THURSDAY, DECEMBER 15, 1898.

HINDU MANNERS AND CUSTOMS.

Hindu Manners, Customs and Ceremonies. By the Abbé J. A. Dubois. Translated from the Author's later French MS., and edited with notes, corrections, and biography by Henry K. Beauchamp. With a Prefatory Note by the Right Hon. F. Max Müller, and a Portrait. Pp. xxxvi + 730. (Oxford: at the Clarendon Press, 1897.)

THE work of the Abbé Dubois, both in the original French, and in the English editions—the one published in 1816, the other some thirty odd years ago—has long been a standard work on modern Indian customs, much valued and frequently quoted by ethnologists. But strange to say, what has hitherto been known as the Abbé's work is in fact merely a rough sketch and (as Mr. Beauchamp says) "only an extremely poor representation of what the Abbé's great work really was." The history of the book is peculiar. The French MS. of the original draft was placed in the hands of Major Wilks in the year 1806, when the Abbé had been about fourteen years in India. Major Wilks studied the work, and on his recommendation the MS. was, in 1807, purchased by the Madras Government and transmitted to London for translation and publication. Yet the English translation was not published until 1816. In 1815 the MS. was returned to the Abbé, and he "put into it all the additions and corrections suggested by many years of additional study and investigation; and when he sent it back to the Government of Madras, it was, practically speaking, a different work altogether." However, neither this revised MS., nor a finally corrected copy prepared by the Abbé three years later, have ever been used for the editions hitherto published, although both MSS. were sent to England and preserved in the India Office Library. One copy of the finally revised MS. was left in the records of Fort St. George, and this has now been translated and edited by Mr. Beauchamp, so that at last we possess the Abbé's work in its final and corrected shape.

The work of the Abbé Dubois is vastly superior to the ordinary accounts of travellers and missionaries in India. Few Europeans have succeeded in obtaining so much valuable information concerning the life of the natives as the Abbé. The secret of his success is best told in his own words (p. 10):

"I had no sooner arrived amongst the natives of India than I recognised the absolute necessity of gaining their confidence. Accordingly I made it my constant rule to live as they did. I adopted their style of clothing, and I studied their customs and methods of life in order to be exactly like them. I even went so far as to avoid any display of repugnance to the majority of their peculiar prejudices. By such circumspect conduct I was able to ensure a free and hearty welcome from people of all castes and conditions, and was often favoured of their own accord with the most curious and interesting particulars about themselves."

That he went about in this way, and identified himself, as it were, with the people, makes the Abbé's account of Hindu manners, customs, and ceremonies so very valuable even in the imperfect form in which it has been known for years, and of course all the more valuable in its final and corrected form as presented to us by Mr. Beauchamp. Times have changed, no doubt, since the days when Abbé Dubois wrote. But Mr. Beauchamp is certainly right in saying that the work is "as valuable to-day as ever it was; even more valuable in some respects." For although the Abbé's work is merely an account of the inner life of the Hindus as seen and studied by him at the beginning of this century and in a limited area, viz. the country that lies south of the Vindhyan range, yet the broad facts of Hindu religion and sociology, as recited by the Abbé, are to a great extent true for a much wider area, and they are extremely instructive when compared with the facts known from ancient Hindu literature on the one hand, and with the manners and customs of the present day on the other.

Mr. Beauchamp has added some very valuable notes which go far to prove that the Hindu character is not quite as unprogressive as it is generally imagined to be, that even in India civilisation is not at a standstill, but that some progress has been made even within the short space of seventy or eighty years. On the other hand, if we compare the Abbé's account of Hindu life with what we know from ancient Hindu literature (and our knowledge of *ancient* Hindu life has become infinitely more accurate and comprehensive than it was when the Abbé wrote), we are constantly startled by the tenacity with which ancient customs survive in India. And for this very reason the Abbé's description is of inestimable value for the student of ancient India.

The most valuable parts of the book are those in which the author relates what he has seen himself. The Abbé is a shrewd and patient observer, and his account is full of the most interesting information about caste divisions, religious ceremonies and superstitions, about witchcraft, social customs, especially marriage rites (pp. 214–235), burial and mourning customs (pp. 321 *sq.*; 354 *sqq.*; 488 *sqq.*), about the status of women (pp. 315 *sqq.*, 339–370, &c.), infanticide, customary law, snake worship, cattle worship, &c. The Abbé has even a vague idea of what is now called comparative mythology (*cf.* p. 550 *sqq.*).

But what he relates, not from his own observation, but from literary documents (written in Sanskrit or Tamil), must be used with great caution, and should be compared with more recent and authentic publications, such as the works on Hindu law and ritual translated in the "Sacred Books of the East." The books from which the Abbé derives his information are mostly modern compilations of a sectarian character. Thus, the "Nittia-Karma" (rather "Nityakarma"), from which the author quotes largely (p. 238 *sqq.*), is evidently a text of the Vaishnava sect, and many of its details would not be applicable to members of other sects.

It must also be borne in mind that the Abbé is a Christian missionary, and his judgment is by no means unbiased. His strictures on the Hindu character are certainly most unfair, and his wholesale condemnation of the Brahmans as a class cannot be accepted by any serious student. Our acquaintance with the history of civilisation in India enables us to gain a far more favourable view, both of the moral and intellectual development of the Hindu nation. To quote only one example. What the Abbé says (p. 380 *sqq.*) about the learning of the

Brahmans, contending that they have not systematically cultivated learning, and that they have not made any appreciable progress in its pursuit, is absolutely false in the light of our present knowledge of Sanskrit literature. A mass of scientific literature (on grammar, astronomy, medicine, philosophy) is there to contradict such a statement.

The Abbé's knowledge of Buddhism is derived from very secondary sources—evidently from accounts given by the most passionate opponents of the Buddhists. Hence he speaks of "this odious doctrine" of "pure materialism," and of "this abominable school" (p. 415) with utter contempt. Had he known Buddhism from its own literature, and been able to acquaint himself with Buddhist ethics, or had he known only the older and purer Sanskrit literature (which, indeed, in his days was scarcely accessible), his judgment of the moral character of the Hindus would probably have been less partial, and his picture of the Hindus as a nation would have shown brighter features than is the case now.

The editor and translator has performed his task very creditably. We should only have wished that the Sanskrit quotations had been given in a more correct form, and a more modern spelling of the Sankrit names and terms substituted for the spelling used by the Abbé. The index (of six pages to 724 pages of text!) is rather too meagre for a work of such an extent, and treating on such a variety of subjects. But these are minor faults in a work for which every Indologist and Ethnologist will be thankful.

M. WINTERNITZ.

FOSSIL PLANTS.

Fossil Plants for Students of Botany and Geology. By A. C. Seward, M.A., F.R.S., F.G.S. Vol. i. Pp. xviii + 452. (Cambridge University Press, 1898.)

THE botanical side of palæontology has been passed over in general treatises and text-books in a manner that shows the authors had little, if any, personal knowledge of fossil plants. This has been due to the want of any trustworthy elementary manual on the subject. Mr. Seward's admirable book, of which only the first volume is published, will supply this want. Though addressed to students of botany and geology, it must be regarded mainly as a guide to palæobotany for the benefit of the former, since no one not well versed in botany could follow the technical descriptions of such structures, for example, as the Calamites. On the other hand, introductory chapters on geology and the conditions under which fossil plants are preserved, enable the botanical student to read the book with no previous study of geology.

Mr. Seward, while not going so far as the late Prof. Williamson, who would diagnose no fossil plant which did not exhibit internal structure, lays great stress on the pitfalls in the way of those who have to determine fossil plants in which no structure is preserved. The group of jointed stems on p. 95, belonging to Cryptogams, Gymnosperms, Monocotyledons and Dicotyledons, is scarcely a happy illustration of the danger of trusting to superficial resemblances, since hardly any one at the present day would be likely to base determinations on such material without collateral evidence. In collecting and studying fossil floras, if these are at all extensive, it is easy to perceive whether they are from damp or dry stations, from temperate or warm climates, and so on; and such considerations would materially help in ascertaining whether Equisetum or Casuarina and Ephedra would be likely to be present. The worker, however, is rarely obliged to rely on isolated leaves or twigs, and an examination of the matted masses in which Equisetum is usually fossilised, is convincing as to the real nature of the plants. In dealing with late Cretaceous and Tertiary plants it may be well to remember that continental floras, now held to be indigenous to certain regions, have formerly been migratory over wide areas, and are probably now but sojourners on the spots they occupy. The genera composing them were associated together in the past much as they are now, a fact that may assist in their determination. Floras of oceanic islands have probably been indigenous from remote periods, as with the Tertiary plants of Madeira, which comprised few exotics.

Palæontologists may hardly agree as to the propriety of adding the terminations "ites" or "opsis" to recent genera when they have been proved to have existed in the fossil state, unless the nomenclature of plants is to differ from that of animals, otherwise we should have Nautilites, Terebratulites, Ostreites. Such terminations are more useful when implying doubt as to the actual identity of the recent and fossil genera. These, however, are minor matters, and the introductory chapters are on the whole so lucid and sufficient, presenting all requisite information in so concise and reasonable a manner, that there is little room for criticism.

Almost 300 pages of the first volume are devoted to the "systematic" description of fossil plants, beginning at the lowest and leaving off in the midst of vascular cryptogams. The lowest forms of plant life, unless partly siliceous or calcareous, are rarely preserved, and are of little interest to the geologist or palæontologist. The completeness with which even the largest seaweeds decay, especially the brown algæ, leaves little hope that many can have been preserved; and there can only be one opinion as to the wisdom of discarding all problematical markings. The ancient and gigantic Nematophycus is almost the only one determined with certainty. It was remotely allied to Laminaria, and is met with in Silurian and Devonian rocks. The Diatoms, so far, do not appear to be more ancient than the Lias. The Siphoneæ are a group of exceptional palæontological interest, and though most of the Caulerpites of old authors are passed over, the minute and often beautiful calcareous organisms so familiar to collectors of Eocene mollusca receive adequate attention. The very ancient Corallinaceæ, the plant nature of many of which has only recently been admitted, are fully dealt with, and the extensive part they are now known to have played as reef-builders is recognised. The Characeæ form a distinct group, the Charophyta, the fruits of Chara, so abundant in the Eocenes, first definitely appearing in the Jurassics, if not indeed in Palæozoic rocks.

The fossil Hepaticæ are of little interest, being so poorly represented in the fossil state, and of those recorded the author scarcely accepts any except the Marchantites of Sezanne and some of the fragments preserved in amber. Though it seems so probable that mosses must have been well represented in carboniferous

forests, no unmistakable specimen of that date has yet been discovered.

The concluding chapters are devoted to vascular cryptogams, over 140 pages being assigned to the Equisetales, chiefly to the remarkable group of Calamites, which must have been so conspicuous an element of carboniferous vegetation. Though cryptogamic, they formed large trees forty or fifty feet high, with woody trunks of exogenous growth. For this reason a section of the Calamites named Camelodendron have been and are even yet regarded as Gymnosperms by some French writers. The genera and species of this group are peculiarly difficult to diagnose, every organ being detached and preserved in a different manner. Internal casts of pith cavities in sandstone are the most familiar objects, but the more valuable specimens are those which preserve their internal structure, so ably deciphered by Williamson and others. The foliary organs are found separately in the shales and ironstone nodules; and the strobili in various conditions, which have permitted their internal and external structure to be examined. The roots of several kinds are also found detached from the stems. The author, without attempting to unite these scattered organs into specific wholes, has grouped the facts in the clearest manner. The variety presented prove that several distinct generic types existed, and as each variety of each separate organ was first described in ignorance of its probable relationship to the other, a complicated nomenclature has resulted. The Calamites, well represented in the Devonian, did not survive the Permian, though represented in the newer rocks by the closely related Equisetum.

The second important carboniferous group, Sphenophyllum, is also placed in a separate class, the Sphenophyllales, as a type that cannot be assigned to any existing group. Its leaves are wedge-shaped, with one or several veins and disposed in whorls, the strobili long and narrow, and the stem slender and woody. It was possibly a climbing plant, and is regarded as linking the Calamites and Lycopods.

In so brief a notice it is difficult to do justice to a work so full of matter and observation. Botanists and geologists must equally congratulate themselves on having so obscure and difficult a subject put before them for the first time in a really lucid and comprehensive manner. J. S. G.

INFINITESIMAL CALCULUS.

Infinitesimal Analysis. By William Benjamin Smith. Vol. i. Pp. xvi+352. (London: Macmillan and Co., Ltd., 1898.)

IT may be assumed that the contents of this volume represent, on the whole, the author's conception of a reasonable first course for the average University student. Judged from this point of view, the work certainly deserves approval, and is a favourable specimen of the class to which it belongs.

In the first two chapters the processes of differentiation and integration are explained, with appropriate graphical illustrations. No attempt is made to discuss all the subtleties which modern function-theory has shown to be involved in the assumption of the possibility of differentiation and integration, but the analysis, so far as it goes, is sound, and something is done to guard the student from making false generalisations.

The next four chapters deal mainly with applications. These have been judiciously selected, and are of practical importance as well as theoretical interest. Kinematical applications might have been advantageously included; in fact, considering the general character of the book, it is strange that kinematical considerations have been almost entirely ignored.

Chapter vii., on partial integration, concludes with Green's theorem; it is a pity that Stokes's theorem was not also included. A short but useful chapter on definite integrals, and another on curve-tracing, conclude the volume.

On pp. 18–20 there are some remarks about velocity with which we profoundly disagree. After allowing that "according to the most familiar notions" $\Delta s/\Delta t$ "is the *average speed* (or velocity) during the time Δt," and that "if the space be a function of the time" (it is difficult to see how any other assumption could be made) then in general $\Delta s/\Delta t$ has a definite limit ds/dt when Δt becomes infinitesimal, Prof. Smith proceeds:—

"Mechanically, however, this limit is not itself an average speed at all, it is not of the same nature as the variable difference-quotient $\Delta s/\Delta t$. For this quotient *never* assumes this limiting value, no matter how small Δt be made. And this is quite what we should expect and what the nature of the case demands. For motion implies duration, however small, of time, and change, however small, of place. When there is no lapse of time and no displacement there is no motion, and hence no speed (or velocity). In all strictness, there can be *no motion at an instant* and hence no *speed* (or velocity) *at* an instant. The concept of speed (or velocity) or motion will not combine with the concept of instant (or point of time) to form a compound concept."

Surely Prof. Smith has here confounded the concepts of motion and displacement. If we allow that motion at an instant is impossible, how are we to escape Zeno's paradoxical conclusion that all motion is impossible? How can I move from one place to another during a minute, say, if *at every instant* of that interval motion is impossible? The remark, later on, that "this limit of the average velocity, characterises not the action but the state of the body, and is itself *not* a velocity though everywhere named so," does not improve matters, and is really irrelevant. The definition of velocity is quite independent of such question-begging terms as "action" and "state." Each of these terms, as applied to velocity, is just as good and just as bad as the other: it is when we add the words "of the body" that the metaphysical difficulty comes in, on account of the relativity of motion. But assuming that we can form a clear concept of a continuous displacement expressed by a law $s=f(t)$, there is neither a logical nor a metaphysical difficulty in proceeding to $\dot{s}=f'(t)$ and saying that this is the velocity at time t, if we have already agreed that when $s=at+b$, the velocity is a (a, b being constants): that is, in whatever sense a measures the velocity for the law $s=at+b$, then *in precisely the same sense* $f'(t)$ measures the velocity at time t for the law $s=f(t)$.

Another passage to which we feel bound to call

attention is example 18, p. 229. Here the analysis really solves the problem of finding when $(a+1)(\beta+1)\ldots(\lambda+1)$ is a maximum subject to the condition that $a^{\alpha}b^{\beta}\ldots l^{\lambda}=N$; $a, b, \ldots l$, N being given quantities. But the heading of the article is, "How must the prime factors of a number enter into it that it may have as many divisors as possible? (Waring)," a question from which we have vainly tried to extract any meaning whatever, and with which, in any case, Prof. Smith's analysis cannot have anything to do. G. B. M.

OUR BOOK SHELF.

Die Optik der elektrischen Schwingungen. (Experimental Investigations on Electro-magnetic Analogies of the most important Optical Phenomena.) By Prof. A. Righi. Translated into German, with additions by the author, by B. Dessau. Pp. xi + 267; with 40 illustrations and figures. (Leipzig: O. R. Reisland, 1898.)

THOSE to whom Prof. Righi's Italian edition of last year was not accessible, will welcome this German translation of his interesting book. The reproduction, by means of electro-magnetic waves, of some of the more complex optical phenomena, necessitates the use of an oscillator which gives out a series of waves that do not decrease too rapidly in intensity, and that are considerably shorter than those used by Hertz in his experiments.

Prof. Righi has carried on a number of investigations with such oscillators which emitted waves ranging upwards from 2·6 cms. in length, and the present volume is devoted for the most part to an account of this work.

The first part deals with a detailed account of the construction and use of his oscillators and resonators, and with the secondary waves due to the presence of the receiver and neighbouring bodies. These effects are studied first, in order that they may not lead to misinterpretations in the later results.

In the second part the electro-magnetic analogies of many optical phenomena are considered.

The working details of the experiments are given, and the difficulties attending them are pointed out, thus enabling one to reproduce the effects with the least amount of trouble.

Two investigations which have appeared since the publication of the Italian edition are then appended, and the last part of the book consists of mathematical additions on various topics connected with the subject in hand.

The book is written in an able manner, and conveys to the reader a clear idea of the properties of electrical waves, and Prof. Righi's method of manipulating them. J. Z.

Calculations in Hydraulic Engineering. By T. Claxton Fidler, M.Inst.C.E., Professor of Engineering, University College, Dundee. Part i. Pp. xii+155. (London: Longmans, Green, and Co., 1898.)

THIS is the first part of an extended treatise, and it discusses Fluid Pressure and the Calculation of its Effect in Engineering Structures. The treatment of the subject is refreshing and stimulating, by contrast with the arid methods of our scholastic text-books. The illustrations of the abstract theory are taken from actual problems on a large scale, which appeal to the engineering student, to whom this treatise is addressed. A striking novelty is the discussion in Chapters iv. and vi. of the buckling tendency in straight pipes under uniform fluid pressure. Although the material of the pipe carries no longitudinal thrust, the conditions of stability are exactly the same as in Euler's theory of the bending of a column. This paradoxical fact is discussed theoretically, and its experimental verification is described in an Appendix. Chapter v. is on Fluid Arches, and shows how the pressure in a main, forming a tubular arch, can be used to assist the stability. We are reminded of Prof. Fitzgerald's suggestions of inflated structures and columns, and the pneumatic system of architecture, in which the strength is kept up by compressed air, pumped in at intervals as required, as in the tires of our bicycles. A short account of Prof. Fitzgerald's theory will be found in the recent edition of Perry's "Applied Mechanics." Chapters viii. and ix. treat of the equilibrium and stability and bending stresses of floating bodies, not from the point of view of the Naval Architect, but as required by the Civil Engineer in the design of pontoons, bridge-caissons, and gas-holders.

The diagrams are carefully drawn to represent some real actual construction, and the illustrative examples are worked out to their numerical conclusions, an essential part of the theory for the engineering student, although so completely ignored in our academic treatises. G.

Birds of the British Isles. By John Duncan. Pp. xvi +448; illustrated. (London and Newcastle: Walter Scott, Ltd., 1898.)

THE excellent illustrations and brief descriptions of British birds published in the *Newcastle Weekly Chronicle* met with such a favourable reception, that the author has considered it advisable to reproduce them in book-form. And in their new guise they form a volume which can scarcely fail to be acceptable to readers with limited purses, since, while every species is figured, the published price of the work is only five shillings. Neither can it be said that the volume is "cheap and nasty"; the type being clear and good, and the illustrations for the most part of high merit. Perhaps, indeed, they lack the pictorial elegance of photogravures, but as good specimens of wood-engraving they leave little to be desired; and there are many reasons why that style of illustration should not disappear from works of natural history. In many respects Mr. Duncan appears to be a disciple of Bewick; and in the case of the cuckoo (p. 142) so closely has he followed his master that his figure is merely a reversed replica of the original cut, with some additional details of surroundings. Generally, however, the figures are original, and they are often in advance of those of Bewick.

