softening bronze was known to the ancients. Proclus says (Works and Days, line 1842) that "in ancient times men used bronze in cultivating the ground just as they use iron now; but that copper being soft in its nature, they hardened it by immersion." Eustathius also says (Iliad, book I., line 236) that they tempered the bronze when using it in place of iron. The chemist Darcet, at the end of the last century, showed: 1. That pure copper, heated to redness and plunged into cold water, is neither hardened nor softened; 2. Bronzes having only tin alloy, and that less than thirty per cent, heated and cooled in air, become weak and brittle; 3. The same bronzes, heated and cooled in water, are softened, and become very tractable.

It is nearly certain that the men of the bronze age tempered their implements in taking them from the mould. Those destined to stand a blow were left in this state. Arms and tools needing more temper were heated over, and cooled in the air.

Another prehistoric art, rediscovered by the engineers of Alexandria, and recently again brought to light from the orient, is rendering bronze flexible. This property of flexibility is certainly possessed by some very ancient specimens. The engineer Philo, who lived in the century before our era, describes, in his 'Treatise on artillery,' the fabrication of springs of bronze needed in some of his machinery.

The author from whom the foregoing notes are taken, A. de Rochas, will soon publish, through Masson at Paris, a volume on the origin of industry, and the first application of the sciences. — (*Rev. scient.*, Sept. 22.) J. W. P. [537

Seamy side of the Vedas. — Max Müller tells us in his recent work, 'India, what it can teach us,' that in the Vedas we have a nearer approach to a beginning, and an intelligible beginning, than in the wild invocations of Hottentots and Bushmen. Mr. Andrew Lang holds the mirror up to this assertion by showing that a highly civilized people are farther from the beginning in their religion than races which have not evolved nor accepted society. Again: there is nothing particularly wild in some of the invocations of the Bushmen (*Cape monthly*, July, 1874), nor of the Papuans (*Journ. anthrop. inst.*, Feb., 1881). Compare the prayer of Odysseus to the Phaeacian king. And, finally, the faith of Vedic worshippers was very near akin, in the wildness of its details and its mythology, to the faith of Bushmen and Hottentots. In the Rig Veda human sacrifice has left its traces, the practice enduring in symbols and substitutes which point back to something 'nearer the beginning.' The ninetieth hymn of the tenth book of the Rig Veda tells how all things were made out of the limbs of a giant, Purusha. A similar legend is found among Scandinavians, Iroquois, Egyptians, Greeks, and Tinneh. It would be easy to show that Vishnu, in the shape of a boar bringing up the world from the waters, is equivalent to the North American coyotes and muskrats performing the same feat. The origin of species from Purusha is matched only by the metamorphoses and amatory pursuits of Zeus, Kronos, Demeter, and Nemesis. Indeed, we seem to have a nearer approach to a beginning in the Vedic hymns, in those very portions in which they resemble the primitive philosophy of Bushmen and Navajos. The gods in the Vedic religion are deified nature; and we frequently see gods in animal form fighting with animals, afraid of enemies, behaving like the half anthropomorphic, half theriomorphic deities of the Australians, Hottentots, and Bushmen. The gods are begotten of heaven and earth, and are not necessarily immortal. The birth of Indra is very similar to that of Heitsi-Eibib, the supreme god of the Hottentots; and some of his feats have parallels in Scandinavian, Thlinkit, Murri, and Californian myths. Speaking of the other Vedic gods, Mr. Lang quotes the language of Racine respecting the deities of the Greeks: "Burning was too good for most of them. . . . If any one wishes to see at a glance how much savage thought persisted till the age of the Brahmanas, let him compare the myths of the constellations (*Sacr. books of the east*, xii. 282) with the similar myths in Brough Smyth's 'Aborigines of Victoria.' Except upon the hypothesis that the Aryans came civilized into the world, they must have descended from savage ancestors. That they retained savage practices, such as human sacrifices, and much worse things, is universally admitted. Why should they not have retained savage ideas in religion and mythology, especially as of savage ideas Aryan mythology and religion are full to the brim?" — J. W. P. [538

Anthropology at Berlin. — The organ of the Berlin society of anthropology has just completed its fifteenth year, and contains matter of interest not only to the local but also to the general student. Part iv. opens with a paper by Ernst Bötticher on the analogies of the Hissarlik finds. Dr. Schliemann's 'owl-faced' vases are characterized as *canopus* vases, and thus connected in type with the various art productions of Egypt, in which the bird-face predominates. The ornamentation of funereal urns with a bird-face, — be it that of a falcon, owl, or sparrow, — and the occurrence of the same custom from the Baltic to the Nile banks, are worthy of remark. Until historic evidence clears up the subject, the learned must move their opinions back and forward in the alternation of independent evolution and social contact. —— Prof. Arzruni reviews the jadeite and nephrite discussion, quoting and criticising the writings of Meyer, Damour, Janettaz and Michel, Fischer, Beck, and v. Muschketow. The author carefully excludes from the discussion minerals which have been confounded with those above named, and also mentions the fact that they have different characteristics in different localities. In Europe, up to this time, neither jadeite nor nephrite has been found *in situ*. Prof. Arzruni closes his paper with the citation of those localities in each continent which have furnished the minerals or their products. —— M. Kulischer speaks of the handling of children and

