THURSDAY, APRIL 17, 1913.

A TEXT-BOOK OF HUMAN PHYSIOLOGY.

Physiologie des Menschen. By Prof. Luigi Luciani. Ins Deutsche übertragen und bearbeitet von Prof. S. Baglioni und Dr. H. Winterstein, mit einer Einführung von Prof. M. Verworn. Lieferung elfte-fünfzehnte. Pp. 1–782 + viii. (Jena: Gustav Fischer, 1908–1911.) Price 4 marks each.

THE present five parts complete the German version of Luciani's "Text-book of Human Physiology." The first part opens with the general physiology of sensation, giving a brief but adequate critical review of Johannes Müller's doctrine of specific nerve energies, and of Weber and Fechner's psycho-physical law governing the quantitative relationship between stimulus and sensation. The greater part of the fifty-one pages composing the first chapter is devoted to cutaneous sensations. The second chapter, occupying more than sixty pages, deals with internal and visceral sensations. While the exposition is full of detail and interest, it would have gained in clearness by a more thorough account of the classification of cutaneous and deep sensations suggested by Head and Rivers. The second chapter closes with an excellent account of the labyrinthine sensations.

The sense of taste forms the subject-matter of the third chapter, and occupies more than thirty pages. The survey given is exceptionally interesting and complete, and is well illustrated by plates. The fourth chapter is devoted to the sense of smell, and is prefaced by a brief description of the structural features of the organ of smell. The very large number of qualitative variations in odours renders the classification of olfactory sensations an almost impossible task. The author gives a very interesting and critical account of the classifications attempted by Linné and Zwaardemaker.

Nearly eighty pages are given up to the sense of hearing, which occupies the fifth chapter. It is impossible in a brief review to do justice to the excellence of the account given. The two following errors may be noted with a view to their correction in future editions. On p. 208 the word "perilymph" is used instead of "endolymph." Some confusion has also arisen in the discussion of the theory of hearing suggested by Helmholtz. In consequence, the first two sentences of the final paragraph of p. 229 require to be re-written. Fortunately, since the two sentences are obviously contradictory, there is little risk of the reader being led astray.

The sixth chapter deals fully with the dioptric mechanisms of the eye; while chapter vii. is devoted to the study of the structural features and properties of the retina, and the retinal changes concerned with vision. The description of the electromotive changes occurring in the retina as the result of exposure to light does not include the more recent results obtained by the use of the string galvanometer.

Chapter viii. contains an extremely lucid account of the movements of the eyeballs, of binocular vision, and of visual perceptions and judgments. It closes with the description of the protective and secretory mechanisms of the eyeball.

General metabolism forms the subject-matter of chapter ix. The historical development of the subject is fully discussed. A necessarily brief but clear account is given of the methods employed for the estimation of the intake of foodstuffs and oxygen, and the output of solid and gaseous waste products. Chapter x. is devoted to the discussion of the regulation and measurement of heat production in the organism; while chapter xi. deals with the various theories of nutrition, and the experimental and statistical evidence upon which they are based. Chapters xii. and xiii. are given up to the physiology of reproduction. An excellent survey of the physiology of pregnancy, parturition, and lactation is given in chapter xiv.

The subjects of development, growth, maturity, and senile decay occupy the fifteenth chapter. The two latter subjects receive a much more detailed treatment than is usual in text-books of physiology, and the whole chapter is one of exceptional interest.

The wide view of the scope of physiology held by the author is well illustrated by the final chapter, which is anthropological in nature, dealing with the characteristics of the various races of mankind from the physiological point of view. It has been contributed by Prof. S. Baglioni.

Clearly no pains have been spared to make this text-book adequate for the needs of senior students of physiology, and Prof. Luciani may well be congratulated on the completion of a text-book which may fairly be described as a colossal task for one writer. The work is well and profusely illustrated and clearly printed.

TYPICAL AMMONITES.

Yorkshire Type Ammonites. Parts i–viii. Edited by S. S. Buckman. The original descriptions reprinted, and illustrated by figures of the types, reproduced from photographs mainly by J. W. Tutcher. (London: William Wesley and Son, 1909–1912.) Price 3*s.* 6*d.* net per part, post free.