Although brief, the descriptions appear sufficient to identify the species. In the introduction, by Mr. C. Dixon, criticism of the work from a literary standpoint is deprecated; but the author might have ascertained that the British Isles form part of the Palaearctic region (p. 191), and also that the word *palaios* contains four vowels. As a whole, the volume is a highly creditable and artistic production. R. L.

Railway "Block" Signalling. By James Pigg, A.I.E.E. Pp. 387. (London: Biggs and Co.)

THIS account of the development and details of the "block" system of railway signalling brings together a large amount of interesting information upon a method of regulating railway traffic which has assisted very considerably in bringing about the present state of precision and safety in railway work. The system has been in use for about thirty years, and it now represents the most extensive of all the adaptations of electricity to railway work. Mr. Pigg describes clearly the principles of train signalling and the apparatus employed; he also includes in his work the codes, regulations, and rules relating to railway signals of various kinds. With regard to the lines along which developments will probably be made he remarks:—"Railway signalling appears to have now reached a stage at which some departure from the present methods seems probable. The lines upon which changes will be made will, in all probability, result in a greater degree of automatic control than obtains at present."

The volume is an instructive contribution to an important subject.

The Story of Geographical Discovery. By Joseph Jacobs. Pp. vi + 224. (London: George Newnes, Ltd., 1899.)

MR. JACOBS has written a very readable little book. The historical aspect of geographical discovery is interestingly dealt with, and many subjects not usually included in books of geography are rightly given considerable prominence. The text is illustrated with twenty-four helpful maps, which serve to show the gradual increase of knowledge of our globe. The concluding table, showing the progress of geographical science from the time of Anaximander of Miletus down to the voyage of the *Challenger*, is most instructive. The author has collected his material with discrimination, and has evidently devoted much time and care to the preparation of his inspiring little volume. The recent marked development of imperial instincts should ensure the book the popularity it merits.

The Sphere of Science: a Study of the Nature and Method of Scientific Investigation. By F. S. Hoffman, Ph.D. Pp. viii + 268. (New York and London: G. P. Putnam's Sons, 1898.)

THIS book is the outcome of a series of lectures recently given by the author to his classes in Union College, to supplement their work in formal logic. Its object is to make clear what constitutes a science, and the grounds upon which every science must rest.

Very naturally, an important place is given to such considerations as the aims of science, what science takes for granted, the scientific method, and the limitations of science. Dr. Hoffman is always readable, and his style is pleasing. The book is by no means only a text-book; it will be found interesting by many educated readers, and should prove particularly useful in providing students of science with a knowledge of the groundwork of scientific investigation.

Chloroform: its Absolutely Safe Administration. By Robert Bell, M.D. Pp. 40. (Glasgow: R. L. Holmes, 1898.)

DR. BELL states the results of over thirty years' experience in the administration of chloroform. He writes "as one having authority," since he has no death to record from the use of chloroform throughout this long practice. It is maintained that when properly administered, there is absolutely no danger attending the use of chloroform as an anaesthetic; and Dr. Bell gives a large amount of evidence in support of his contention.

A Middle Algebra. By William Briggs, M.A., and G. H. Bryan, Sc.D., F.R.S. Pp. vi + 354. (London: W. B. Clive.)

IN this volume a knowledge of the more elementary properties of quadratic equations and progressions is assumed, and the requirements of candidates for the intermediate examinations for degrees at the University of London are especially borne in mind. Prof. Bryan's name is a guarantee for the accuracy of the book; and the arrangement, printing, and general appearance leave little to be desired.

Primer of Geometry. By James Sutherland, M.A. Pp. 117. (London: Longmans, Green, and Co., 1898.)

MANY of the early propositions in Euclid's First Book are reduced to actual measurements in this volume, and are thus brought within the ready grasp of the mind of the average boy. The book really teaches the rudiments of geometry and mensuration upon Fröbelian principles. Where the exercises it contains can be carried out, some of them will prove of educational value; but others are misleading.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Syrian Fishes with Abnormal Eyes.

NEAR the town of Hasbeya, Syria, arise springs which constitute in part the source of the small Hasbany river. In a short stream formed by those waters, I have found several varieties of abnormal-eyed fish, which, for convenience, may be grouped under five heads.

Fishes with (1) large protruding eyes; (2) an eye normal, and the other large and protruding; (3) half-protruding eyes; (4) two abnormal eyes unequal in size and development; (5) one eye normal, and the other rudimentary. At less than a hundred feet from the above-mentioned stream are two caves, but, strangely enough, only normal-eyed fishes could be found in the waters adjacent. The abnormal fishes are restricted to that stream, and are in the ratio of about one to four to the normal ones. The water is cold and tolerably clear, shallow near one bank and gradually deepening towards the other, to a depth not exceeding 7 feet in summer. No kingfishers or other fish-catchers were observed. Some of the fishes belonging to No. 1 had dark bodies and dark eyes, and seemed from their mode of motion to be little, if at all, sensible to light. Others belonging to No. 2 showed, by introducing a foreign object now near the normal eye and now near the abnormal one, that the latter saw less than the former. Dr. William van Dyck and Prof. A. E. Day, of the American College in Beirût, saw the fishes, and agreed that they had not met with any of the like during their study of the fauna of Syria. I may state that, having a small quantity of specimens, I would very willingly put it at the disposal of any specialist who may be interested in the question.

SALEEM MAKARIUS.

Al-Mokattam, Cairo, December 2.

Birds and Poisonous Fruit.

IT is naturally difficult to obtain direct evidence as to how birds rid themselves of the indigestible parts of the fruit they eat. It is a question to which I have given some attention from its bearing on the dispersal of seeds. I have found large quantities of the seeds of hawthorn, dog-rose, mistletoe, and ivy evidently voided by birds, as I incline to think generally as fæces, especially in the case of the hawthorn and ivy. Some large bird, I suppose the rook, consumes ivy berries largely in the spring, and gets rid of the seeds in what appears to be a mass of excrementitious matter. Many of these have not lost their vitality, and germinate readily in the same season. I have some thriving ivy plants obtained from such seed sown in 1896, and numerous seedlings this year of similar origin, the seed being sown on April 28, and coming up on June 7. I do not think much stress need be laid on the fact that much of the fruit swallowed is voided undigested, though the mistle-seeds I found were in a mass something like a lump of frog-spawn, with much of the pulp of the berry still adhering to each seed. I fancy birds and beasts, like many human beings, frequently swallow greedily far more than is good for them, especially when they light upon an abundant supply after enforced abstinence. An observant farmer informs me that horses coming in hungry to the manger will, if allowed, swallow corn more rapidly than they can digest it, if the grains are supplied whole, and that a large proportion passes in a condition to germinate. For this reason he has it crushed before given to them. I could supply Mr. Bennett or Mr. Lowe with some other curious evidence on this question if they care to have it, and will send their address.

Bedford. E. M. LANGLEY.

I CAN confirm Mr. Lowe's theory on this question.

For many years I have had robins coming to the hand for food in my garden. Before flying to the hand they constantly wait until they have succeeded in ejecting seeds from their crops. Great tits and blue tits also come to the hand, but never pause to eject anything. They are probably not large consumers of poisonous fruits.

I have on my lawn a large round china dish on an iron stand, in which many birds bathe, and from which they drink at all

hours of the day. I often see the bottom of this dish sprinkled with seeds, evidently ejected by the birds. At present they are the seeds of the Laurustinus (*Viburnum Tinus*).

Rosehill, Falmouth, November 29. HOWARD FOX.

Periodic Tides.

THE letter of Mr. A. S. Thompson, in your issue of December 8, adds further interesting information as to secondary undulations, to that which I sent you in a paper printed in NATURE of February 3 last. This paper appears to have escaped Mr. Thompson's attention, as in it he will find that this subject was investigated on the Swiss Lakes by Duillier in the middle of the last century, and by Vaucher in 1804. They found that these undulations are common to all lakes at intervals of about twenty minutes. More recent ly the subject was taken up by Mr. Napier Denison on the Great Lakes in Canada, where he found oscillations of three to four inches at intervals of from fourteen to eighteen minutes; and by Mr. Bell Dawson during the tidal survey of the Gulf of St. Lawrence, where he found regular minor undulations occurring, in addition to those due to the tides. W. H. WHEELER.

December 10.

Cristatella Mucedo.

As this very beautiful polyzoon is generally believed to be nearly, if not quite extinct in ponds in the neighbourhood of London, I should like to record the fact that on November 19 last, I took a fine specimen two inches in length, which is still living. The colony was packed with statoblasts, most of which are now discharged. It was not perfect when taken, and has again divided since it has been in a small aquarium.

HENRY SCHERREN.

9 Cavendish Road, Harringay, N., December 3.

The Invention of the Gimbal.

WILL you or some of your readers kindly inform me, when and by whom the construction of the gimbal was contrived for the first time? KUMAGUSU MINAKATA.

7 Effie Road, Walham Green, S.W.

THE VALUE OF EXERCISE.[1]

THE value of exercise for the purpose of maintaining *mens sana in corpore sano* has been recognised from the remotest antiquity. Exercise, however, in its entirety seems to be divided into two sections which, though springing from the same cause, have led to different results: professional exercise or the training and maintaining of a body of athletes, and what may perhaps best receive the name of domestic exercise. The former appears to be one of the many instances of what was originally a means of becoming an end. Professional athletics doubtless took their origin in the use of exercise as a means; the perfect development of body and mind being the end. The huge muscles and small heads of professional athletes show us that the original means has finally become the end. This result from the point of view of the hygienist must be regarded as grotesque, and to the physician the professional athlete is neither more nor less interesting than the macrocephalic dwarf. The fainting and sickness of the over- or under-trained schoolboy, and the insomnia of the over-crammed student are essentially phenomena of the same class, and due to the same cause—viz. pathological plethora of some vascular areas, and pathological anæmia of others.

The use of exercise as a therapeutic agent, as also its use for the maintenance of health, falls under the second variety. The practice of exercises as part of one's toilette is very old. Any one conversant with the "heilgymnastik" (curative exercises) of the present day, let them belong to the systems of Ling, Schott, or Zander, cannot fail to be impressed with their resemblance to the devotional exercises of the devout Mahometan. Although doubtless the positions assumed by the worshipper are symbolical of passive submission, cringing obeisance, or subjected defiance, the point of interest to the physiologist is that after the performance of these devotions one experiences a distinct sense of fatigue. Thus by incorporating in his system of devotion actual muscular exercise the Prophet practically prescribed a system of "heilgymnastik," and forestalled the modern hygienic use of exercise. It would be interesting to know to what extent the exercise part of his devotions may be modified in the case of a Mohametan with *morbus cordis*. One fact, as will appear from the context, is worthy of notice. The devotional exercises are all performed slowly, and the change of posture is gradual. This is doubtless from a religious standpoint reverential, but from a physiological standpoint it prevents the occurrence of breathlessness or palpitation. In the one case which I had the opportunity of observing (devotion at sunset), the respirations were accelerated by four, the pulse by sixteen per minute by the devotions. This was in Algeria, near Hammam Rhira, at an altitude of 2000 feet. This effect might, no doubt, partially be due to psychical influences.

The modern therapeutic use of exercise is mainly directed to the attainment of two objects, local or general. The local use of exercises for the strengthening of certain groups of muscles mostly interests the surgeon or the neurologist. The ingenuity of Zander in inventing machines by which almost every group of muscles in the body can both be exercised, and made to do an exactly graduated amount of work, has done much to develope and systematise treatment in this branch of therapeutics. In the case of all muscles, including the heart, an optimal contraction is only obtained when the muscle contracts against an optimal resistance. This optimal resistance varies according to the condition of the muscle. In the case of the local use of exercise it is most important at the beginning of each set of exercises to find the optimal load. The great advantage of the mechanical system of resistance exercises, as compared with the manual method, is that once this optimal load is found it can be maintained constant, or as the condition of the muscle improves can be accurately increased. From this it follows that the work done on each occasion can be measured mathematically. It is impossible to achieve this by hand.

The second object aimed at by the therapeutic use of exercise is the one of most interest to the physician, viz. the production of a general systemic effect. This effect manifests itself chiefly upon the circulatory and respiratory systems. The sweating produced by exercise, although bringing into play the secretory function of the skin, and thus causing the excretion of certain noxious substances, as well as possibly the production and addition to the blood of an internal secretion, is essentially a circulatory phenomenon, and will not be further considered here, especially as exercise is, therapeutically, rarely pushed to such an extent as to produce sweating. One of the effects of exercise upon the respiratory system is known to every one, viz. breathlessness, or an increase in the depth and frequency of the respiratory movements. This dyspnœa varies according to the condition of the patient, and the amount or rather acuteness of the exercise. Physiologists are indebted to Zuntz and Geppert (*Pfluger's Archives*, xlii. p. 159) for having added most essentially to our knowledge of this condition. Before the work of these observers the dyspnœa attending exercise was held to be due to a diminution in the amount of oxygen and an increase in the amount of CO_2 in the blood; was, in short, regarded as an asphyxia. This hypothesis was based upon the experimental results of Mathieu and Urbain ("Du Gaz du Sang," *Archives de Phys.*, iv., 1871–72). Zuntz and Geppert, however, showed

[1] "Respiratory Exercise in the Treatment of Disease." By Harry Campbell, M.D., B.S., F.R.C.P. Pp. viii + 200. (London: Baillière, Tindall, and Cox, 1898.)

that during and immediately after exercise the amount of O in the blood was increased, and amount of CO_2 diminished as compared with their amounts at rest. They further concluded that during muscular exercise the contracting muscle poured into the blood substances the chemical nature of which was unknown, but which exerted a stimulating action on the medullary repiratory centre. In this phenomenon, according to them, neither pulmonary nor muscular centripetal nerves play any *rôle*. This latter dictum has been disputed by Filehne and Kionka (*Pfluger's Archives*, lxii. 96, p. 201), who hypothecate the existence of afferent nerves in the lung and muscles, which are sensitive to CO_2 production and are stimulated thereby. The main result of Zuntz and Geppert's work was not challenged by them, and still stands. In a later monograph Zuntz and Geppert maintain, and apparently correctly, their former work in its entirety.

This increased respiratory activity is within certain limits from a therapeutic standpoint a desideratum, as pulmonary resistance is thereby diminished, and the general circulation and flow of lymph accelerated.

In order to produce this salutary effect the respiration during exercise should be easy and full, and anything approaching effort, with its usual concomitant, closure of the glottis, should be avoided.

In this connection Dr. Campbell's recent book is interesting and useful. We cannot agree with the view expressed on p. 111, with regard to the causation of the dyspnœa attending exercise. The author at the close of his book gives a list of respiratory exercises calculated to attain certain ends. Dr. Campbell has produced an instructive and interesting monograph, and we shall be pleased to welcome his promised work on the mechanical treatment of heart disease.

Concerning the effect of muscular exercise upon the circulatory system, we have a very abundant literature to review, both physiological and medical. The recent development which this branch of therapeutics has taken, as exemplified by the thousands of visitors flocking to Nauheim, and the various mechanic, or manual gymnastic institutes, and the still larger numbers treated at their own homes, render the subject of considerable interest. The effects of the contraction of a muscle or group of muscles upon the circulation may be divided into local and general. The local effects, or the effect of its contraction upon the circulation through a muscle, was first investigated by Ludwig and his pupils, Sczelkow, Sadler and Gaskell. Some of Sadler's (*Ludwig's Arbeiten*, 1869, p. 77) results have a direct bearing upon resistance exercises as practised at the present day, since he studied the circulation through a group of muscles which were thrown into contraction, but were at the same time prevented from becoming shortened. He found that, as in the case of muscles contracting under ordinary circumstances, more blood passed through them than in the condition of rest. He also found that more blood passed through the contracting muscles when they were prevented from becoming shortened, than when they were allowed to do so.

Gaskell's (*Ludwig's Arbeiten*, 1877, p. 45) experiments showed that the maximum flow occurred either at the end of a long contraction (tetanus), or directly after the cessation of a contraction. In all these experiments the excitant was electric stimulation. In the case of exercise in the living animal the excitant is either volitional or reflex. The results, however, of Cheauveau and Kaufmann (*Archives de Phys.*, 1892, p. 279), who worked on the masseter of the horse during mastication, and in the main confirmed the above results, showed that the artificial nature of the excitant in Ludwig's experiments made no appreciable difference. Mosso[1] found that the volume of an arm as measured phlethysmographically increased immediately after contraction of the flexors. Some experiments I made conjointly with Dr. Lauder Brunton[1] showed that the amplitude of the pulsation of the arteries contained in the gastrocnemius increased considerably immediately after contraction of this muscle. The tracing showed that in addition to the arteries being dilated immediately after contraction they were relatively fuller of blood.

These results, obtained by different methods and by several observers, seem clearly to indicate that one of the local circulatory effects of muscular exercise is a dilatation of the vessels of the corresponding muscular area; or, in other words, a lessening of the resistance to the flow of blood through the muscles. In view of the relaxation of the antagonistic muscles which apparently accompanies the contraction of any group of muscles, it would be interesting to see what, if any, changes occur in the vessels of these relaxing muscles. If a dilatation occurs here also, as seems *à priori* probable, the vascular area affected would be considerably increased, and then the effect on the general circulation would be magnified.

If we turn from the local circulatory effects of muscular contraction to the effects produced on the general circulation by the contraction of a group of muscles, we shall find in the first place that a determining factor of the greatest importance is the amount of exercise; and this is best measured by the degree to which the respiration is affected. The results of former observers, Marey ("La Circulation du Sang," 1881, 343). Oertel,[2] von Basch, and others, have been entirely confirmed by those of more recent investigators, viz. Hallion and Comte (*C. R. Soc. de Biologie*, x. serie, iii. 906), Bloch, Mosso (Der Mensch auf den Hochalpen Leipsig, 1899), Brunton and myself (*loc. cit.*), Zuntz and Hagemann (*Deutsch Med. Woch*, 1892), Taugl and Zuntz (*Pfluger's Archiv.*, lxx. 544, 1898), and Kaufmann (*Archives de Phys.*, serie 5, t. iv. p. 493). Zuntz and his collaborators are evidently unaware of the work of Mosso and his pupils, and of Brunton's and my own paper.

The results of Zuntz and his collaborators showed that in the horse a gentle walk was accompanied by a fall in blood pressure amounting to about one-twelfth. In the case of dogs, gentle exercise was accompanied by a slight rise in blood pressure amounting to one-twelfth or one-tenth, whereas violent exercise rapidly caused a doubling of the blood pressure in the carotid. The experiments made in Mosso's laboratory on man, including those contained in Brunton's and my own paper, confirm the above results obtained upon animals. However gentle the exercise, an increase, sometimes very slight in blood pressure, occurs; this, however, sometimes during exercise, invariably after it, is followed by a fall, which continues for some time after the exercise has ceased. If the exercise is violent the accompanying rise in blood pressure is considerable—one-sixth to one-eighth, and this high pressure is continued so long as the exercise lasts, the pressure gradually returning to its former level; this, in some cases, taking two hours or more. All observations upon the blood pressure in man directly after exercise more or less severe, which have been sufficiently numerous, confirm these results (see "Oertel," *loc. cit.*). These experiments are of interest from a therapeutic standpoint, in that they show that it is possible to obtain the beneficial effects of exercise at the expense of a very slight extra strain upon the heart.

A question at the present time of considerable interest is, how are the cardio-vascular results which follow exercise brought about? Are we to assume that they are central, and are produced by the action of substances of

[1] "Sulle Variazioni locali del polso nel ante-braccio del uomo." Torino, 1878.