youth upon the lower culture steps. He broaches a very ingenious theory, which seeks to include infanticide and all sorts of torture and ordeals in a common category of helping the survival of the fittest. In savagery, intimates the author, two children are as many as the parents can raise: they knock the surplus on the head. They subject their sons and daughters to frequent vigils, fastings, fatigues, and pains, mourning for them meanwhile as dead. Indeed, many die under the treatment, but the fittest survive. Very many scraps of information, gathered here and there, are brought within the range of the author's theory. In this connection, one should not fail to consult Ploss: 'Das kind in brauch und sitte der völker.' —— Mr. Aurelius Krause read a paper upon the relationships existing among the peoples of the Chukchi peninsula. Are the coast Chukchi and the reindeer Chukchi the same people? —— In speaking of the 'footsteps of Buda,' — a gigantic track found in the ruins of the most hallowed shrine of Buddhism at Gaya, in southern Bihar, — M. Grünwedel calls to mind, that in every part of the world are to be found, in solid rock, impressions made by the feet of gods and heroes. —— Gen. von Erckert sends to the society from Petroosk measurements of the weight, length of body, and length of limbs, taken from Russian peoples, — Wotjaks, Great Russians, Little Russians, Volga Tartars, Meshtsheraks, Poles, Bashkirs, Tscheremis, and Jews. — (*Zeitschr. f. ethnol.*, xv. pt. 4.) J. W. P. [539

The London anthropological institute. — The unlimited resources of British anthropologists lead one always to expect something good from the journal of the institute. The first paper in the current number is by F. Bonney, on some customs of the aborigines of the River Darling, New South Wales. Mr. Bonney resided on a sheep-range from 1865 to 1880, and therefore knew the Bungyarlee and Parkungi tribes 'before they were spoilt by civilization.' The aboriginal population, owing to periodic droughts of great severity, could never have exceeded 100 on an area of 2,000 □ m. Epidemics also have told upon the people. There is a typical similarity among all Australian aborigines; but, to a close observer, each tribe has its own peculiarities. The oft-repeated statement that they are the lowest type of humanity is a libel. Mr. Bonney describes their parturition customs, systematic infanticide, child-rearing, initiation of youth, class-marriage, courtesy, charms, sucking-cure, diseases, blood-cure, burials, and mourning. —— Mr. Tremlett writes of stone circles in Brittany, by which is meant two concentric rings of rude stone masonry, covered by a mound. One, called Nignol, was undoubtedly a cremation mound; since, exterior to the outer circle, cinerary urns were found, as well as between the walls. The inner circle consisted almost entirely of ashes and charcoal. Two others were similarly constructed, — one at Coët-a-touse, the other at Kerbascat. —— The subject of group-marriage is reviewed by Mr. C. S. Wake, and an attempt made to show its origin. The author assumes two fundamental rights, — the individual, or sexual; and the tribal, or self-protective. The origin of the Australian four-class division is to be sought in the separation of the original marrying group into two grades, a parent and a child grade. —— Major H. W. Fielden exhibited a series of South African stone implements. —— The Rev. James Sibree, following up the investigations of Col. Garrick Mallery, U.S.A., reports a number of gestures from Madagascar as a contribution to the study of comparative sign-language. —— Mr. A. W. Howitt reports some Australian beliefs, commencing with a delightful paragraph or two on synonymy, which we should like to quote. The superstitions described relate to the physical universe, the human individual here and hereafter, and Ghost-land. —— On the 19th of June a special meeting was held at the Piccadilly hall, by invitation of Mr. C. Ribeiro, who exhibited five Botocudo Indians and a collection of implements. —— Mr. A. H. Keane read a paper on the Botocudos. Their home is the province of Espiritu Santu, in Brazil; their name, probably from the Portuguese *botoque* (a barrel-plug), alluding to their labrets. The Tembeitera, or lip ornament, and the immense ear-plugs, give rise to an extended notice of the geographical distribution of these objects. The Botocudos are of Guarani stock physically, although of non-Guarani speech. Their physical characteristics are elaborately set forth by Mr. Keane, and extended references made to their culture, sexual relations, dwellings, industries, tribal organization, burials, religion, and language. — (*Journ. anthrop. inst.*, xiii. no. ii.) J. W. P. [540

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Geology. — Mr. J. S. Diller, an assistant of Capt. C. E. Dutton, who has charge of the investigation of the volcanic rocks in the division of the Pacific, made a geological reconnaissance of the Cascade Range, during the early part of the season, in exploring the eastern side of the range; going as far north as the Dalles, and thence to Portland, finally coming down on the west side to Red Bluff, California. He and his party travelled some twenty-five hundred miles. They were unable to do any topographical work on account of the smoke, which also interfered with the work of Mr. Gilbert Thompson (chief topographer of the California division) in the neighborhood of Mount Shasta.

Paleontology. — During the past season Mr. Charles D. Walcott received at the office, for the use of the National museum collections, a series of