WITH the issue of the eighth part of Mr. S. S. Buckman's "Yorkshire Type Ammonites" the first volume of this important work is

brought to completion. The chief aim of this publication, as pointed out in NATURE for February 17, 1910 (p. 455), is to establish on a sound basis, by photographs of type-specimens and by critical and descriptive notes, the species imperfectly made known in the writings of Young and Bird, John Phillips and Martin Simpson. The method followed is akin to that adopted in the well-known "Palæontologia Universalis"; and in undertaking his arduous task Mr. Buckman has been fortunate in securing the collaboration of Mr. J. W. Tutcher, who possesses much experience and skill in carrying out photographic work of this kind.

The present volume happens to deal only with Liassic species, sixty-seven of which are depicted in eighty plates. The fact that no more than a single species appears on any one plate, and that the descriptive letterpress and illustrations relating to each species are issued in the form of a separate unit, will facilitate a rearrangement of the plates in any desired zoological or stratigraphical order. With the final part of the volume, which includes an index, is issued a useful measurement table designed by Mr. Tutcher. This gives a ready means for ascertaining the proportional measurements of a specimen and the amount of its enlargement or reduction in a figure.

There are several features which add greatly to the value of this work. The notes and comments which elucidate the application of certain generic names will be welcomed by many workers in this field of study. A separately paged introduction contains useful and suggestive matter under the headings "Terminology" and "Ammonite Development," where some important theoretical points are concisely handled. Generalisations regarding the cyclical development of shell-form and ornament in the evolution of the ammonite test are illustrated by a series of tables accompanied by explanatory text.

No one engaged in ammonite studies can afford to dispense with this work, which deserves generous support. It is to be hoped that the issue of the succeeding volume may not be long deferred.

TOPOGRAPHY AND TRAVEL.

(1) *From Pole to Pole.* A Book for Young People. By Sven Hedin. Pp. xiv+407+xxxix plates. (London: Macmillan and Co., Ltd., 1912.) Price 7*s.* 6*d.* net.

(2) *Highways and Byways in Somerset.* By E. Hutton. With Illustrations by Nelly Erichsen. Pp. xviii+419+map. (London: Macmillan and Co., Ltd., 1912.) Price 5*s.* net.

(3) *A History of Geographical Discovery in the Seventeenth and Eighteenth Centuries.* By E. Heawood. Pp. xii+475. (Cambridge University Press, 1912.) Price 12*s.* 6*d.* net.

(4) *New Trails in Mexico.* An Account of One Year's Exploration in North-western Sonora, Mexico, and South-western Arizona, 1909–10. By Carl Lumholtz. Pp. xxv+411+plates. (London: T. Fisher Unwin, 1912.) Price 15*s.* net.

(1) DR. SVEN HEDIN'S book, which is for young readers primarily, is conceived on no very formal lines. It is evidently intended to convey, by means of a light descriptive style, a series of impressions or mental pictures of different regions of the world, rather than to instruct in details. Naturally enough, his text is based in great measure on his own travels, and in the first and larger of the two parts into which the book is divided we find a good deal of personal narrative which cannot fail to attract youthful readers; withal it will serve an educational purpose of no little value as giving an idea of the objects and methods of scientific exploration. In this first part we are conducted across Europe from Stockholm to Constantinople, thence into Persia, India, central Asia, China, Japan, and homeward. In the second part, Africa, the Americas, the South Seas, and the polar regions are given more brief, and in truth less satisfactory, treatment, mainly by means of a choice of individual salient features for description, or isolated facts of history. There are some sketch-maps and good photographs.

(2) Readers who know the peculiar charm of Mr. Hutton's writing on English topography will expect much of a volume of the "Highways and Byways" series bearing his name. They will not be disappointed, for his volume on Somerset must be one of the most pleasant in the series to read. Moreover, along with evidence of deep historical research they will find here and there signs that the author possesses the scientific eye for topography, as when he describes the isle and vale of Avalon in their physical relationship, and discusses the former as it may have appeared when an island in fact. Miss Nelly Erichsen's work as an illustrator is no less welcome than familiar, and the choice of subjects seems excellent, each picture justifying its inclusion by its relationship to the text.