[1] "Remarks on the effect of Resistance Exercises in Man, local and general." (*British Medical Journal*, October 16, 1897.)

[2] "Handbuch der allgemeiner Therapie der Kreislaufs Storungen." Leipzig, 1891.

unknown chemical nature, the products of muscular contraction, acting upon the medullary centres, or that they are reflex? In this latter case two hypotheses may be adopted—viz. that the afferent impulse is due to peripheral chemical, or peripheral mechanical stimulation. So far as I am aware no work has been done on the lines of Geppert and Zuntz (*loc. cit.*), or Filehne and Kionka (*Pfluger's Archives*, Bd. lxii, 201, 1896) with regard to the vascular effects of exercise. A paralysing action on motor nerve endings has been ascribed to the products of muscular activity, but to what extent the nerve endings in non-striped muscle are influenced by these products has not been shown. A further question of interest, which remains yet to be decided, is what are the vascular areas which become anæmic during exercise? The nausea or vomiting, which is the frequent accompaniment of violent exercise when one is in "bad condition," seems to point to the splanchnic area as the one at the expense of which the muscular plethora occurs; but, so far as I am aware, no phlethysmographic records of the abdominal organs during extensive muscular contraction have as yet been made.

In considering the effect of the contraction of a muscle upon the circulation through it, the muscular substance of the heart itself naturally comes into consideration. The circulation through the coronary arteries when these vessels have not lost their normal elasticity from atheroma or other causes, is unquestionably increased by full and frequent cardiac contraction, and the state of nutrition of the heart thereby improved. Further, increased pressure in the aorta within certain limits is advantageous to the coronary circulation. The experiments which have been made recently upon the excised mammalian heart (Langendorf, *Pfluger's Archives*, lxx., 1898, p. 473) tend to show that the conditions for optimal contraction—that is, for a maximum output of energy at each beat—are practically the same in the case of the mammalian as in that of the frog's heart (Tunnicliffe, *Journal of Phys.*, xx. 1, 96). Of these one of the most important is the choice of an optimal load, the cardiac muscle in this respect being similar to ordinary striped muscle. This, from a practical standpoint, amounts to the fact that although a heart can be, and of course very often is overloaded, or in other words is unable to meet the resistance which the normal circulation offers to its contraction, it can also be underloaded; that is, the cause of its insufficient contraction may be that not sufficient resistance is offered to its systole. This underloading of the heart may play an important *rôle* in sluggish circulations in women, and men living sedentary lives. Fairly severe but gradually commenced and gradually increased exercise in these individuals will often supply the necessary load, and bring back the cardiac action to the normal. It is the function of the physician to discriminate between the over- and under-loaded heart, and to treat it accordingly; exercise may find a place in each variety of this treatment.

In this paper nothing has been said with regard to another aspect of exercise from a therapeutic standpoint. We have discussed the possibility of certain chemical substances produced during the contraction of muscle exerting an action on the respiratory and cardio-vascular centres, but we have said nothing of the possible effect on general metabolism of such products or others accompanying them. That such an effect is produced is seen by the general nutritive results of local muscular exercise and of massage. Whether the physiological basis of such a result consists in the removal of waste products—that is, is essentially increased excretion—or in the production of substances which have an action allied to the internal secretion of glands, remains yet to be decided.

F. W. TUNNICLIFFE.

THE ZOOLOGICAL EXPLORATION OF THE GREAT AFRICAN LAKES.

OWING to the unique and extremely interesting nature of the fauna in Lake Tanganyika, the study of which was recently the object of an expedition supported by the Royal Society, and led by Mr. J. E. S. Moore, a Committee has been formed, consisting of Sir John Kirk, G.C.M.G., K.C.B., F.R.S. (late British Resident at Zanzibar), Dr. P. L. Sclater, F.R.S. (secretary to the Zoological Society), Mr. Thiselton-Dyer, C.M.G., F.R.S. (director of Kew Gardens), Prof. Ray Lankester, F.R.S. (director of the Natural History Departments of the British Museum), and Mr. G. A. Boulenger, F.R.S. (of the British Museum), for the purpose of organising another expedition to the same regions, to thoroughly survey the basin, not only of Lake Tanganyika, but also the unknown portions of the northern extension of the great series of valleys in which Tanganyika, together with Lakes Kivu and the Albert Nyanza, lie; to collect specimens of the aquatic fauna and flora, and to study the geological history of this part of Africa. The latter object of the investigation should be of especial interest, for it was shown by Mr. Moore that almost without exception the shells of the singular series of whelk-like molluscs, captured by him in Tanganyika, are indistinguishable from those now found fossilised in Europe, among the remains of old Jurassic seas. It would thus appear that at some remote period of time, the great valley of Tanganyika was in connection with the sea, and that the strangely isolated marine fauna, which still inhabits its slightly brackish waters, has remained there ever since. So far only the *Medusae* (jelly-fish), the *Mollusca*, and the *Crustacea*, belonging to this antique fauna, have been discovered in the lake; but when its vast size and depth are fully realised, it is unquestionable that by far the larger portion of its fauna is as yet unknown.

Tanganyika thus presents a unique field for scientific exploration at the present time, and is, indeed, one of the few places now left upon the earth where animals (like those peculiar to Australia) which have long since become extinct elsewhere, may still be found.

Another notable fact ascertained during Mr. Moore's last expedition, was that the marine, or *Halolimnic* fauna of Lake Tanganyika does not exist in either Nyassa or in Lakes Shirwa, Mwero, Bangweolo, or any of the remaining lakes about which anything zoological is known; but it may yet be found in Lakes Kivu, the Albert Edward and Albert Nyanzas, which lie, as has been said, in an extension of the same great depression which contains the Dead Sea towards the north. The probability of this being so, is also increased by the curious fact that the fauna of Tanganyika bears some resemblance to that of the lower portions of the Nile.

During the present expedition it is therefore intended to go north from Tanganyika, which will form the zoological headquarters of the expedition, through the unknown region which lies between Tanganyika and Lake Kivu, on, finally, to the Albert Edward and Rowenzori districts. It is intended then that the expedition shall pass eastward, through the Uganda stations north of the Victoria Nyanza, down the Uganda roads and railway to the sea. Mr. Moore's previous expedition was hampered by the unexpected difficulties of transport and the want of a steamer properly to carry on dredging and sounding operations in the lake, and, in consequence of this, much valuable material, particularly large specimens of entirely new species of fish, had to be deliberately left behind. At the present time, however, the African Lakes Corporation are running the London Missionary Society's old steamer once more upon the lake, and all these deficiencies can therefore now be overcome, provided the necessary funds are raised.

A careful consideration of the details of the expenditure has led the Committee to the conclusion that in order to enable Mr. Moore to successfully lead another expedition for two seasons, and to accomplish the above-stated objects, a sum of not less than 5000*l.* wtll be required. The Committee have already received encouraging offers of support, including one of 1000*l.* from a gentleman connected with the commercial and political interests of British Africa. They point out, however, that the results to be obtained will increase almost in the ratio of the square of the initial expenditure; and in a private circular, which has been issued, the members of the Committee appeal to those who feel interest in the objects of the expedition, for assistance in carrying out an enterprise which is not only of the highest scientific importance, but is also of great significance in securing British influence in a critical region of the African interior.

UNIVERSITY COLLEGE AND THE UNIVERSITY OF LONDON.

WE are glad to be able to publish the following text of a resolution adopted by the Council of University College, London, at their session on December 10. The offer contained in the resolution is a noble one; and we hope that the example afforded by it will be followed by other similar institutions, in order that the labour of the Statutory Commission may be simplified.

That a Deputation be appointed to represent to the Statutory Commission that—inasmuch as

(1) University College, London, was founded as the University of London, with the object of providing a complete University education in London of the highest type.

(2) The intention of the founders and benefactors of University College will only be carried out by the incorporation of the College in the University, so that its resources shall still be utilised for the furtherance of the highest educational work and for research.

The Council are prepared to summon a general meeting of the members of the College, and to propose to them that such steps should be taken as may be necessary for placing the site, land, buildings and endowments of the College at the complete disposal of the reconstituted University.

In making this offer the Council do not desire to throw any obstacle in the way of any other institutions in London which may be disposed to place their resources at the disposal of the Governing Body of the University.

It will be necessary in accordance with the precedent afforded by the Universities Act (Oxford and Cambridge) to protect the interests of the existing teachers and executive staff of the College. The existing teachers are, however, to have no claim as such to any rank in the re-constituted University, or to any vested interest other than that they now have in the College.

Special provision will probably have to be made as to the boys' school and its endowments, and perhaps for appropriate buildings on another site being provided for this department of the College work. Arrangements will also have to be made with regard to the Hospital and its funds, of which the College is now the Trustee.

(Signed on behalf of the Council),
J. GREGORY FOSTER,
Acting-Secretary.

NOTES.

PROF. MARSH has been elected a correspondant of the Section of Mineralogy of the Paris Academy of Sciences, in succession to the late Prof. James Hall.

THE Geographical Society of Berlin (Gesellschaft für Erdkunde zu Berlin) have sent out a circular inviting the friends and promoters of geography in all countries, and especially the members of geographical societies and cognate scientific bodies, to be present at the seventh International Geographical Congress, to be held in the German capital from Thursday, September 28, to Wednesday, October 4, 1899. Before the beginning and after the close of the Congress, excursions will be arranged through such parts of Germany as are of interest from the points of view of physical or economic geography. The subjects which are to be discussed at the Congress will be arranged in the following groups: (1) mathematical geography, geodesy, cartography, geophysics; (2) physical geography (geomorphology, oceanology, climatology); (3) biological geography; (4) industrial and commercial geography; (5) ethnology; (6) topical geography, exploring travels; (7) history of geography and of cartography; (8) methodology, school geography, bibliography, orthography of geographical names. According to the usual custom, the English, French, German, and Italian languages will be admitted as languages of the Congress, and all papers must be written in one of them. The latest date for receiving papers is June 1, 1899; and the subjects should be notified by April 1, 1899. All correspondence relating to the Congress should be addressed to the VII. International Geographical Congress, 90 Zimmerstrasse, Berlin, S.W.

DR. CAPITAN has been elected president of the Paris Anthropological Society for 1899.

THE Desmazières prize has been awarded by the Paris Academy of Sciences to Dr. J. B. de Toni for his "Sylloge Algarum."

THE Paris correspondent of the *Chemist and Druggist* states that a "Retrospective Museum of the History of Chemistry" is being organised to figure in the Paris Exhibition of 1900. It will comprise objects relative to scientific discoveries and industrial improvements—in fact, everything that can clearly show the successive progress accomplished in the chemical industry and the importance of the discoveries made by French savants. Amongst the objects indicated as admissible are laboratory apparatus, reports on discoveries, portraits of inventors, investigators, and manufacturers, descriptions of processes, products obtained by inventors or in scientific laboratories, drawings, plans, models in relief, &c. Industrial museums, faculties, schools, manufacturers, and private individuals are invited to send a list of articles they may be willing to lend.

A PRIZE of 1000 marks is offered by the Economic Society of Mohrungen, near Königsberg, for the best work on the relations of electricity to living organisms. The work must discuss either fundamentally new phenomena in plant or animal electricity, or, from the point of view of physics, discuss the sources of organic electricity, or its significance for life in general or for certain functions.

VERY little is at present known of the flora of Porto Rico. This is not likely to remain long the case, since the attention of the Americans has been turned to the island. An American citizen, Mr. Cornelius Vanderbilt, has offered to bear the expense of a botanical expedition to the island by Mr. A. A. Heller, under the auspices of the New York Botanical Garden

AN informal Committee will shortly meet in Calcutta to consider the reports by the Astronomer Royal and Sir Norman Lockyer, who were recently asked for advice regarding Indian astronomical and solar observatories. The future working of these observatories will be discussed, and Sir James Westland, Messrs. T. Holderness and J. Eliot, and General Strahan, Surveyor-General, will probably be members of the Committee.

IT is announced that the Royal Academy of Medicine of Belgium has appointed a Commission to consider the following proposal:—"The Royal Academy of Medicine asks the Government to enter into negotiations with foreign Governments with a view to drawing up an International Pharmacopoeia."

A SHORT course of lectures adapted for a juvenile audience will be given at the Society of Arts on Wednesday evenings, January 4 and 11, 1899, at 7 o'clock, by Prof. F. Jeffrey Bell. The first lecture will be on "Hands and Feet," and the second lecture on "Some Ways in which Animals Breathe."

THE following are among the Lecture Arrangements at the Royal Institution before Easter:—Sir Robert Ball, six lectures (adapted to young people) on astronomy; Prof. E. Ray Lankester, ten lectures on the morphology of the mollusca; Mr. A. Henry Savage Landor, three lectures on Tibet and the Tibetans; Dr. Allan Macfadyen, four lectures on toxins and antitoxins; the Right Hon. Lord Rayleigh, seven lectures on the mechanical properties of bodies. The Friday Evening Meetings will begin on January 20, when a discourse will be delivered by Prof. Dewar on liquid hydrogen; succeeding discourses will probably be given by the Right Hon. Sir Mountstuart E. Grant Duff, Mr. Victor Horsley, Prof. H. S. Hele-Shaw, Mr. Richard R. Holmes, Sir Frederick Pollock, Bart., Prof. H. L. Callendar, the Right Hon. Lord Rayleigh, and other gentlemen. The year 1899 is the centenary year of the Royal Institution, and arrangements are being made with a view to its celebration in a fitting manner. Details will be announced at a later period.

REFERRING to next year's meeting of the British and French Associations, the Paris correspondent of the *Times* remarks:—Science, happily, has no politics, and the French Association for the Advancement of Science, with the view of fraternising with the British Association, has fixed its next congress for September 14 to 22 at Boulogne. The office-bearers of the two associations have agreed on a joint gathering at Dover during the two congresses. Although the younger association will thus cross the Channel to show its deference for seniority, it is understood that there will be a return visit. The French Association having thus, so to speak, broken the ice, it may be hoped that, just as it has already held a congress across the Spanish frontier, it will before long receive and accept an invitation from some English town. The distance can evidently be no objection, for it has held two congresses in Algeria and a third in Tunis.

SIR WILLIAM JENNER, G.C.B., F.R.S., Physician in Ordinary to the Queen and to the Prince of Wales, died on Sunday, at the age of eighty-three years. From a long obituary notice in the *Times*, we extract the following particulars of his career:—He was born in 1815, at Chatham, and was educated at University College. In 1844 he graduated as M.D. in the University of London; and in 1848 he was appointed professor of pathological anatomy to University College and assistant-physician to University College Hospital. In 1852 he was elected a Fellow of the Royal College of Physicians, and was appointed Gulstonian Lecturer. He then became physician to the Hospital for Sick Children, assistant-physician to the London Fever Hospital in 1853, and full physician to University College Hospital in 1854. In 1857 he succeeded to the professorship of clinical medicine in University College. In 1862 he was appointed Physician in Ordinary to Her Majesty, and professor of the principles and practice of medicine at University College. In the following year he was appointed Physician in Ordinary to the Prince of Wales, and in 1864 was elected a Fellow of the Royal Society. He was created a baronet in 1868, K.C.B. in January 1872, and G.C.B. in 1889. He was President of the Royal College of Physicians from 1881 to 1888, and had received honours from many learned bodies both in this country and abroad. He was a D.C.L. of Oxford, LL.D. of Cambridge and of Edinburgh, a Commander of the Order of Leopold of Belgium, and an honorary member of the Belgian Academy of Medicine. Jenner was not a voluminous writer. His chief works were on the "Identity or non-identity of typhus and typhoid fevers," and on "Diseases commonly confounded under the term continued fevers." He also published his Gulstonian Lectures on emphysema, and two or three volumes of clinical lectures on diphtheria, rickets, tuberculosis, and other subjects.

AFTER a long illness, Sir William Anderson, K.C.B., F.R.S., Director-General of Royal Ordnance Factories, died on Sunday last, December 11. He was born in St. Petersburg in 1835, and was educated at the High Commercial School there, where he was head of the school and silver medallist, and had conferred on him the Freedom of St. Petersburg. He was a pupil of Sir William Fairbairn, and a member of the firm of Messrs. Courtney and Stephens, engineers, of Dublin, from 1855 to 1864. He communicated a number of papers on engineering subjects to the Institute of Civil Engineers of Ireland, and was President of that Society in 1863. He received the Telford medal and the James Watt medal of the Institute of Civil Engineers. He was distinguished for the ability with which he applied his knowledge of the science of heat, and other cognate sciences, to the practical requirements of the engineer. The knowledge of Russian obtained in early life enabled him to translate the works of Chernoff on steel, and the researches of General Kalakontsky on the internal stresses in cast-iron and steel. He was elected a Fellow of the Royal Society in 1891; and was Vice-President of the Institution of Civil Engineers, a Past-President of the Institution of Mechanical Engineers, and hon. D.C.L. of Durham University. In 1889 he was appointed Director-General of the Royal Ordnance Factories, and last year he was created a K.C.B.

A MEMORIAL has been prepared for presentation to the Lord President of the Council (the Duke of Devonshire) and the President of the Board of Trade (Mr. Ritchie), protesting against the proposed removal and distribution of the collection of fish which was brought together by the late Mr. Frank Buckland, and has formed the Buckland Fish Museum in South Kensington Museum. With the view of rescuing the museum and increasing its usefulness, it is proposed that it should be made part of the duties of the inspectors of fisheries to preserve and deposit in the Museum of Economic Fish Culture any objects of permanent interest which may come under their notice, together with models of improvements in fish passes, fish culture apparatus, &c., which may be useful for reference or record. It is also suggested that the secretary and the inspectors of the Fisheries Department, together with the representatives of the Fishmongers' Company, should be appointed visitors to advise on and aid in the efficient management and development of the museum.

THE death of Dr. James I. Peck, assistant professor of biology in Williams College, and distinguished for his investigations in marine biology, is announced in *Science*. The following particulars are given, by Prof. H. C. Bumpas, of his contributions to biological knowledge:—In 1888 Dr. Peck prepared one of the first serious contributions to the study of variation that had been made since the time of Darwin. The summer of 1889 he spent at Woods Holl, where he worked upon the habits of the young of certain food fishes. In 1890 he published his Cymbuliopsis paper. In 1892 he was again a member of the scientific staff of the Fish Commission Laboratory, where he worked upon the Pteropods and Heteropods collected by the *Albatross*. The summer of 1893 was spent in preparing his paper on the "Food of the Menhaden," and in 1894 he continued his plankton studies and prepared a paper on the "Sources of Marine Food." In 1895 he was placed in charge

of the Laboratory of the Fish Commission, and in 1896 he accepted the position of assistant director of the Marine Biological Laboratory.

THE *Chemist and Druggist* announces the death, at Grasse, of M. Jacques Passy, who attracted attention some time ago by his interesting researches on the chemistry of perfumes as regards their composition and physiological action. He was a chemist of promise, and one of the leading assistants of M. Alfred Binet, the director of the laboratory of psychological physiology at the Paris Sorbonne.

M. DE FONVIELLE writes:—"The success achieved on the night of November 13-14 by the astronomer Hansky in his balloon ascent, has induced M. Janssen to undertake further aerial experiments next year for the same purpose. At least two ascents are to take place from three different stations; one in Europe, one in America, and the last in Central Siberia. These ascents are to take place respectively and successively—three on the night of the 13-14, three on the night of the 14-15, at 2 o'clock a.m., local time, and to last to 7 o'clock. The aeronauts will be instructed to re-ascend on the following morning, viz. 14-15 for the first, and 15-16 for the second. The balloons are to measure from 50,000 to 60,000 cubic feet each in order to carry three men, one aeronaut and two observers, supplied with electric lamps, celestial maps, and chronometers. The balloon is to ascend to an altitude of 10,000 feet with registering thermo-baric hygrometer. Free balloons are to be sent up for testing the high atmosphere at an altitude of 10,000 feet."

A FINE series of stereoscopic diagrams of the catenaries on a rotating sphere, a paraboloid and a cone, as well as of geodesic curves on oblate and prolate spheroids, accompanies Prof. A. G. Greenhill's paper in the *Proceedings* of the London Mathematical Society, xxix. pp. 585-670, on "The Catenary and the Associated Trajectory on the Paraboloid and Cone." In the paper itself, the equations and properties of the curves represented are worked out by means of elliptic functions, and we understand that the illustrations are due in great part to the co-operation of Mr. T. I. Dewar. In order to make the curves stand out in better relief, they are mostly drawn on a background ruled to resemble a tesselated pavement.

THE thermodynamics of equilibrium in systems of two and three components having one liquid phase, forms the subject of an interesting paper by Dr. Giuseppe Bruni in the *Atti dei Lincei* for October (vii. 8), in which the author derives the following conclusion:—If to a system of two components with only one possible liquid phase there be added a third component which does not combine with the first two and is not isomorphous with them, the curves expressing equilibrium of the same order (curves of saturation in binary systems and cryohydratic curves in ternary systems) are parallel. Only in systems represented by the curve of the ternary mixture, the third added component exists mostly in the solid phase.

SINCE Lord Kelvin published in 1856 the details of the phenomenon known as the Thomson effect, few experimenters have turned their attention to experiments of a quantitative character, Batelli's investigations being almost the only exception. An absolute measurement of the Thomson effect in copper is described by Mr. R. O. King in the *Proceedings* of the American Academy of Arts and Sciences (xxxiii. 19). As Batelli did not experiment with copper, no direct comparison with his results can be made, but his value obtained for iron is about twice as great as Mr. King's present value for copper. According to Tait's assumption the value should be about five times as great.

ATTENTION seems to have first been called to the errors in localising sounds by E. Weber. The particular problems involved seem to be two, namely, the perception of the direction from which a sound comes and the perception of its distance. An attempt to contribute data towards the solution of these two problems has been made by Matataro Matsumoto, of the Tokyo Imperial University, and his researches on acoustic space appear in vol. v. of the *Studies* from the Yale Psychological Laboratory. The author considers that an acoustic sensation receives its spatial form primarily from the space-idea which is given to us by the visual, tactile and motor sensations. Acoustic space presupposes the existence of the space-form of other sensations. We have only to give an account of how the perception of the position of sounds arises on the basis of the already existing space which was given to us by other senses; as to the further problem of the ultimate origin of the space-form of perception, its solution must be sought in the visual and tactile perception.

THE late Mr. W. J. C. Miller, formerly Registrar of the General Medical Council, was perhaps best known in his capacity of mathematical editor of the *Educational Times*. But he also devoted many of his leisure moments to writing popular articles on natural history, many of which he contributed to the Selborne Society's *Nature Notes* and other journals. These papers are now to be published in a volume entitled "Nature Studies," under the editorship of Mr. H. Kirke Swann. The book should prove very agreeable reading, besides providing, for the many friends of Mr. Miller, a lasting memorial of the author.

A CONVENIENT method of preparing filamentous algae and fungi for the microscope is described by Mr. Charles J. Chamberlain in the *Journal of Applied Microscopy*. Mr. Chamberlain uses Flemming's weaker solution or chromo-acetic acid for fixing, followed by iron alum hæmatoxylin for staining, and mounts in glycerin concentrated by gradual evaporation from a ten per cent. solution. It would be interesting to learn, in applying the method to desmids, whether these can be prevented from their not unfrequently persistent tendency of floating to the surface and getting carried off in the repeated washings that are necessary.

DR. BRINTON has reissued a short article, contributed to the *American Anthropologist*, on "The Peoples of the Philippines." The two stocks which were found in possession of the islands at their discovery by Magallanes in 1521 were the small black Negritos, now reduced to about 10,000 persons, and the brown Malayan peoples, who are in the vast majority. As Dr. Brinton says: "The ethnic and historic relations of these two races offer some interesting problems in anthropology"; and it is not too much to hope, now that America has obtained the sovereignty of the islands, that these problems will be investigated and the results published for the benefit of science. It is painful to be reminded of the absolute neglect of these important matters by the British Government, who, with better opportunities than is possible in any other country, do less than is done by most of the European Governments; while the English student turns naturally with hope to the American Government. Dr. Brinton inclines to the theory, in which we think he is correct, that these two races of the Philippines are ethnographically distinct. The Negritos, so called, are extremely rude, owning no fixed habitations, not tilling the soil, making no pottery, and possessing no clothing except a girdle. Among their beliefs is that when one of their own people dies it is due to the black art of their Malayan foes, and they kill a Malayan if they can. This has given rise to a curious and significant relationship between the conquerors and conquered, which Dr. Brinton does not mention by the way; and we think there is a good field for observation here in a matter not always accessible to the inquirer, but which is, nevertheless, of the

greatest importance. Of course, Dr. Brinton's note is only a summary of the present knowledge, but it is welcome.

IN *Das Wetter* for November, Dr. W. Meinhardus, of Berlin, discusses a fall of ice or frozen rain which occurred over a large part of the central and eastern parts of Germany on October 20. This phenomenon, which is sometimes called glazed frost, is one of the most peculiar and rarest forms of precipitation, which covers all bodies upon which it falls with a more or less thick layer of ice. From the reports received at the Berlin Meteorological Office, it appears that the frozen rain occurred with extraordinary violence in several localities. At Potsdam, Dr. Süring calculated that a blade of grass bore eight hundred times its own weight of ice. The ice-coating lasted through the whole of the day, and only disappeared with the setting in of a warm westerly current on the following morning. The occurrence of glazed frost is usually explained by the rain falling upon bodies below the freezing point, but no frosty weather had preceded the fall in this case. The conditions that produced it appear to have been (1) a layer of air in the upper regions, with a temperature above the freezing point; (2) this upper layer must have been moist, and have had a tendency to move upwards, so that condensation and rain-formation occurred; and (3) below this layer there must have been another stratum with a temperature below the freezing point. This inversion of temperature conditions is borne out by observations received from several of the mountain stations.

A PAPER on the ventilation of tunnels and buildings was read at the Institution of Civil Engineers, on December 6, by Mr. Francis Fox. In regard to the first part of the subject, Mr. Fox enunciated the proposition that if the amount of carbon dioxide in the air of a railway tunnel did not exceed 20 parts in 10,000, then the ventilation might be deemed satisfactory. The case of the Metropolitan Railway tunnels, having been the result of recent investigation, was not mentioned otherwise than to recall the fact that the amount of carbon dioxide in the air had been shown to be as much as 86 parts per 10,000. The great Alpine tunnels were next referred to. In the case of that under Mont Cenis, 8½ miles long and 26 feet wide, the higher altitude of the middle of the tunnel above its entrances was inimical to good ventilation, and at times great difficulty was experienced in carrying on the traffic. The St. Gothard Tunnel, 9½ miles in length and 26 feet wide, was nearly level from end to end and, until recently, natural ventilation only sufficed, but, owing to increase of the traffic and the use of briquette fuel, the Saccardo system had lately been introduced. This consisted in blowing into the mouth of the tunnel a large volume of air which, on the principle of the injector, caused an induced current in the annular space between the interior surface of the tunnel and the gauge of maximum construction. In the second part of the paper Mr. Fox referred to the statement by Dr. Ransome, F.R.S., that 70,000 deaths occurred annually in Great Britain from tuberculous disease, nearly all of which could be saved were the subject of fresh air both understood and acted upon by the community. Competent medical authority considered that the quantity of carbon dioxide in the air of rooms should not exceed 10 parts per 10,000, equivalent to about 16 cubic feet per head per minute. In French hospitals 50 cubic feet per patient per minute was allowed. Mr. Fox considered that 20 cubic feet per minute would be sufficient for ordinary purposes. Tables were given of the impurity in the air of schools, with different systems of ventilation, of that in dwelling-houses, and of that in sewers; from which it appeared that the latter was the least impure of the three.

PROF. W. F. GANONG, of Smith College, Northampton, Mass., U.S.A., is desirous of obtaining accurately determined seeds of Cactaceæ for studies on the embryology of the order. His investigations on this subject are being published in the *Botanical Gazette*.

DR. N. WILLE has been appointed curator of the Museum and Herbarium of the University of Christiania, in succession to the late Prof. Blytt; and Dr. Carl Fritsch has been elected to succeed Kerner v. Marilaun as director of the Botanical Museum at Vienna.

LORD LISTER'S recent remarks upon the humanity of vivisection, reported in NATURE of October 20, have induced the Hon. Stephen Coleridge to gather a few extracts from the medical journals and the *Journal of Physiology*, and present them as evidence of "prolonged and terrible tortures." This he does in the hope that Lord Lister will "*do himself* the justice to confess that his statement at Liverpool was inaccurate"!

THE English equivalent of the German word "Anlage" is still a matter of discussion among biologists. Among the words favoured by various writers are forecast, fundament, rudiment, beginning, origin, and foundation. Dr. Arthur Willey recently suggested in these columns (August 25, p. 390) the word primordium as an accurate and well-sounding rendering of Anlage. Prof. Burt G. Wilder expresses a favourable opinion upon this word in *Science*, but thinks the shorter word proton, already familiar in numerous compounds, and used by many biologists, is a better equivalent.

DR. AMICO BIGNAMI, lecturer in the Institute of Pathological Anatomy of the Royal University of Rome, discusses in the *Lancet* the inoculation theory of malarial infection, and gives an account of a successful experiment with mosquitoes. He remarks at the end of this week's contribution: "To sum up, malaria is a disease which is contracted by inoculation—a fact of which we have now obtained the first experimental proof, since we have seen that an individual who has never had malarial fever by sleeping in a healthy place where no one had ever previously taken fever may sicken with malaria of a grave type if bitten by certain species of the mosquito brought in the adult state from some distant locality of highly malarious character. Further, everything points to the conclusion that inoculation is the only mode by which infection is acquired, since air and water as carriers of infection may be excluded, and because arguments based on analogy all tend in the same direction. This much at any rate we can assert—namely, that inoculation is the only mechanism of infection which has been demonstrated experimentally."

AN elaborate illustrated catalogue of apparatus used in physical and chemical laboratories and lecture rooms, and for bacteriological and microscopical work, has been issued by Messrs. W. and J. George, Ltd., the successors of the firm of Messrs. F. E. Becker and Co. The catalogue runs into no less than 662 pages, is printed on good paper, and profusely illustrated with pictures (many of them new) of instruments and accessories. Special attention appears to have been given to the arrangement of the contents, the description and price of each piece of apparatus being immediately adjacent to the illustration of the apparatus. The overcrowded appearance of many catalogues of scientific apparatus is thus avoided, and all particulars with regard to any instrument are readily found. The catalogue should be seen by teachers and investigators of all branches of experimental science.

IN a recent number of the *Journal für praktische Chemie* is an interesting contribution by Prof. Curtius and Dr. Rissom to the chemistry of azoimide and its metallic derivatives. Some losses having been noticed during the preparation of azoimide, by distilling a metallic salt with acid, it was found that heating

in contact with dilute mineral acids caused notable decomposition of the hydrazoic acid. A large number of metallic salts were prepared and analysed, and in every case the salts were found to be anhydrous. The metallic derivatives differ considerably in their explosive properties. Thus, of the derivatives containing the metals of the alkalis and alkaline earths (with thallium), lithium nitride is the only one exploding violently on heating, and thallium nitride the only one detonating when struck on an anvil. The action of heat upon the nitrides of these two groups is very remarkable, as when small quantities of the nitride are heated carefully in thin glass tubes, decomposition takes place quietly, nitrogen being evolved, and the pure metal left behind; this being, as the authors point out, much the easiest method of preparing small quantities of barium, strontium, and calcium.

THE additions to the Zoological Society's Gardens during the past week include an Egyptian Jerboa (*Dipus aegyptius*) from North Africa, presented by Miss Da Costa; an African Buzzard (*Buteo desertorum*), an Iceland Falcon (*Hierofalco islandus*), captured in the Red Sea, presented by Captain E. W. Burnett; a Peregrine Falcon (*Falco peregrinus*), captured in the Red Sea, presented by Captain Bear; a Rough-keeled Snake (*Dasypeltis scabra*) from South Africa, presented by Mr. H. Oakley; two Scops Owls (*Scops giu*), South European, deposited; a Brazilian Tapir (*Tapirus americanus*, ♀) from the Upper Amazons, two Common Rattlesnakes (*Crotalus durissus*) from North America, purchased; an Axis Deer (*Cervus axis*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE GEMINIDS.—For the greater part of the evenings of the 10th, 11th and 12th of this month, clouds prevented observations of the Geminids in London. Late on the night of the 12th, however, when the sky became to some extent clear, a brief watch of an hour, from 11h. 30m. p.m. to 12h. 30m. a.m. G.M.T., disclosed the fact that these meteors were very much *en evidence*. Between 11h. 30m. and 12h. 5m. no less than twenty-four Geminids were observed, four of which were of great brilliancy and brighter than a first magnitude star. The direction of observation was necessarily restricted towards the north-west. Curiously enough, a further watch from that time until 12h. 30m. was only rewarded by the observation of one meteor, and that not a Geminid, which gave one the impression that the shower had terminated. Clouds prevented further observation. Whether the shower was more brilliant earlier in the evening cannot, so far as this place of observation is concerned, be stated. Another observer, Mr. W. E. Rolston, of the Royal College of Science, South Kensington, was also surprised at what appeared to be quite a shower of meteors on the same evening. He recorded the appearance of several meteors during the interval 11h. 15m. p.m. to 12h. 20m. a.m. G.M.T., one of which, as he describes, "an exceptionally long and bright one, leaving a long trail of reddish sparks, which lasted for about two seconds." The same observer also mapped nine true Geminids on the night of the 9th.

COMET CHASE.—Using the same elements as those we published in our last number, the following is the ephemeris for the current week.

Ephemeris for Berlin Mean Midnight.

1898.	R.A. (app.)	Decl (app.)	Br.
	h. m. s.	° ′	
Dec. 14 ...	10 47 51 ...	+25 49·3 ...	1·39
,, 16 ...	49 51 ...	26 6·0	
,, 18 ...	51 44 ...	26 23·4	
,, 20 ...	53 31 ...	26 41·3	
,, 22 ...	10 55 11 ...	+26 59·8 ...	1·39

The comet is thus still in the constellation of Leo, and is situated approximately between 54 and 57 Leonis. It is now brighter than it was at the time of its discovery. Prof. E. Weiss thinks that it may be identical with 1867 I.

It is interesting to remark that the comet was discovered photographically near the radiant point of the Leonid meteor swarm. Four other photographs taken—two at the Yale, and two at the Harvard observatories—have corroborated its presence.

THE TOTAL SOLAR ECLIPSE OF JANUARY 22, 1898.—We have received from the Survey of India Department the report on the observations made at Dumraon, Pulgaon, and Sahdol during the recent solar eclipse. The report is divided into three sections, each section giving an account of the arrangements and observations made at the three different stations. The first, somewhat necessarily brief, is written by Mr. T. A. Pope, Assistant Surveyor-General, who had charge of a three-inch photographic doublet. With this instrument an excellent series of plates of the corona was obtained, one of which is reproduced as frontispiece to the present volume. The Pulgaon report, by Captain G. P. Lenox Conyngham, R.E., contains an interesting and well illustrated description of the camp, and the programme which the party had before them. Mr. Newall and Captain Hills, it will be remembered, occupied this station, and received valuable assistance from the officers and others present. The report on the observations at Sahdol, by Major S. G. Burrard, R.E., is somewhat more voluminous than the two preceding. In addition to a general account of the arrangements as regards the camp distribution and the preparatory work of the observers, such results as could be immediately deduced are given. Thus, for instance, we have a comparison between the temperature curves obtained on the actual and following day of the eclipse, showing clearly the drop from the time of first contact to about half an hour after totality, and the subsequent rapid rise. The large assembly at Sahdol made it possible to organise a party to make sketches of the corona. This was done, with the result that we have here thirty-one facsimiles of the hand-drawings made. After an examination of these sketches, we can truthfully remark, with Major Burrard, that "the accordance between these drawings is more remarkable than their discrepancies." The remaining portion of the report is devoted to a brief summary of the Hindu method of eclipse prediction, a chapter on future total solar eclipses in India, with twelve charts of tracts of past and future solar eclipses, and lastly to the answers to a series of questions concerning the corona and the attendant phenomena.

The volume, which is published under the direction of Major-General C. Strahan, R.E., the Surveyor-General of India, is very well illustrated, and should serve as a useful guide and source of valuable information for future eclipse expeditions.

NOVEMBER METEORS.—The *Harvard College Circular* (No. 35), which has just come to hand, describes in a brief manner an account of the preparations for observing the Leonid shower in America, and the preliminary results obtained. It will be remembered that last year Prof. E. C. Pickering organised a large staff of observers not only to make visual observations, but to record, if possible, their trails and spectra photographically. This year the organisation was even more complete, and stations were selected all round the earth in order that the number of visible meteors might be counted during the entire period that the earth passed through the swarm. The present *Circular* deals with the observations made at Cambridge (U.S.A.) and Providence, the reports from other stations not having yet arrived.

At the former town the night of the 13th was cloudy, but the 14th was clear. Thirty persons at the observatory recorded 800 meteors, not including duplicates, the maximum number having occurred at 3 o'clock in the morning, when 61 meteors east of the meridian were counted in thirty minutes. No less than 227 trails of eighty different meteors within 30° of the radiant were charted. At Providence the vicinity of the radiant point was continuously watched by at least ten observers, and 400 meteors were seen. Prof. Pickering chose this station (which is forty miles south of Cambridge) for visual determinations of parallax.

As regards the success of photography for this work, the results obtained seem very promising. Ninety-six photographs were taken at Cambridge with the Draper telescopes, and eleven with smaller instruments. Not only were photographic doublets employed, but prisms were utilised; but these, unfortunately, failed to give any record. By means of the doublets thirty-one trails of eight different meteors were photographed, three of which appeared on one plate. Four meteors were photographed at both stations, so that the parallax can be obtained photographically. A preliminary determination of the radiant point

gives the position for 1900 as R.A. 10h. 6·8m., Dec. +20° 16m., which is 9m. following, and 38′ south of that given by Denning. Some peculiarities of the photographed trails were that they attained a maximum and then diminished as rapidly as they increased, sudden changes due to explosion were well shown, the trail was sometimes surrounded by a sheath of light, and lastly, in one case the trail remaining after the meteor had passed was recorded.

ASTRONOMICAL CONGRESS AT BUDAPEST

AS was announced in NATURE of August 25, the International Astronomical Association (*Astronomische Gesellschaft*) held its seventeenth Congress at Budapest at the end of September.

The meeting was an unusually large one, and the reception by the Hungarian colleagues and the scientific and political authorities was exceedingly cordial. There were present, amongst others, the directors of the Observatories of O'Gyalla (von Konkoly), Hérény (von Gothard), Kalocsa (Father Fenyi, S.J.), Vienna (Weiss), Munich (Seeliger), Karlsruhe (Valentiner), Heidelberg (Wolf), Göttingen (Schur), Jena (Knopf), Berlin (Foerster), Breslau (Franz), Bamberg (Hartwig), Turin (Porro), Upsala (Dunèr). Besides these, many well-known astronomers attended, such as Müller, of Potsdam; Nyren, of Pulkova; Pechüle, of Copenhagen; Schröther, of Christiania; Kreutz, director of the International Bureau at Kiel, and of the *Astronomische Nachrichten*; Bauschinger, director of the Institute of astronomical calculations of Berlin, and many others. The absence of English and French astronomers, many of whom form part of the Society, was much regretted, and perhaps it is due to this fact that the Congress, out of natural reserve, abstained from raising the question of the fundamental stars and constants, resolved, perhaps too hastily, by the Conference at Paris in 1896.

The first meeting was opened by President Seeliger on September 23, in the large hall of the Academy of Science, where all the subsequent meetings were also held. Von Wlassics, the Minister of Education, who afterwards offered lunch to the members of the Congress, the burgomasters of Budapest, and Baron Eötvös, President of the Academy, well known for his experiments on gravitation, attended.

In the meetings of September 25, 26 and 27, besides other affairs of the ordinary business of the Society and the confirmation of the members of the Presidency, retiring by seniority, many scientific subjects, briefly referred to here, were discussed. Prof. Schür described the new reductions of the observations of planets and comets, made at Bremen by Olbers. Such reductions are made after the original notes of Olbers, placed at the disposal of the Göttingen Observatory. Dr. A. Stichtenoth, together with Prof. Schür, takes part therein. In the first place are discussed the determinations of time made by Olbers through observations of the setting of the principal stars behind the vertical side of the tower of the observatory, then the measures of the radius of the circular micrometer adopted, by the medium of the observations of couples of stars applied to the comparison with one particular comet; and lastly, these same planetary and cometary observations. In the published papers the times of the observations and the distances along the circle of declination of the comet and the comparison stars from the centre of the ring will be given. It is hoped that it will be possible to place these important materials at the disposal of astronomers during next year.

Dr. Bidschof, of the Imperial Observatory of Vienna, gave an account of some catalogues completed by him. These contain a list of the nebulae that were determined micrometrically at the observatory of Vienna up to the end of 1897, besides a stellar catalogue, containing the results of the new observations of the southern stars of Santini, executed at the Viennese observatory.

Dr. Brendel, of Göttingen Observatory, referred to the publication of Gauss's works. Soon after the death of Gauss the editing of his works was confided to Prof. Schering, of the Royal Academy of Göttingen. Schering published six large volumes, but did not succeed in completing the publication, so that, besides the great part of astronomical subjects published in the sixth volume, and the "Theoria Motus," printed in the seventh, the numerical discussion of the perturbations of the motion of Pallas, which will occupy the remainder of the seventh volume, remained unedited. Concerning this, it is necessary to note that, Gauss having left an enormous quantity of material (above half a million of figures) on this subject, without sufficient explanation, the reconstruction of the mode of these calculations becomes very difficult, though not impossible. The so-called libration, connected with the curious phenomenon, by which seven evolutions of Jupiter correspond exactly to eighteen of Pallas, presents special interest. The eighth volume will contain additions to all the materials of mathematics and physics dealt with in the fifth. Finally, the ninth volume will be concerned with biographical matters.

Prof. Franz demonstrated that the lunar globe previous to its solidification must have been elongated in the direction of the earth by the tides produced by our planet. Whilst the theory of tides and the physical libration assigns to such elongation the small amount of 0·0001 of the radius, Gussen, from the measure of two lunar photographs in different librations, obtained the considerable elongation of 0·0500. To eliminate such contradictions between the theory and the observation, Prof. Franz has measured five lunar photographs from the Lick Observatory in various combinations, and found an elongation of the lunar globe of 0·0027. Thus a nearer approach to the theory is reached, which, however, cannot result in complete accord, through the want of homogeneity in the lunar mass. Hansen put forward the hypothesis that the opposite part of the moon was deeper, so that it had gathered on itself water and air, thus rendering animal and vegetable life possible. On this hypothesis a lively and interesting discussion ensued between Profs. Foerster and Franz.

Dr. Witt, of the Urania Observatory of Berlin, observed that a simple glance at the stereoscopic views of the moon shows a considerable elongation.

Dr. Marcuse, formerly delegate of the Geodetic Office of Potsdam, in the Sandwich Islands, for the study of the variation of latitudes, called attention to the necessity of generally extending the methods of photographic registration of the observations of latitudes, applying them in quite a general manner to the geographical determinations obtained in travelling. He considers, having had occasion from 1893 to superintend the construction of a photographic zenithal telescope, and afterwards to use it, that the photographic registration of the measures of altitudes and transits can be easily obtained by means of a convenient universal instrument, adapted to visual as well as photographic measuring; and that with it, surety and precision are gained. An instrument for that purpose is being constructed.

Dr. Max Wolf, of Heidelberg, so well known for his photographic discoveries of small planets, spoke on the researches made by him on an objective worked by Dr. Pauly in Jena, with the aperture of 21·2 cm., and the focal distance of 445 cm. It is formed of the new glass of Jena, and must possess better chromatic corrections than the old systems. In fact, the investigation with the spectroscope has shown that the colours are exactly comprised from the extreme red to the blue; only towards the G line the colours begin to deviate. A comparison of the curve that represents the position of the focal points corresponding to the various colours, with analogous curves given by objectives of Fraunhofer, Grubb and Clark, shows the superiority of the objective of Pauly to the best anterior ones. While the deviation of the focus in the middle of the blue scarcely reaches to 0·00003 of the focal distance, that of 0·00065, determined by Clark, is far the least considerable of those remaining. The correction of sphericity is also small. Many delicate couples of stars are separated; *e.g.* η Coronae (distance 0″·4), μ_2 Bootis (0″·9), 1 Coronae (0.″4), λ Cassiopeiae (0″·6), μ Cygni (2″·9), ξ Hercules (0″·5), $o\Sigma$ 338 (0″·7), Σ 2695 (0″·9), Arcturus in the angle of position 120° appears lengthened; ζ Bootis and 52 Arietis could not be resolved. The size of the stellar discs amounts to 0″·24 for the sixth magnitude, to 0″·15 for the eighth. Dr. Pauly added some explanations on the manufacture of the new objective. The first attempts to eliminate the secondary spectrum go back to the year 1886; but then the glass used was not suitable. Only for two years has it become possible to obtain a new glass perfectly well adapted, the dispersive properties of which insure absolute elimination of the secondary spectrum. The pictures of the sun and moon are surprising, especially of the moon.

Prof. Porro presented a paper by the new member of the Association, Prof. Vito Votterra, of the Turin University, on the mechanical theory of the motions of the terrestrial pole. In this paper are recapitulated the results of a more extended work, which will be published in *Acta Mathematica*.

Following upon this communication, Prof. Porro gave an account of the present state of the calculations being made at New York and Turin for a new reduction of the observations of Piazzi, and for the compilation of a stellar catalogue founded on the same. According to arrangements made between Dr. Auwers and Prof. Schiaparelli, the work is divided between Dr. Herman S. Davis, of the Columbia University Observatory, and Prof. Porro. Mrs. Coreita R. Davis shares in it at New York, Dr. Vittorio Balbi at Turin.

A third notice given by Prof. Porro concerns the eighteen tables, in which he has had reproduced in facsimile the original sketches of the constellations, drawn by Francesco Bianchini in the seventeenth century.

The sketches contain the first essays on exact relative ocular determinations of the stellar magnitudes, executed by a method not differing essentially from that suggested and applied a century and a half later by Herschel. Argelander and Schiaparelli had deplored the loss of these papers, which ought to be of service for the historical study of the variable stars. The speaker had been able to find the manuscripts in a code of the Capitular Library of Verona, to which Bianchini, when dying, had bequeathed all his books; and had found that, without giving to the afore-named study the contribution expected by Bianchini and Montanari (of which also observations are reported), the papers themselves furnish the first document of exact determination of the relative magnitudes of the stars, which is recorded in the history of astronomy, resolving the query propounded by Argelander in his paper, "De Fide Uranometriae Bayeri."

Dr. Fritz Cohn, of Königsberg, described some general results of a new reduction of the most ancient meridian observations of Bessel. Of the observations made by Bessel in the years 1814–19, none had been published till now, save the known Fundamental Regiomontan Catalogue of Maskelyne's thirty-six stars for the epoch 1815. Bearing in mind the date of the observations and the name of the observer, it had been thought desirable to undertake a reduction of the materials gathered together. As the fundamental problem it seemed necessary to show the systematic errors of the Besselian method, and eliminate the damaging effect. Inasmuch as the presentation of the systematic errors in Bessel's catalogue depends considerably on the method of reduction adopted, it was needful to seek for a method that should limit as much as possible the influence of the systematic errors on the results. Applying a method studied purposely to such an end, a considerable improvement of Bessel's catalogue was obtained. But a perfectly satisfactory result could not be obtained till the cause of the error was discovered in a different distribution of the passages of the stars between day and night, and until such cause could be exactly calculated. After such a result it would be desirable that also in other series of observations of fundamental stars, especially ancient ones, search should be made of eventual systematic errors, because it is to be expected that from the consideration of these the accuracy of the results would gain considerably.

Prof. Foerster read a brief notice on some questions connected with the length of the year and the calendar. The numerous numerical data on which his discourse was founded do not lend themselves to a recapitulation of the interesting matter treated with the usual ability by the illustrious director of the Berlin Observatory.

On the measurement of the brightness of the nebulae and the clusters of stars, spoke Dr. Holetschek, of Vienna. He has been occupied for several years in determining the luminous impression made by the light of a comet through the weakest telescope in which the comet itself is visible, and eventually by the naked eye, noting the stars that are visible with equal facility or with equal difficulty in the same conditions. In this manner it has been possible for him to represent such luminosity with numbers, and now he has begun the application of the same system to nebulae and clusters of stars also. Manifestly, the method does not lend itself equally well to all classes of similar celestial objects: in particular it is not adapted for nebulae illuminated diffusely and uniformly, and for clusters of stars spreading over a wide space, as those in the Classes VII. and VIII. of Herschel.

Applying his method to objects of the first two classes of Herschel, Holetschek has found, for instance, that the brightness of the Pleiades corresponds to magnitude 1·5, that of the Presepe of Cancer to 4, of the nebulae of Andromeda to 5·3. Messier having compared the brightness of the comet 1779 to that of four different nebulae, of brightness 6·5; 7; 8·7; and 9·6, the author has been able to extract good values for the brightness of the comet. In the determinations executed between 1886 and now, he did not succeed in recognising any variations in the brightness of the nebulae under observation.

Prof. R. von Kövesligethy, of Budapest University, referred under the title "Ueber die Beiden Parametergleichungen der Spectral Analyse," on the studies just finished by him in the field of spectral analysis, the scope of which is to found astrophysics on mathematical bases. He shows how the two fundamental equations of the theory of heat are destined to have the same importance in astrophysics as the principles of mechanics have in astronomy, and that it is only now necessary to determine by observation the quantities that figure in such equations. To such an end the equation of emission is formed very simply in function of the length of the wave, and of two parameters that depend on the nature of the bodies; and it is not difficult to prove that the proceeding is severe, recurring to the proposition of Clausius on the radiation and to the equations of dispersion. Besides, it represents perfectly a series of bolometrical measures of the spectrum. The author insisted on the application of his theory to very important questions, also of mathematical astronomy, as the determinations of the parallaxes, the volume and densities of the heavenly bodies.

Father Fenyi, S.J., spoke on the observations of solar protuberances at the Kalocsa Observatory from 1884. He noted, first of all, that the greatest heights of the protuberances observed evidently depended upon the greatest amount of solar activity. With regard to the nature of the protuberances, he observed that they appear in the absolute vacuum, according to the theory of Schmidt, by which the density of the critical stratum around the sun could be determined with accuracy; but hydrogen cannot have a greater density than that of the critical stratum, and hence the maximum of density possible to hydrogen at every height can be determined. If this density be determined only for a height of 25″, it is seen directly that no trace of hydrogen can exist there; because on a volume equal to that of the sun a single molecule alone would fly from it. The theories that contradict this result are, therefore, to be rejected.

Prof. Hartwig, of Bamberg, called attention to the star SS Cygni, which, together with U Geminorum alone, forms a special class of variables, that offers special occasions, by its connection with new or temporary stars, to the study of these mysterious stellar bodies. The character of this class consists of an unexpected lighting up, followed by a rapid increase of magnitude, after which comes a slow return to the usual brightness. The spectographic study of SS Cygni seems possible for the large instruments now in activity, and would certainly furnish useful information on the causes of similar mysterious phenomena.

Another communication was made to the Congress by Prof. Kreutz, who referred to the actual state of the calculations of cometary orbits.

Among the numerous visits made by the members of the Congress to noteworthy places in the city and in the kingdom of Hungary, special mention should be made of the O'Gyalla Observatory, where the splendid hospitality of Dr. von Konkoly was not less admired than his munificence in preparing and presenting to the State a magnificent collection of instruments, designed by him and constructed under his direction, and of the Institute of Physics of the Budapest University, where they attended the experiments on gravitation of Baron Eötvös. The general impression that remained was of sincere admiration for the very notable progress made in the field of science by the country of Hungary, whose name was given to a new planet discovered by Wolf.

FRANCESCO PORRO.

RECENT PROGRESS IN ORNITHOLOGY.[1]

AS the editors of *The Ibis* have already remarked in their preface to the volume for the present year, one of the leading ornithological events of 1898 is the completion of the "Catalogue of Birds." The twenty-sixth volume of this work, prepared by Dr. Bowdler Sharpe and Mr. Ogilvie Grant, the only one required to finish the series, will, I am assured, be

[1] Address given by Mr. Sclater at the opening meeting of the British Ornithologists Club, on October 19.

laid before the Trustees at their next meeting, and be ready for issue very shortly afterwards. Thus, after a period of twenty-five years, this most important piece of ornithological work has been brought to a conclusion. No human product is perfect, and the Catalogue has been, and will be, the subject of many criticisms. One obvious defect in it is its want of uniformity, the various authors having been permitted, owing to the wise discretion of the authorities, very liberal opportunities for the expression of their own views in their respective portions, although a general adherence to one plan has been rightly insisted upon. But when the enormous amount of labour required for this work, and the absolute necessity of employing more than one author upon such a huge task are considered, it will be obvious that greater uniformity was practically unattainable. In the case of the "Catalogue of Reptiles and Batrachians," where the series of specimens and species was not so large, the herpetologists are fortunate in having had the whole of the work performed upon a uniform system by the indefatigable energy of a single naturalist.

The "Catalogue of Birds," as complete in twenty-seven volumes, gives us an account of 11,614 species of this class of Vertebrates, divided into 2255 genera and 124 families. It has been prepared by eleven authors, all members of the British Ornithologists' Union, and with one exception, I believe (who is not a resident in England), now or formerly members of this Club. I think it will be universally allowed that we have, in this case, a great and most useful undertaking brought to a successful conclusion.

Another good piece of ornithological work, likewise the product of a member of this Club, which has just made its appearance, is Mr. Beddard's volume on the "Structure and Classification of Birds." It seems to me to be a most useful manual on this subject, profusely illustrated, and full of convenient references to further information on various points which it would have been impossible to compress into a single volume. It will be found to be a mine of wealth to those who choose to dig in it, and contains a good summary, not only of the results arrived at by Mr. Beddard himself, but also by Garrod and Forbes, his illustrious predecessors in the office which he holds.

Mr. A. H. Evans, whose volume upon Birds for the "Cambridge Natural History" we have been long expecting, informs me that this work is finished, except the index, and will be shortly published. We shall all welcome its appearance with the greatest pleasure. A second work that Mr. Evans, together with Mr. Scott Wilson, is engaged upon is the "Aves Hawaiienses," of which we have long been waiting for the final part. This, I am assured, is now in a forward state, and is likely to be issued without further delay.

From information received from Mr. Rothschild, I am pleased to be able to say that his somewhat parallel illustrated work on the "Avifauna of Laysan," of which the last part was issued in 1893, will also be shortly brought to a conclusion, and that the third and final part will be issued in the course of next year. Taken together, these two works will form a most valuable contribution to our knowledge of the Avifauna of the Northern Pacific. I must also not forget to mention, amongst recent contributions to our science, the excellent work of Dr. Meyer and Mr. Wiglesworth on the birds of Celebes—one of the most elaborate and complete ornithological monographs on the birds of a special district ever prepared. Celebes, I may remark, as a debatable land between the Australian and Oriental regions, was in special need of the full treatment and discussion which it has here received from the authors of this work.

But the brethren of the B. O. C. and their friends, I think I may say, are at prosent not less active in the field than in the cabinet. We are fortunate in having with us to-night the two principal members of the new expedition to Socotra and Southern Arabia, which will leave England on the 28th inst. It will, of course, take up natural history in every branch, but with Dr. Forbes and Mr. Ogilvie Grant as its leaders, and a trained taxidermist in attendance, we need not fear that the interests of Ornithology will in any way be overlooked. In Socotra itself much has been already done, but little or nothing has been ascertained ornithologically of the southern coast of Arabia, and we know, from Bent's writings, that even in this commonly supposed barren district, bird-life is abundant in certain spots, which we trust may be within reach of the Expedition.

Besides the Socotran Expedition many other explorations by various members of the B. O. U. are in progress or in contemplation. Captain Boyd Alexander, who has worked so well in the Cape Verde Islands, is struggling through the middle of Africa from the Cape to Cairo. Under present circumstances he seems likely to come out successfully, and will, no doubt, bring information on birds, if not specimens, with him. Mr. Lort Phillips hopes to return to his favourite quarters in Somaliland during the course of the present winter, and expects to get together the supplementary materials still required for the preparation of his proposed work on the birds of that most interesting country. Mr. John Whitehead, who has added so much to our knowledge of the zoology of the Philippines, proposes to return to the same country very shortly, in order to continue his researches in a field which he knows so well and in which he takes such great interest. Before leaving, he has placed in the hands of the editors of *The Ibis* a series of valuable field-notes on the birds collected during his last journey. These will appear in the forthcoming volume of our journal. Mr. Alfred Sharpe, C.B., who is shortly returning to his post in Nyasaland, promises to continue the employment of collectors in different parts of that Protectorate, the zoology of which he, following in the footsteps of Sir Harry Johnston, has already done so much to investigate.

Finally, I may remark that, as will be seen on turning over the pages of contents in the last volume of *The Ibis*, we have correspondents interested in our favourite subject in nearly every part of the world, and that the great difficulty of the editors is to compress so many valuable contributions within the compass of an annual volume.

Before resuming my seat, I wish to say one more word. Our Government, in connection with that of Egypt, has just taken possession of an enormous district in Africa, probably nearly equal to half Europe in extent. It sternly warns all intruders off, even when they are alleged to be of "no political influence." When it comes to regulate the administration of these new territories, it is to be hoped that the interests of natural history will not be entirely overlooked. Although the Upper Nile districts have been traversed and investigated by many well-known naturalists, there is still very much to be done in these teeming regions of animal-life. We Englishmen are ready and willing to undertake, by individual efforts, much work that in other countries is provided for by State explorers; but it is not too much to expect that our Government should at least help us by providing adequate facilities and occasional assistance, and even, perhaps, by contributions to the expensive process of bringing the results thus acquired completely before the world.

THE ECONOMIC EFFECTS OF SHIP CANALS.

IN a paper submitted to the American Academy of Political and Social Science by Mr. J. A. Fairlie, on "The Economic Effects of Ship Canals," it is pointed out that while the construction of the North Sea Canal doubled the tonnage of the shipping of Amsterdam in the first six years after it was opened, the effect was purely local, as will be that also of the Manchester Ship Canal; and that although the Welland, Corinth and Kiel Canals have larger possibilities, their actual consequences have as yet been small. With the Suez and Sault Saint Marie Canals the results have been both important and far-reaching, and have affected the trade of the world. Both these canals have led to a rapid change in the material and character of the vessels used; to important changes in the sources of production; to the development of the growth of wheat in the countries which they serve; and to a large reduction in the cost of bread and other food in this country.

The Suez Canal opened in 1870 with a traffic of 486 vessels having a tonnage of 436,000 tons; in 1891, the record year, the traffic had increased to 8,700,000 tons. The new route by effecting a saving of 3000 miles on the voyage from the ports of Western Europe to the East, or almost half the distance to Bombay, brought about a complete revolution in the character of the shipping business to the East. By the Cape route coaling places were few, and the facilities for coaling expensive; the consequence was that owing to this, and the large space occupied by coal, to the exclusion of paying cargo, sailing vessels were more profitable than steamers. By the canal, steamers can coal at Gibraltar, Malta, Port Said and Aden; consequently,

owing to these facilities and the shorter distance, sailing vessels soon became superseded by steamers, and it was estimated that 2,000,000 tons of vessels were thus thrown out of employment. Under the old system, when voyages from India took the greater part of a year, and the time of arrival could not be calculated within a month or two, it was necessary to keep large stocks to meet the varying demand for goods, and hence the erection of the enormous range of warehouses at the India Docks. Steamers by way of the canal make the voyage in thirty days, and the time of their arrival can be regulated within a day or two; shorter voyages and punctuality of arrival make it possible for merchants to order direct from the East, and hence less capital is required and the cost of warehousing saved. The Suez Canal has had a material effect in fostering the growth and export to this country of Indian tea, which has increased from 11 to 120 million pounds. The export of rice from India has also enormously increased since the opening of the canal, and now constitutes the largest single item in the export trade of India. When the only route was round by the Cape the difficulty in transporting wheat, owing to its liability to heat during the voyage, and the loss from weevils, made the export of grain unprofitable. Since the opening of the canal India has become the second exporting country of the world, the exports of grain amounting now to over 50,000,000 bushels.

Other merchandise, both of import and export, has been affected to a less degree; the shorter route has also rendered possible the export from Australia and New Zealand of very large quantities of meat, fruit and other food products.

The Saint Mary Falls Canal, commonly called "The Soo," has now a traffic even larger than that of the Suez Canal, and exceeds the total foreign trade of the port of New York. The development of the trade now carried on over the Great Lakes is almost entirely due to this "Soo" canal. The size of vessels engaged in the navigation in 1870 averaged 175 tons; now there are five lines, owning sixty steamships of from 1750 to 3000 tons. The increase in trade is due in a great measure to the opening out of the iron mines of northern Michigan and Wisconsin, which have been made available by the canal route from the mines to the ports in the southern lakes. But the most important factor in the increase of the navigation is the transport of wheat and flour, the low rates at which these can be carried by water encouraging the growth over a very widely extended area of country. The other resources which have been developed by the construction of this canal are timber, coal and copper. One conspicuous feature due to this canal is the immense increase in population in the Lake Superior region and the development of towns.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

THE Anthropological Section met in the Park Place Schoolroom, under the presidency of Mr. E. W. Brabrook, C.B., ex-President of the Anthropological Institute.

On Thursday, September 8, the morning's programme consisted mainly of papers on physical anthropology.

The sixth annual Report of the Committee on the mental and physical deviations from the normal among children in public elementary and other schools was read by Mr. White Wallis, and gave a further account of those children whose mental and physical condition renders them unfitted for the public education provided in ordinary elementary day schools. The new information has been mostly obtained by studying the correlations of the cases, and the facts tabulated show that great difficulties must arise in making any provision for the proper care of these children, who show a much greater tendency than average children to become delicate under an adverse environment. The large proportion of both boys and girls who present "abnormal nerve-signs" shows the importance of trying to remove each such sign by carefully adapted physical training, and that the improvement of the brain condition of such children below the average in mental and physical development requires skilled teachers and good hygienic surroundings.

Mr. O. H. Howarth read a paper on human life at high altitudes, with the object of determining whether the adaptability of man to extreme conditions is of comparatively recent development, or of gradual growth. He exhibited an object which he regarded as a stone celt, found at an elevation of 7700 feet in the Rocky Mountains in Colorado. As causes of human inhabitation of extreme altitudes, he named the pursuit of industries impracticable elsewhere, and seclusion for religious purposes, and enumerated the conditions favourable and unfavourable to the persistence of human life under these conditions. He described numerous specialised superstitions; especially the impulse to establish cults on high peaks, and the belief in disembodied spirits, leading to a variety of precautions to prevent their interference. In the discussion which followed, Dr. Beddoe pointed out that Tibet, which was the highest average altitude in the world, was the only place in which real theocracy existed, and that the shepherds in remote parts of Australia often became demented because they were so much alone. Dr. Francis Galton thought it would be worth while to observe the behaviour of animals in high altitudes. Prof. Tylor suggested that some attention might also be directed to the collection of literature dealing with this subject. Mr. C. H. Read regarded the object exhibited by Mr. Howarth as a purely natural production, not a manufactured implement. Dr. G. A. Dorsey and Dr. J. G. Garson continued the discussion. Mr. Howarth briefly replied.

Miss M. A. Ellis presented a note on the human ear as a means of identification, stating that ears do not change shape after childhood, and classifying the great varieties of shape by marking off the *helix* into five divisions. Various types of ears were exhibited, and a brief discussion followed.

Mr. K. Minakata's paper on *Tabu* in Japan was read in abstract.

Mr. G. Leith read an important paper on a large and varied collection of stone implements from South Africa, describing the situation and characteristics of the bushmen's haunts, in some of which were found implements and other signs of occupation, just as they had been left years ago; and remarking upon the various types of stone implements which are found both in the cave deposit, and in the talus in front of the cave. With these poisoned arrows the bushmen were a dangerous enemy to the Boers, even when the latter were equipped with firearms. The investigation of Lighthouse Cave, at Cape St. Blaize, led to the discovery of many fine specimens of skinning knives, scrapers, and flaked implements, indicating that it had been a place for the manufacture of these implements for many ages. Alluding to his researches in various beds of gravel at various altitudes in which he discovered large numbers of palæolithic stone implements of very remarkable size and shape, he classified the latter, according to their position, into neolithic or modern, palæolithic or ancient, and eolithic. The evidence of these gravels proved without doubt, in his opinion, that South Africa was the home of man at a very remote period of history. The eoliths found there corresponded exactly with the plateau implements found on the Kentish Weald by Mr. Harrison. Prof. Dawkins did not think that the evidence was clear as to their belonging to the Gravel ages, and had no doubt that he could find a parallel from North America for the specimens produced.

Mr. F. T. Elworthy described a number of Roman symbolic hands from Pompeii and elsewhere, of the kind known as *Mano Pantea;* contending that these hands are not votive offerings, but in fact the Roman Penates. Mr. A. J. Evans and Mr. E. S. Hartland pointed out that these hands all belong to the late heterogeneous cults of the early empire, and have no connection with the indigenous family cults of Italy. Mr. J. L. Myres described other examples exhibited in the British Museum, one of which bears a definitely votive inscription. Bishop Brownlow commented on the Christian benedictory use of the gesture represented in these pre-Christian hands.

Mr. H. Warington Smyth described the river craft in use among the Siamese, explaining the construction of the "dug-out" Me Kawng boats, and discussing the various native types. To this was appended a brief description of the simple fourteen-reed instrument in use among the Lao of the Me Kawng Valley, illustrated by an example of this characteristic and monotonous music.

On Friday, September 9, after the President's address, Dr. Beddoe gave a summary account of the mediæval population of Bristol, based on two series of skulls, the one mediæval, the other probably of the eighteenth century, disinterred on the occasion of the removal of St. Werburgh's church, and on certain lists of surnames of various dates. He found the mediæval skulls very generally small, short and broad (cephalic index 80·0), while the later ones exhibited the same long types that characterise the present population of

Bristol and the surrounding districts (index 76·6). He ascribed the mediæval brachycephalism to the large proportion of people of French descent, which was indicated by that of French surnames, these latter having gradually declined in number ever since the fourteenth century.

Prof. H. A. Miers, F.R.S., read a note on the origin of stone-worship, in which he pointed out that when meteorites fell in early times, they must have provoked religious awe; quoting instances among recorded falls in which this was certainly the case, and some in which the meteorite became an object of worship. Mr. Arthur Evans pointed out in reply that the meteoric theory of stone-worship had in fact been formerly dominant, but could not be held to account satisfactorily, in a large number of cases, for the observances associated with the worship of stones.

Prof. C. Lloyd Morgan gave a short account, with lantern illustrations, of the camps and megalithic remains to be visited during the meeting in connection with the excursions.

Mr. A. L. Lewis sent a note on the circles of Stanton Drew.

A description of the megalithic monuments of Dartmoor, by Mr. P. G. S. Amery, was postponed to Wednesday's session.

The afternoon session was held in the Princess Theatre, Park Row, and attracted an audience of nearly a thousand persons. Prof. E. B. Tylor, F.R.S., discussed the survival of palæolithic conditions in Tasmania and Australia, with especial reference to the modern use of unground stone implements in West Australia; pointing out that the stone implements from Tasmania, the making and use of which by the natives came under the observation of the colonists during the first half of this century, have a character which may be called quasi-palæolithic. They were fragments or flakes of stone, in no case ground, but edged by chipping on one face only, and trimmed so as to afford a grasp to the hand, no haft of any kind being used. These instruments correspond to some extent with scrapers, &c., belonging to the Drift and Cave periods in Europe; but their general rudeness, and the absence among them of symmetrical double-edged and pointed implements like the flint picks of Old World palæolithic times, place the modern Tasmanians at a distinctly lower stage than the Europeans of the mammoth period. The stone implements found in Tasmania, of which some good collections have now been made, indicate a state of the Stone Age in past times not essentially different from that found in actual existence before the disappearance of the native population. These quasi-palæolithic implements, old or new, have to be considered apart from the few cases of ground stone hatchet blades fixed in handles, which are now admitted to have been introduced in modern times by Australian natives.

The purpose of the paper was to offer evidence making it likely that the early Stone Age condition characterising Tasmania extended within no distant period over the whole Australian continent. A native Australian hatchet hafted with gum on a stick-handle was exhibited, lent by Mr. W. Ayshford Sanford, of Nynehead Court, Somerset, who brought it half a century ago from the Perth district of West Australia. The blade of this instrument, with its unsymmetrical edge formed by chipping along one side of the original flake, is simply indistinguishable from the ordinary Tasmanian form placed beside it. Prof. Tylor stated that, unwilling to judge hastily from a single specimen, he had for years been in correspondence with anthropologists in Australia as to the presence there of such implements, and had lately, through communications from the Bishop of Tasmania and Mr. Alexander Morton, of the Hobart Museum, received intelligence that the latter, than whom no one better understands the Tasmanian implement question, has on a late journey to the little-known Murchison district in West Australia, while not meeting with ground stone axes, found the natives using chipped stones quite similar to those used by the Tasmanian aborigines, as shown by photographs sent for comparison. These quasi-palæolithic implements not having yet been dispossessed in this district by the ground stone hatchets, which apparently were introduced from the Torres Straits region, it would seem that this neolithic invasion was of no remote date, and that the vast area including Australia as well as Tasmania may have been till then peopled by tribes surviving at a level of the Stone Age which had not yet risen to that of the remotely ancient European tribes of the Drift gravels and limestone caves. While disclaiming any hasty inference, Prof. Tylor called attention, from this point of view, to the importance of, and the similarities between, the modern Australioid skulls and the prehistoric skulls of Neanderthal, Spy, Padbaba, &c.

On Saturday, September 10, Prof. Tylor opened the morning session by introducing the final report on the north-western tribes of Canada. He pointed out that, while the work of the committee has materially advanced our knowledge of the tribes of British Columbia, the field of investigation is by no means exhausted. The languages are still only known in outline. More detailed information on the physical types may clear up several points that have remained obscure, and a fuller knowledge of the ethnology of the northern tribes seems desirable. Ethnological evidence has been collected bearing upon the history of development of the culture area under consideration; but no archæological investigations have been carried out which would help materially in solving these problems. For this reason Prof. Tylor thought it was a matter for congratulation to know that the ethnological investigation in British Columbia will not cease with the operations inaugurated by the committee, but was now entrusted to the committee for the ethnological survey of Canada, the second report of which was to be read during the morning. He finally bore testimony to the very high value of the work done by that committee.

Mr. J. L. Myres then read a condensed abstract of the complete final report of the committee. It consists of two parts: (1) Report of the investigations into the physical characteristics of the tribes of British Columbia, by Dr. Franz Boas and Mr. Livingston Farrand; (2) a summary of the work of the committee in British Columbia, by Dr. Franz Boas.

Sir John Evans, commenting upon the report, said that one question that arose was whether the committee had been able in the course of their labours to acquire any of those old personal objects which formed such an interesting subject in the report. He knew that in the museum at Victoria there was a collection of the antiquities of the north-western tribes of Canada, but he believed that the bulk of the objects collected in Canada were still in the museum of New York. This circumstance, however, was largely due to the greater liberality of the United States Government. It would be a graceful act if the authorities of that museum were to present to the British Museum a typical collection of the objects that Dr. Boas had obtained, assisted as he had been by the British Association. When in Vancouver and Victoria he had thought it a great pity that the many objects collected from the original inhabitants of the country had not found their natural home within the British dominions. Dr. Dorsey, he was sure, would agree with him that there was an abundance of material from which a selection could be made for the mother country. In conclusion, he asked those present to express their pleasure that the labours of the committee had terminated so satisfactorily.

Dr. G. A. Dorsey, of Chicago, stated that one of the objects of his present visit to England was to arrange for the transfer of some portions of the collection under his care to museums in England. He gladly testified, from his own practical experience, to the value of the reports of the committee as a guide-book to the tribes which they described. He further pointed out that Dr. Boas was not now in the service of any association, but was employed by the New York Museum, the directors of which had placed at Dr. Boas' command something like 1200*l.* for equipment purposes.

The President endorsed the views of Sir John Evans and Dr. Dorsey as to the value and importance of the work of the committee and its embodiment in the pages of the report.

Mr. Hartland expressed the hope that the whole series of reports, some of which are out of print, might be republished in a convenient form; and a resolution to that effect was subsequently sent up by the Sectional Committee to the Committee of Recommendations.

Mr. A. Krauss read a paper, illustrated by lantern slides, on the Tarahumare people of Mexico. He showed that the Tarahumaris lie in the most inaccessible portions of the Sierra Madre of Northern Mexico. They are ignorant and primitive, and many still live in caves. What villages they have are at altitudes of some 8000 feet above the sea level. They are a small and wiry people, with great powers of endurance. Their only food is pinoli, which is maize parched and finely ground. They have a peculiar drink called teshuin, also produced from maize and manufactured with considerable ceremony. The language of these hillmen is limited to about 300 words, and their imperfect knowledge of numbers renders them unable to count beyond ten. The religion they have seems to be a distorted and imperfect conception of Christian tradition mixed with some of their own ideas and superstitions. Miss Zelia

Nuttall summarised her own observations of the same peoples.

Miss Mary A. Owen contributed a note on the myths and customs of the Musquakie Indians.

Mr. C. Hill-Tout sent photographs of newly-discovered rock drawings from British Columbia.

The second report of the Committee of the Ethnographical Survey of Canada stated that the investigation presents two main branches: (1) that dealing with the white races, and (2) that dealing with the aborigines or Indians. These, however, are not entirely distinct, for a particularly interesting line of inquiry is that relating to the Métis or "half-breeds," resulting from the intermixture of the whites and Indians.

Three sets of anthropometric instruments have been purchased, and distributed to Mr. Charles Hill-Tout, of Vancouver; to Mr. A. F. Hunter, of Barrie, Ontario, who has associated with him Dr. F. Tracey, of Toronto; and to Dr. A. C. Hebbert, of Montreal. A camera, specially adapted to its work in the field, has been placed in the hands of Mr. Hill-Tout.

Communication has been opened with the Committee appointed by the American Association for the Advancement of Science for an Ethnographic Survey of the United States.

The several provincial governments of Canada have been approached for the purpose of obtaining, if possible, grants in aid of the work of the Committee. Nothing has, however, so far resulted from the communications referred to in the way of material aid; but Mr. David Boyle has been commissioned by the Government of Ontario to obtain photographs of the Indians of the province in connection with his investigations of Iroquois religious rites. Proceeding upon the lines adopted by Mr. B. Sulte in regard to the province of Quebec (whose results form Appendix II. of the Committee's Report), a similar inquiry has been undertaken by Mr. A. F. Hunter in regard to the composition of the population of the several counties of the province of Ontario. In British Columbia Mr. C. Hill-Tout has been able to do some work among the Haida Indians, and his results are presented in Appendix I.

On Monday, September 12, Miss A. G. Weld exhibited an early Cinghalese bronze image of Buddha, found in 1886 on the estate of Baltrasna, about 15 miles from Kells, by a labourer digging deep into a bog. Mr. C. H. Read accepted the image as a genuine work of Buddhist art, but quoted the frequent discovery of Chinese porcelain seals on Irish sites, which, like the figure in question, were probably not imported before the establishment of the tea trade. Sir John Evans pointed out that a bog would offer a safe place of concealment for stolen property. Dr. Beddoe stated that there was evidence, which was at least suggestive, that Buddhist missionaries did at some remote period reach these islands.

Mr. W. Crooke, late Director of the Anthropological Survey of the North-western Provinces and Oudh, read a paper on the jungle-folk and other Dravidians of Northern and Central India, describing the character of the country occupied by these races, their environment, food-supply and industries, and considering, mainly on the evidence of anthropometry, the relations between these jungle races and the peoples inhabiting the great northern plains. The suggestion that they were Mongoloid was dismissed as contrary to evidence recently collected. There was probably an original Negrito element in the earlier Indian races, but the existing traces of it appear hardly elsewhere than in the Veddas and the Todas. The existing Dravidians possibly represent a later emigration from the African continent, possibly reaching India by a route more northerly than that taken by the Negritos. In regard to the preponderate Dravidian element in the existing races, he briefly discussed the measurements collected by Mr. Risley and himself, and while generally accepting the conclusion that the effect of the Aryan invasion was more social than racial, he emphasised the need of a more extensive collection of measurements both on Indian soil as well as in Eastern Africa. He then proceeded to note survivals of primitive custom among the Dravidians. A discussion followed in which Dr. Beddoe, in conflict with Mr. Risley, asserted the existence of a considerable Aryan element among the present races.

Mr. Sidney Hartland desired to emphasise the value of the work done by Mr. Crooke in his inquiries among the races of the North-west Province and Oudh, and referred to the fact that ethnological work was positively discouraged among its officials by the Indian Government. Any one who realised the already very complex character of the facts relating to the native races, and the still increasingly complicated differentiation of new sub-castes and sections, must come to the conclusion that the amazing indifference of the Indian Government to ethnological questions was nothing short of suicidal. He would be glad if a representation could be made to the Indian Government urging the pressing importance to the Indian Empire of an exhaustive and sympathetic study of the races under its care.

The President heartily associated himself with the suggested appeal to the Indian Government.

An *ad interim* Report of the Torres Straits Anthropological Expedition was read, to the effect that Murray Island was reached on May 6, where, in the course of a fortnight, a number of anthropological and psychological observations were made. Delena was reached on May 27, and Port Moresby on May 31. In the absence of the Governor, Sir William Macgregor, Mr. Musgrave gave every assistance. Short visits were paid to Kaile, Kappakappa, Hula, Babaka and Kerepunu. Subsequently a short excursion was made to the Astrolabe Range. Drs. Rivers, MacDougall and Myers have obtained a large number of observations in experimental psychology, and the whole of the party have enjoyed good health.

Mr. R. E. Guise, in a paper on the tribes inhabiting the vicinity of the mouth of the Wanigela (Kemp Witch) River, New Guinea, described the tribes of Bulâa, Kamali, Babaka, and Kalo.

Mrs. Isabella Bishop read an instructive paper on the Mantzu of Western Sze-Chuan. She entered upon the territory of the Tssu-Su of Goms and lived for some weeks among the Mantzu, being lodged either in their houses or on their roofs. She described the aspect of their villages and their dwellings, their devotion to Lamaistic Buddhism, their system of government, and their marriage and burial customs. Their most noteworthy characteristic was the position accorded to women, who were as unfettered as in England and America, and were on an absolute equality with men, possessing legal rights to property. She minutely described the dress and ornaments of both sexes, showing their occupations and amusements, and pointed out certain resemblances to the Lolos of Yunnan. They had their own language, but it was written in Tibetan characters. Their physiognomy was European in expression as well as feature, and recalled that of the Latin races. Mr. Archibald Little described some of his own experiences in the region, and characterised the inhabitants as being polite and hospitable. They seemed to be wedged in between China and Tibet; and how they came there appeared to be an ethnological puzzle, as their appearance was similar to the high-class Italian. Mr. Warington Smyth commented upon the characteristics of the country.

Sir T. Hungerford Holdich's paper on the Afridis and Swatis was postponed, owing to the serious illness of the author.

On Tuesday, September 13, Miss Mary H. Kingsley read a paper on West African conceptions of property, the object of which was to give some idea of the law and nature of property among the peoples of true Negro stock. The geographical distribution of the true Negro stock is a subject worthy of attention for several reasons. One is that among these peoples were found the most highly developed form of native African culture; another, that in the matters of physical and mental characteristics the true Negro differs greatly from the better-known Bantu stock. A high percentage of error had at present been attained by the failure to recognise these differences, and thereby the work of Sir A. B. Ellis on the true Negro, and that of Bastian on the true Bantu, had not yet been given its full scientific value. The three kinds of property existing in West African culture are (1) an ancestral property of the tribe ("stool" or "cap" property); (2) family property in which every member of the family had a certain share, to which every member had to contribute, and on which every member had a claim; (3) private property, acquired by personal exertion (over and above that made in co-operation with other members of their family) gained by gifts, or made in trade by the exertion of superior trading ability. Each of these kinds of property was equally sacred in the eye of native law. The only kind that could become another kind of property was the private. Stool property and family property remained of their kind for ever, and could not be alienated, though liable, with all the other kinds, to meet debt. Wealth was divisible into (*a*) the means by which property could be acquired and developed, to which division belonged wives and slaves; (*b*) property in power over market rights, utensils, canoes, arms, furniture, and trade goods. Property was guarded by and existed under the law represented by the cult of the law

god, and by the influence of religion. The President said that so elaborate a legal system, with such sound equitable principles, had seldom been brought before the Association. Sir William Crookes expressed his great admiration of the paper, and hoped that Miss Kingsley would read similar papers at future meetings.

Mr. H. P. FitzGerald Marriott then read a paper on the native secret societies of the West Coast of Africa. These societies maintained the religious and social principles of the people, and administered justice according to native law and custom. Some of them were merely temporary, such as the lesser Purroh of certain parts of Sierra Leone, of which white men spoke; others, again, were ancient tribal institutions, such as the secret religious or State Purroh, with its grand council, of which most people were unaware. Mahommedan influence was seen not only by the personal association of the latter, but by the knots that were used as charms both by some of these societies as well as by individuals. The names and varieties of these societies were numerous. Those nearest to each other were generally on good terms, though distinct; and all could be more or less connected. In various instances the Government could employ these societies to carry out its ends, and by means of methods to which the natives were accustomed could gradually habituate them to British law and order.

M. le Comte Charles de Cardi read a paper on "The natives of the Niger Delta," giving an account of the early navigators who visited Western Africa; of the origin of the Benin people and of many of their customs; of Ju-Juism in the delta, with some description of devil-huts; and concluding with an estimate of the capabilities and future of the West African natives.

Mr. C. H. Read contributed a paper, illustrated by a series of lantern slides lent from the collection of the Anthropological Institute, on "Ancient works of art from Benin city." He pointed out that the position of Benin near the great waterway of the Niger had brought it into contact with influences from the north. It was thus possible that here might be found some relics of the ancient civilisations of the Mediterranean. Relations with Abyssinia were founded on the journey of a Franciscan friar from Benin to Ethiopia in the fourteenth century, and some corroboration of this was found in the Benin tradition that the king was subject to a powerful prince far to the east. In the hope of finding evidence of these traditions in the loot that came from Benin, Mr. Read had made representations to the Government, with the result that a large collection of ancient examples of Benin art had been secured for the British Museum, though it could scarcely be said that they had any direct bearing on the relations of Benin with either the extreme north of Africa or the East. A document of great interest bearing on their origin was a report by Sir Ralph Moor, giving the account of a palaver with the Court historian, three Ju-ju men, the master smith, the master wood-carver, and the master ivory carver, from which it appeared that the white men first came in the time of King Esige, and one of them, named Ahammangiwa, made the plaques and brass-work for the King. Assuming an average reign of twenty to twenty-five years for each of the kings, this would bring the time of Esige to about 300 years ago, a date that would correspond very well with the date of the European costumes shown in the plaques.

Mr. C. W. Hobley sent some vocabularies and illustrative examples of the languages of Kavirondo. Copies of these are to be seen and consulted in the library of the Anthropological Institute.

In the afternoon Prof. Flinders Petrie gave a summary of the principal discoveries during the last five years that had revealed the rise of Egyptian civilisation. Various excavations at Koptos, Naqada, Abydos and Hieraconpolis had discovered remains belonging to the ages before 4000 B.C., which had hitherto been the starting point of known history. Beginning with the Libyan stock, with some Negro mixture, which occupied Egypt in its earliest civilisation, he showed some of the objects he had found at Naqada. These were at first temporarily assigned to a new race; but now they could be safely assigned to the pre-dynastic stock about 5000 B.C., and even earlier. In the graves of this aboriginal race were found bowls of black clay with patterns imprinted upon them. In each of the countries where this type had been found, it was contemporary with the introduction of metals. The proximate date of this was 5000 B.C.—and that accorded very well with the time necessary for arriving at the high culture attained by 1500 B.C. Therefore these discoveries were of great value in giving the relative state of Egyptian civilisation to that of the rest of the world at the introduction of dynastic rule. There was a wide difference between the people of 5000 B.C. and those of 4000 B.C., but no difference between those of the latter period and modern times. This showed that a different race entered the country about that period.

Next came the earliest dynastic remains, *e.g.* the presumed tomb of King Mena, the founder of the dynastic history, of about the date of 4700 B.C., then the remains of other royal tombs found at Abydos belonging to the first three dynasties. The gradual decay of flint working between 4500 B.C. and 1500 B.C., as metals came into use and copper was gradually hardened into bronze, had no parallel in the world. Prof. Petrie showed diagrams and impressions of cylindrical seals as used by the kings of the first three dynasties, also a vase exhibiting the earliest representation of Egyptian mythology and other vases, tablets, and slates showing animals and birds. These finds were very important, as they showed the rise of the art of modelling, and of the Egyptian ideas and appreciation of the forms of animals and of the human body, and proved that Egyptian art reached its high-water mark somewhere before B.C. 4000. Other finds showed the kings in triumph over their enemies, receiving captive kings, opening the public works, or reclaiming the marshes. The handled copper vessels showed the most advanced metal work found of the first three dynasties. The population of the pre-dynastic age was different in type from that of historical times, and in the early monuments the presence of diverse types was very clear. We had at last before us evidence of the close of the period previously considered prehistoric, showing the development of the art, writing, and civilisation of Egypt and the composition of a race which had since maintained its character during 6000 years. Egypt was then an originator in the arts and not a borrower, but ever since then most of the nations of the earth had been borrowers and not originators. Here we were studying the history of a country not borrowing but developing a vast and complex civilisation on its own resources.

Sir John Evans said that the wonderful flint knives must have been the culminating point of an art stretching over a vast series of years. Where was all that civilisation developed? He hoped that the recent conquests in Egypt would materially assist us in investigating that matter.

Mr. Arthur Evans thought a comparison of the pottery of other parts of the Mediterranean basin with that of Egypt helped to bridge the gap which separated early Egypt from the dawn of civilisation in Europe. He considered that Prof. Flinders Petrie would be safe in assigning his discoveries even to an earlier date than he had done.

Prof. Flinders Petrie, in reply, said that he himself thought that he was well within the mark, but he chose the date he had fixed in order to be absolutely safe.

Miss A. Goodrich Freer then read a paper on "The folk-lore of the Outer Hebrides." This folk-lore has a degree of interest which justified the inconvenience attendant on its collection. A peculiar value attaches to the ancient hymns, stories and legends, and to the charms, spells and divinations, because these were more certainly becoming difficult to recover.

On Wednesday, September 14, in the morning, the programme consisted of papers on archæology and folk-lore.

Mr. Sidney Hartland presented the sixth Report of the Committee on the Ethnographical Survey of the United Kingdom, emphasising the fact that, while the whole scheme of the committee's inquiries included a number of subjects, it was not considered necessary for each observer to deal with them all, and that some subjects, such as current traditions and beliefs, and dialects, were more immediately pressing than others.

Mr. A. Bulleid presented the third Report of the Committee on the Lake Village at Glastonbury. Twelve more dwelling mounds have been examined, as well as the ground between and around them, and the southern end of the settlement has now been completely explored, the timber substructure in this locality being in a better state of preservation than in any part hitherto examined. Mounds A, B, C and D showed the gradual growth of the village, easily recognised by the floor of one mound overlapping the floor of the mound immediately contiguous to it, also for the number of bone needles found. Mound E contained the remains of a small furnace of baked clay, fragments of crucibles, and small pieces of bronze. In Mound A A, part of the framework ostensibly of a loom was discovered; evidently discarded before the first dwelling was erected.

Mr. Arthur Evans supplemented this report with a paper on the place of the Glastonbury Lake Village in British archæology. He insisted upon the homogeneous character of the culture here revealed, and showed that it belonged entirely to the pre-Roman period and the first and second centuries B.C. It represented a distinct phase of a form of culture introduced into Britain by the invading Gaulish tribes. The glass-working industry of Glastonbury was probably derived, by the same overland route as various forms of vases, safety-pins, and other relics, from the old Venetian region where this art flourished already in prehistoric times. The name Glastonbury itself was a translation of the Celtic Ynis-witrin—Glass Island.

Prof. Boyd Dawkins said that the inhabitants of that village had most probably introduced both glass-making and lead-mining. He had no doubt that Mr. Arthur Evans's derivation was correct. Sir John Evans thought that the mere fact of the dwellings being in that unsuitable position pointed to the probability that the constructors were lineally connected with other lake dwellers on the continent of Europe. That the occupation of the village ceased in the first century after Christ seemed probable, because of the general absence of Roman ware.

Prof. W. M. Flinders Petrie then read a paper on traces of primitive *Terramare* settlements in the modern towns of North Italy. He showed that recent clearing at Castellaro di Fontanellato had disclosed the fact that the marsh towns of North Italy in the Bronze age were arranged on a strictly square system of crossing roads, and that this type of town was perpetuated in the regular plan of the camps of the Roman army. On examining the present plans of the cities of Lombardy, the outline of the original square settlements could be plainly traced. Replying to the objection that the existence of square forms of towns did not itself prove that those forms were of pre-Roman date, Prof. Petrie said that that was not really his argument; granting or assuming the pre-Roman date, the square forms of the towns would indicate the presence of *Terramare* settlements.

Mr. P. F. S. Amery then exhibited, with explanatory remarks thereon, a series of lantern slides showing the megalithic monuments of Dartmoor, in anticipation of the Devonshire excursion arranged in connection with the Bristol meeting.

The Report of the Committee on the Excavations at Silchester stated that the area selected for excavation in 1897 included two *insulæ* (XVII. and XVIII.), extending from *insula* III. (which was excavated in 1891) to the south gate, and lying on the west side of the main street through the city from north to south. It is proposed during the current year to excavate the two *insulæ* south of *insulæ* XV. and XVI. (excavated in 1890), and a triangular piece of ground to the south of them, almost as large as a third *insula*. When the examination of this area is completed, considerably more than half the city will have been systematically excavated and planned.

Miss Nina Layard reported the discovery of human skeletons walled up in the remains of the Black Friars' monastery at Ipswich.

Mr. T. W. Shore read a paper on traces of early Kentish migrations. He identified such early Kentish colonies by Jutish or Kentish place-names under their present or more ancient form; by other place-names derived from the Jutish hero Hengest; by survival of gavelkind and customs of land tenure analogous to those of Kent, and of kindred customs.

Papers on the folk-lore of Guernsey, by the late Mrs. Murray-Aynsley, and on myths of insect life, by Mr. S. Clement Southam, were taken as read; and the session closed with a vote of thanks for the use of the Park Place Schoolroom, and with the exhibition in the Committee-room, by Mr. H. Bolton, of human relics from the recently discovered caves at Uphill.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

A LETTER written by the Public Orator, Dr. Sandys, thanking Mrs. John Hopkinson and other members of her family for their munificent benefaction of 5000*l.* to the University of Cambridge, to be applied to the building of a memorial of the late Dr. John Hopkinson and Mr. J. G. Hopkinson, was read by Dr. Sandys in the Senate House, and approved by Grace of the Senate, on November 10. It has since been engrossed on parchment and presented to Mrs. Hopkinson.

Science announces that the late Edward Austin, of Boston, has given by his will 1,100,000 dollars for public purposes; 500,000 dollars is left to Harvard University, 400,000 dollars to the Massachusetts Institute of Technology, 30,000 dollars to Radcliffe College, 30,000 dollars to Roanoke College, and 30,000 dollars to the Tuskegee Normal and Industrial School. The income from these large bequests is to be used for scholarships. The sum of 10,000 dollars is also given to the bacteriological laboratory of the Harvard Medical School.

AT a conference on secondary education, convened by the Victoria University, and held on December 3 at Owens College, Manchester, resolutions were passed urging that (1) a Minister of Education of Cabinet rank should represent the Education Department in Parliament. (2) The consultative committee mentioned in Clause 3 of the Bill laid before the House of Lords last session should be obligatory. (3) Immediate provision should be made for the institution of local authorities for secondary education. Another resolution, to the effect that the relations of the proposed Board of Education to the Charity Commissioners should be more clearly defined in the Bill, was adopted.

A COURSE of about thirty-three lectures on "The Morphology and Histology of the Vascular System," commencing on January 11, will be given at University College, London, by the assistant professor, Mr. A. G. Tansley, each lecture to be followed by two hours' practical work or demonstration. An attempt will be made to trace the evolution of the stele of the vasculares through the various stages exhibited by pteridophytes and phanerogams. A special feature of this part of the course will be the inclusion of the important fossil types, many of which throw much light on the course of evolution of the vascular system, and whose anatomy has become fully understood only through the researches of the last few years.

SIR J. GORST, M.P., delivered an address to agriculturists at Cambridge on Saturday afternoon, on "Education in Agricultural Districts." In the course of his remarks, he said that reports showed that the chief reason for the prosperity of agriculture in foreign countries was the education of the people in all technical knowledge pertaining to their industries. If efforts were to be made to raise agricultural education in this country to something like the level of Denmark, France, or Switzerland, they had a very difficult task before them. Elementary education was the bed-rock upon which the whole of the superstructure must be built. It was useless to attempt a national system of technical instruction until there was a sound system of elementary instruction upon which it could be based.

THE Association of American Agricultural Colleges and Experiment Stations recently held a successful meeting at Washington, D.C. The following facts with reference to the Association and its work make a striking testimony of the condition of agricultural education and research in the United States: The institutions represented in this Association employ over 1500 persons in their faculties, who are giving instruction to about 30,000 students. These institutions have over 50,000,000 dollars in permanent endowments, buildings and equipment, and an annual revenue of nearly 6,000,000 dollars, of which more than 2,000,000 dollars is derived from funds granted by the United States. Besides the work of instruction, they are carrying on original research in different directions. This is especially true in many scientific lines relating to agriculture, over a million dollars being spent for this purpose annually. There are now pending in Congress propositions to establish, in connection with these institutions, experiment stations for investigations in mechanical arts and naval engineering, for which some of the colleges already have considerable facilities.

THE Chelsea Physic Garden is in future to be administered in accordance with an extended scheme. The *Pharmaceutical Journal* states that the Apothecaries' Society has decided, owing to considerations of expense, to abandon the management of the garden which, it will be remembered, was founded by Sir Hans Sloane in the early part of the eighteenth century, and was subsequently transferred to that Society in trust. A scheme has accordingly been drawn up for vesting the control in the Trustees of the London Parochial Charities, but it is proposed that the actual management should devolve upon a committee of fifteen members, eight to be nominated by the Trustees, and one each by the Treasury, the Lord President of the Council, the Royal Society, the Technical Education Board,

the Society of Apothecaries and the Royal College of Physicians in turn, the Pharmaceutical Society of Great Britain and the Senate of the University of London. It is intended that the existing garden should be fully maintained, a suite of rooms being provided for lectures and experimental teaching, whilst the Trustees are to be given authority, if they think fit, to erect and fully equip a physiological laboratory.

To carry out the new scheme referred to above, an annual income of eight hundred pounds is to be provided by the Trustees, and it is proposed in addition that the committee shall be furnished with such a capital sum as may be necessary to enable them to enforce the scheme to its full extent. The committee is to appoint a curator for the scientific supervision of the garden, and other members of the staff. Further, the committee will be authorised by the scheme to provide instruction in botany by means of lectures, demonstrations, &c., with special reference to the requirements of elementary education; to arrange for the maintenance of botanical collections of living plants for teaching purposes, and, so far as practicable, for the supply of botanical specimens for the purpose of external instruction. Students of institutions receiving aid from the funds of the City Parochial Foundation are to be eligible for admission without payment of fees; and it is provided that, so long as a yearly payment of not less than one hundred and fifty pounds is made to the Trustees out of the moneys provided by Parliament, students of the Royal College of Science shall also be admitted to the garden without payment, while they, the professors and teachers of the College, shall be entitled to the use of the garden, the botanical collections, and the lecture rooms for such time as may be approved by the Charity Commissioners. It will thus be seen that the scheme is of a far-reaching character, and calculated materially to increase the usefulness of the garden.

SCIENTIFIC SERIALS.

Memoirs of the Kazan Society of Naturalists. Vol. xxx.—On the oro-hydrography of the Nizhne-Isset mining region in Middle Ural, by V. Rozhkoff, with an orographic map in which the plateau character of the region appears very well.—On intracellular growths in cancer, by A. Rebrovsky, with a plate. Sporiferous growths were not found in cases unaccompanied by wounds.—On the parisitism of the Rotatoria *Notomatta Wernecki* in the Vaucheria, by W. Rothert, with a plate.—On the geology of the water-parting between the Volga and the Don at Tsaritsyn, by M. Yanischewsky. A large development of old Post-Pliocene alluvial deposits was found.—Water in wells at Kazan, by Prof. Scherbakoff.—On crystal-bearing cells in cork membranes, by W. Rothert. The observations of Zacharias, Cederwall, and Meyer are confirmed by observations on *Agave*, *Fourcroya*, *Drocaena*, and several others.

Vol. xxxi.—On the structure of the membrane of the vessels in plants, by W. Rothert, with a plate. A preliminary report on extensive researches into this question.—On the pathological and anatomic changes in organs and tissues resulting in raphania, ergotismus, and similar diseases, by N. Vinogradov, with one coloured plate. A detailed investigation of many cases of these diseases, which often assume in Russia an epidemic character.—On investigations of the soil, made in 1896 by R. Rispolozhensky. Part of a wide system of investigation which is being carried on for many years in Russia.—Chemical and physical researches into the soils of Kazan, by V. Sorokin.—The fauna of the upper parts of the Permo-Carbonic formations on the Kama and Chusovaya rivers, by N. Romanov. Eighty-nine species are described, the following being new: *Aviculopecten Stuckenbergi*, *A. parvulus*, and *Pleurotomaria fluctuosa*. The deposits belong to the Kungur division of Prof. Stuckenberg.

Bollettino della Società Sismologica Italiana, vol. iv., 1898, No. 4.—On the investigation of seismic periodicity by the method of overlapping means, by C. Davison. A description (in English) of a rough method of harmonic analysis suitable for the investigation of the annual and diurnal periodicity of earthquakes, with examples worked out in illustration of the method.—On the increase of activity presented by Vesuvius in the months of April and May, by R. V. Matteucci.—Notices of earthquakes recorded in Italy (September 1897), by G. Agamennone. A long and valuable series of records of three earthquakes, two of which originated at Labuan (Borneo) on September 20 and 21, and the third in the province of Ancona (Italy) on September 21.

Bulletin de la Société des Naturalistes de Moscou, 1897, No. 4. This volume contains one paper, "*De Aphodio sculticolli m. (nigrivitti*, Rth.) *ejusque cognatis*," in Latin, by A. Semenoff. The remainder is taken up with the proceedings, which contain a number of shorter notes, and the yearly report. During the year 1897 a considerable number of members of the Society, chiefly botanists, explored various parts of Russia.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 17.—"The Electrical Conductivity and Luminosity of Flames containing Vaporised Salts." By Arthur Smithells, H. M. Dawson, and H. A. Wilson. Communicated by Sir H. E. Roscoe, F.R.S.

(1) The authors conclude from their experiments, that the conductivity of vaporised salt is of an electrolytic character, but that there are features connected with it that distinguish it from electrolytic conduction in aqueous solution. Thus Ohm's law is only obeyed within certain limits, and the general relation between current strength and electromotive force can only be represented generally by a more complex expression.

(2) The conductivities of different salts differ greatly, according to the electropositive constituent.

(5) Among different salts of the same metal differences of conductivity appear at the higher concentrations, but at low concentrations equivalent solutions have equal conductivity.

(4) The conductivity of the haloid salts as a group is distinct from that of the oxy-salts.

(5) The conductivity of the haloid salts of a metal among themselves increases with the increasing atomic weight of the halogen.

(6) The conductivity of the oxy-salts of a metal is approximately equal, and approaches that of the hydrates.

(7) The more easily oxidisable halogen salts are probably partly converted into oxide in the flame, so that their conductivity is composed of two parts.

(8) The behaviour of the salts in flames supplied with chloroform vapour seems to establish the fact that the conductivity and the colour produced by the salt vapour are not due to a common cause.

The coloration of a flame by an alkali salt does not seem therefore to be connected with the conisation of the salt. It must be attributed to the metal set free by a chemical process. This process consists probably in a reduction effected by the flame gases. An oxy-salt would, generally speaking, form in the first instance an oxide, which would then be reduced. In the case of haloid salts it seems also necessary to suppose that an oxide is intermediately formed, the metal being then liberated by reduction.

Physical Society, December 9.—Mr. Shelford Bidwell, F.R.S., President, in the chair.—Dr. C. Chree read a paper on longitudinal vibrations in solid and hollow cylinders The ordinary formula for the frequency of longitudinal vibrations refers to an ideal rod of infinitely small section. This formula constitutes a first approximation, according to which the higher notes are exact harmonics of the fundamental note. Prof. Pochhammer, and Lord Rayleigh independently, over twenty years ago, arrived at a corrective term for solid isotropic rods of circular section, according to which the harmonic relation between the notes is no longer exact. During the last twelve years Dr. Chree has devoted several papers to the subject, confirming by independent methods the *results* obtained by Pochhammer and Rayleigh, and arriving at analogous results for other forms of section, and for material symmetrical round an axis but not isotropic. The first part of the present paper develops what appears to be a new method, based on expressions obtained some years ago by the author for the mean values of the strains in an elastic solid of any kind or shape, exposed to any system of forces. Besides confirming his previous results, Dr. Chree obtains new results applicable to material neither isotropic nor symmetrical round the axis of the rod. The second part of the paper treats of a hollow circular rod, or tube, of isotropic material. When the walls of the tube are thin, the correction to the ordinary formula is twice as large as for a solid

rod of the same diameter. The different methods all point to the conclusion that the ordinary formula supplies a close approximation to the truth only so long as the greatest diameter of the cross-section is small compared to the nodal interval in the rod.—A paper on the thermal properties of normal pentane, by Mr. J. Rose-Innes and Dr. Sydney Young, was then read. In 1894 the authors investigated the relations between the temperatures, pressures and volumes of isopentane, through a wide range of volume; the results are published in the *Proc. Phys. Soc.*, xiii. pp. 602-657. It is there shown that if a and b are constants depending on the nature of the substance and on the volume, the relation $p=(bT-a)$ at constant volume holds good with but small error from the largest volume (4000 cub. cms. per gramme) to the smallest (1·58 c.c. per g.). In the neighbourhood of the critical volume (4·266 c.c.), and at large and very small volumes, the observed deviations are well within the limits of experimental error, but at intermediate volumes they are somewhat greater. As they exhibit considerable regularity, it is a question whether they could be attributed entirely to errors of experiment. In any case, the above relation may be accepted as closely approximate to the truth. The present paper refers to a similar investigation on pure normal pentane obtained by the fractional distillation of the light distillate from American petroleum. The method employed for this separation is fully described in the *Trans. Chem. Soc.*, vol. lxxi. p. 442, 1897; the vapour pressures, specific volumes as liquid and saturated vapour, and critical constants are given in the same journal, p. 446. With regard to theoretical deductions from the present results, advantage is taken of the fact that a similar set of experiments had already been carried out with isopentane, which is an isomer of normal pentane. It was hoped that light would be thrown on the question of the influence exerted by difference of chemical structure on the thermal properties of a substance. The conclusion arrived at as most probable is that the coefficients of the second power of the density in the expansion of p must be different for the two substances. The slope of the curve obtained by plotting $(av^2)^{-1}$ against v^{-1} suggests discontinuity somewhere about vol. 3·4, as with isopentane. Mr. Lehfeldt asked whether the authors had observed any other singularity or discontinuity at vol. 3·4. He also asked whether the authors were satisfied with ordinary squared-paper in plotting their curves. It ought to be possible to design a machine for doing the work mechanically to one-fiftieth of a *m.m.* accuracy. Mr. Appleyard said the fractionating apparatus devised by Dr. Young was a great improvement on older forms; it ensured that there should always be sufficient and yet not too much liquid at each valve-trap. He hoped that details of the tube, in its latest form, would be included in the paper. In the separation of such a mixture as chloroform and alcohol the common method by water-extraction was imperfect; it was not desirable always to convert the mixture wholly into chloroform. Ordinary fractionating tubes yielded an impure distillate in this case. Perhaps the difficulty was inherent for those two liquids. Dr. Young's apparatus would put the question beyond doubt. Dr. Young, in reply, said that the only objection to curve-tracers was their cost. The curves he had obtained from his experimental results were all isothermals; he did not think isobars would indicate anything such as Mr. Lehfeldt had suggested. With regard to such mixtures as chloroform and alcohol, the chances of separation were difficult to predict. A distinction might, however, be drawn between liquids partially miscible, and liquids miscible in all proportions. Hexane (b.p. 69° C.) and benzene (b.p. 80° C.) for instance, were both hydrocarbons miscible in all proportions, and it might be thought possible to separate them by a fractionating apparatus. But experiment shows they cannot so be separated. If alcohol and chloroform should turn out to be miscible in all proportions, the probability was that they could not, effectively, be fractionated; if, on the other hand, they prove to behave like partially miscible liquids, the separation by a fractionating apparatus such as he had described was rendered possible.—The President proposed votes of thanks to the authors, and the meeting adjourned until January 27, 1899.

Chemical Society, December 1.—Prof. Dewar, President in the chair.—The following papers were read:—The oxidation of polyhydric alcohols in presence of iron, by H. J. H. Fenton and H. Jackson. In presence of iron, methylic, ethylic, propylic, isopropylic and amylic alcohols are not oxidised by hydrogen peroxide; but vigorous oxidation of ethylene glycol, glycerol, erythritol, mannitol, dulcitol and sorbitol is effected by hydrogen peroxide in presence of, but not in absence of, ferrous salts.—The occurrence of hyoscyamine in the *Hyoscyamus muticus* of India, by W. R. Dunstan and H. Brown. The stem and leaves of *Hyoscyamus muticus* contain about 0·1 per cent. of hyoscyamine; the alkaloid can be extracted more readily from this plant than from henbane.—The comparative colour of the vapour of iodine in gases at atmospheric pressure and in a vacuum, by J. Dewar. By distilling and condensing iodine on a glass surface at −180° to −190° in vacuum test-tubes or bulbs, transparent films of iodine of varying thicknesses may be obtained. On enclosing pure iodine in half-litre flasks, a visible colour is imparted to the air, carbon dioxide, hydrogen or oxygen with which the flask is filled at ordinary temperatures; if the flask be evacuated, the colour of the atmosphere is markedly less, and this distinction remains even when the flasks are heated side by side on the water-bath.

PARIS.

Academy of Sciences, December 5.—M. Wolf in the chair.—Contribution to the theory of the safety bicycle, by M. J. Boussinesq. A mathematical investigation of the equilibrium of the rider.—On the anomalous dispersion and magnetic rotatory power of certain incandescent vapours, by M. Henri Becquerel. In a previous paper the author has explained the unusually great rotatory power observed by MM. Macaluso and Corbino for radiations from sodium vapour in the immediate neighbourhood of absorption bands by regarding the phenomenon as one of abnormal dispersion. In the present paper experimental details are given of a method of making the sodium flame act itself as a prism. The spectrum from an electric arc, which has passed through this flame, shows discontinuities in the neighbourhood of the D lines. The results form a complete explanation of the results of MM. Macaluso and Corbino, and are in agreement with the theoretical views previously put forward by the author.—On the velocity of sound in air, by M. J. Violle. A discussion of the objections raised by M. Leduc to measurements of the velocity of sound made in the open air. It is shown that the presence of moisture leads to a correction which is smaller than the experimental error of the measurements.—On the synthesis of phenol from acetylene, by M. Berthelot. This synthesis is of interest on account of the comparatively low temperature (200° C.) at which it can be effected. Acetylene is passed into fuming sulphuric acid, the liquid diluted, and the potassium salt prepared of the acid thus formed. This salt, submitted to a potash fusion at 180° to 220° C. for twenty minutes, the mass acidified and distilled; phenol is readily recognisable in the distillate. A repetition of the process upon the residue in the retort yields more phenol.—Action of acetylene upon the metal-ammoniums, by M. Henri Moissan. The metals (sodium, potassium, lithium, and calcium) were dissolved in liquid ammonia at −40° to −80° C., and pure acetylene gas passed in. The residues obtained after evaporation of the excess of liquid ammonia had the compositions, respectively, $C_2Na_2.C_2H_2$, $C_2K_2.C_2H_2$, $C_2Li_2.C_2H_2.2NH_3$, C_2Ca, C_2H_2, $4NH_3$; all these compounds dissociate on heating, leaving the corresponding carbides, C_2Na_2, C_2K_2, C_2Li_2, C_2Ca.—The colour of calcium carbide, by M. Henri Moissan. Absolutely pure calcium carbide is transparent and colourless; the presence of a minute trace of iron is sufficient to give it the reddish brown colour of the material obtained by the electric furnace.—On the properties of aluminium, by M. A. Ditte. Aluminium is readily attacked by many chemical reagents, acids, alkalies and salts; but in many cases a protecting layer of gas or oxide is formed, so that little or no action takes place in cases where thermochemical data would lead to the prediction of a very energetic attack. Circumstances which destroy this film, lead to rapid solution of the aluminium.—Histology of the skin, by M. L. Ranvier. A study of the fatty matter of the corneal layer of epidermis in man and other mammals.—The liver as a pigmented organ in the Invertebrates, by MM. A. Dastre and W. Floresco. A comparison of the differences and similarities of the hepatic organs in Vertebrates and Invertebrates.—On the prediction of the occultations of stars by the moon, and on the calculation of terrestrial longitudes by means of occultations, by M. G. Bigourdan.—Numerical results obtained for the latitude of the Observatory of Paris by observations made on the garden meridian circle, by MM. H. Renan, J. Perchot, and W. Ebert.—On the determination of gravity on the summit

of Mont Blanc, at Chamonix and at Meudon, by M. Hansky.—On differential equations of the second order with fixed critical points, by M. Paul Painlevé.—On the singular points of a function defined by a Taylor's Series, by M. Le Roy.—On the reduction of multiple integrals, by M. Ch. J. de la Vallée Poussin.—On a new phenomenon exhibited by light in traversing certain metallic vapours in a magnetic field, by MM. D. Macaluso and M. O. Corbino. A discussion of the theory advanced by M. Henri Becquerel.—Remarks by M. Becquerel on the preceding paper.—Absorption in a magnetic field, by M. A. Cotton.—Comparative study of the Hertzian field in air and in water, by M. Albert Turpain.—The Blondel-Carpentier hysteresimeter and its application to the statical measurement of hysteresis, by M. A. Blondel. The paper is accompanied by diagrams of the apparatus. Measurements made by the ballistic method were in close agreement with the readings of the instrument.—On the transmission of sound by a wire capable of conducting electricity, by M. Dussaud.—Displacement of metals by hydrogen, by M. Albert Colson. Dry phosphate of silver absorbs hydrogen in the dark and at 12° C. with production of free silver and phosphoric acid. This change goes on more rapidly when the temperature is raised. Silver pyrophosphate, sulphate, and oxide behave similarly.—On the combination of acetone with mercuric sulphate, by G. Deniges. The compound formed has a very high molecular weight, and contains only one-seventeenth of its weight of acetone. Hence it is a suitable means of detecting and estimating small quantities of acetone.—Action of hydrocyanic acid upon epichlorhydrin, by M. R. Lespieau.—On the development of the dilator muscle of the pupil in the rabbit, by M. Ed. Grynfellt.—On the digestion of starch in plants, by M. Leclerc du Sablon.—Elective absorption of some mineral elements by plants, by M. E. Demoüssy. If nitrates and chlorides are simultaneously at the disposal of a plant, nitric nitrogen is absorbed in preference to chlorine.—Chlorophyll assimilation in terrestrial orchids, and in particular in *Limodorum abortivum*, by M. Ed. Griffon. Terrestrial orchids, considered from the point of view of carbon assimilation, are intermediate between plants such as *Epipactis*, in which carbon is taken from the air, and colourless species like *Neottia* and *Corallorhiza*, which are entirely saprophytic. In *Limodorum*, in spite of its richness in chlorophyll, its respiration of carbon dioxide is always greater than its assimilation.—On the toxic powers of chromium compounds with respect to the higher plants, by M. Henri Coupin.—On a new cupric broth, specially designed to combat the black rot, by M. Joseph Perraud. The addition of colophane imparts to the mixture great adhesive power and resistance to washing off by rain.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 15.

ROYAL SOCIETY, at 4.30.—(1) Application of Liquid Hydrogen to the Production of High Vacua, and their Spectroscopic Examination; (2) The Boiling Point of Liquid Hydrogen under Reduced Pressure: Prof. Dewar, F.R.S.—Ionic Velocities: Prof. O Masson.—Note on the Densities of Atmospheric Nitrogen, Pure Nitrogen, and Argon: Prof. Ramsay, F.R.S.—The Preparation and some of the Properties of Pure Argon: Prof. Ramsay, F.R.S., and Dr. Travers.—Observations on the Anatomy, Physiology, and Degenerations of the Nervous System of the Bird: Prof. Rubert Boyce and Dr. W. B. Warrington.—The Action of Magnetised Electrodes upon Electrical Discharge Phenomena in Rarefied Gases. Preliminary Note: C. E. S. Phillips.—On the Reciprocal Innervation of Antagonistic Muscles. Fifth Note: Prof Sherrington, F.R.S.

LINNEAN SOCIETY, at 8.—Sketch of the Zoology and Botany of the Altai Mountains: H. J. Elwes, F.R.S.—A Description of some Marine and Freshwater Crustacea from Franz Josef Land, collected by W. S. Bruce, of the Jackson-Harmsworth Expedition: Thos. Scott.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

CHEMICAL SOCIETY, at 8.—The Interaction of Ethylic Sodiomalonate and Mesityl Oxide: Dr. A. W. Crossley.—Derivatives of Camphoric Acid, Part III.: Dr. F. S. Kipping, F.R.S.—Synthesis of $\alpha\beta\beta$ Trimethylglutaric Acid: H. Perkin, jun., F.R.S., and Dr. J. F. Thorpe.

FRIDAY, DECEMBER 16.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Kentish Town Widening, Midland Railway: Walter Daniel.

QUEKETT MICROSCOPICAL CLUB, at 8.

TUESDAY, DECEMBER 20.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Paper to be further discussed: The Ventilation of Tunnels and Buildings: Francis Fox.——And, time permitting, Paper to be read with a view to discussion: High-Speed Engines: John Handsley Dales.

WEDNESDAY, DECEMBER 21.

GEOLOGICAL SOCIETY, at 8.—On a Megalosauroid Jaw from Rhætic Beds near Bridgend, Glamorganshire: E. T. Newton, F.R.S.—The Torsion-Structure of the Dolomites: Dr. M. M. Ogilvie [Mrs. Gordon].—The Oceanic Deposits of Trinidad, W.I.: Prof. J. B. Harrison and A. J. Jukes-Browne.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—The West Indian Hurricane, September 1898: Captain A. Carpenter, R.N.—The Connection between the Winter Temperature and the Height of the Barometer in North-Western Europe: W. H. Dines.

ROYAL MICROSCOPICAL SOCIETY, at 7.30.—Exhibition of Binocular Microscopes.

THURSDAY, DECEMBER 22.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Telegraphy by Magnetic Induction: S. Evershed.—The Discussion on Dr. Lodge's Paper (Improvements in Magnetic Space Telegraphy, and on Mr. Evershed's Paper, will be opened by Dr. Fleming and Mr. Preece, with Experimental Demonstrations.

BOOKS and SERIALS RECEIVED.

BOOKS.—Wild Life at Home: R. Kearton (Cassell).—The Way the World went then: I. Barclay (Stanford).—Preliminary Report of an Investigation of Rivers, &c., of Ohio (Cleveland, Ohio).—The Witwatersrand Goldfields Banket, and Mining Practice: S. J. Truscott (Macmillan).—Zoological Record, Vol. xxxiv. (Zoological Society).—Lecture Notes on the Theory of Electrical Measurements: Prof. W. A. Anthony (Chapman).—Elements of Sanitary Engineering: Prof. M. Merriman (Chapman).—Manual of Determinative Mineralogy: G. J. Brush, 15th edition (Chapman).—The Annals of Mont Blanc; C. E. Mathews (Unwin).—Michael Faraday: Prof. S. P. Thompson (Cassell).—The Life Story of the late Sir Charles Tilston Bright: E. B. and C. Bright, 2 Vols. (Constable).—An Experimental Course of Chemistry for Agricultural Students: T. S. Dymond (Arnold).—Annalen der Sternwarte in Leiden, Siebenter Band (Haag, Nijhoff).—A Cotswold Village: J. A. Gibbs (Murray).—Earth Sculpture: Prof. J. Geikie (Murray).—Marine Boilers: L. E. Bertin, translated and edited by L. S. Robertson (Murray).—Who's Who, 1899 (Black).—Band of Mercy, Vol. xx. (Partridge).—Animal World, Vol. xxix. (Partridge).—Annuaire, 1899; par le Bureau des Longitudes (Paris, Gauthier-Villars).—The Purification of Sewage: Dr. S. Barwise (Lockwood).—British Journal Photographic Almanac, 1899 (Greenwood).—An Atlas of Bacteriology: C. Slater and E. J. Spitta (Scientific Press).—Flashlights on Nature: Grant Allen (Newnes).—Knowledge, Vol. xxi. (High Holborn).

SERIALS.—Journal of Botany, December (West).—Geographical Journal, December (Stanford).—Zeitschrift für Wissenschaftliche Zoologie, lxv. Bd. 1 Heft (Leipzig).—Catalogus Mammalium: Dr. E. L. Trouessart, nova editio, fasc. 4 and 5 (Berlin, Friedländer).

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