(3) The textual standard of the Cambridge Geographical series—which is higher than the mechanical standard of printing and binding—is well maintained in Mr. Heawood's volume. The

seventeenth and eighteenth centuries in the history of exploration have been subject to a certain neglect, not unnaturally, for the century which preceded them was more brilliant than either. Students of Mr. Heawood's volume will probably find the narrative to amend their perspective (so to say), for the stream of geographical exploration flowed so full during the period that there has been some tendency to describe a few of its salient features to the total exclusion of all others. Mr. Heawood corrects this tendency: though he gives due prominence to so commanding a figure (for example) as James Cook, he also shows his work in its proper historical setting, with suitable reference to his half-forgotten predecessors (so far as he had any) and followers in the wide field over which he ranged. The book is readable and convenient for reference, and the author appears also in the *rôle* of cartographer, for several sketch-maps judiciously illustrating the salient features of early maps are by his own hand. The Cambridge series has performed a useful function in presenting certain aspects of geographical study which are not otherwise easily accessible for study in convenient form. A reference to its list will demonstrate this, and for the reason above cited the present volume would have been justifiably included in the series if on that ground only.

(4) Mr. Lumholtz offers in the volume under notice a popular account of his geographical and anthropological researches in an area of which relatively little has been known, lying about, and mainly north-east of, the head of the Gulf of California. His results in this account are introduced mainly as incidental to the narrative of his travels and experiences; we learn that he was primarily concerned to investigate "certain economic possibilities" of the region, but these do not find any important place in the book. With the inhabitants, however, he established a close acquaintance; he is able to offer by illustration and otherwise considerable insight into their life, customs, and languages, and in an appendix he furnishes a short comparative vocabulary of Papago, Pimo, and Colopa Indian words. He also treats (again with illustrations) incidentally of the antiquarian remains, the vegetation, and the fauna of the region, so that the book will, as a whole, be found to furnish a good general idea of it. There is a large-scale map which is quite effective, and, though still necessarily "sketchy," adds something to the cartographical knowledge of the area, since it embodies material not only from previous work, but also from the author's own surveys.

OUR BOOKSHELF.

Scottish National Antarctic Expedition. Report of the Scientific Results of the Voyage of s.y. *Scotia* during the years 1902, 1903, and 1904, under the Leadership of Dr. W. S. Bruce. Vol. vi., Zoology. Parts i.–xi., Invertebrates, by Dr. C. Vaney, Dr. J. Ritchie, Dr. E. L. Trouessart, Dr. W. E. Hoyle, and others. Pp. xi + 353 + plates. (Edinburgh: The Scottish Oceanographical Laboratory; Oliver and Boyd; Glasgow: J. MacLehose and Sons, 1912.) Price 30*s.*

DR. BRUCE is to be congratulated on vol. vi. of the report of the scientific results of his *Scotia* voyage, for it is very valuable in itself and reflects credit on the leader's energy and skill in organising the collecting. The volume is devoted to invertebrates, and it consists of expert reports on very interesting material. It is an important contribution to our knowledge of the antarctic fauna, and it adds some interesting material to zoological data in general. Thus we find Prof. Clément Vaney speaking of "une très importante collection d'Holothuries," Dr. James Ritchie referring to "the enormous mass of [Hydroid] material brought together by Dr. Bruce during his antarctic voyages," Messrs. Melvill and Standen defining in a supplementary collection of marine molluscs more than twenty new species, Mr. J. Wilfrid Jackson reporting that the Brachiopods collected add materially to our knowledge of the geographical range of certain forms, and augment the antarctic list of species; and so it is all along the line.

We may direct attention to Prof. Chilton's fine treatment of the Amphipods, already referred to in NATURE, Dr. Thomas Scott's important report on the Entomostraca, and to the short but interesting and scientifically cautious report on the Cestodes by Dr. John Rennie and Mr. Alexander Reid. Equally important, so far as the material went, are the reports on Acarina by Dr. E. L. Trouessart, on the Cephalopods by Dr. W. E. Hoyle, and on microscopic fauna by James Murray and E. Penard.

Le Origini Umane. Ricerche Paleontologiche. By G. Sergi. Pp. xi + 202. (Torino: Fratelli Bocca, 1913.) Price 3.50 lire.

IN this useful book Prof. Sergi, of the University of Rome, gives a concise statement of the opinions he holds regarding the origin and evolution of human races. His opinions and inferences demand the most respectful consideration, for they are founded on the investigations of a lifetime, and have in every phase of his busy life been marked by an independent and courageous judgment. Prof. Sergi distinguishes five *genera* of mankind, and regards each of them as of independent origin, their relationship being represented, not as diverging branches from a common trunk, but as parallel or collateral stems issuing separately from an ancestral stock. He also regards anthropoids as parallel developments—

explaining their structural relationships to human races as inheritances from a common basal stock.

It will be thus seen that Prof. Sergi is the arch-priest of that heterodox doctrine—the multiple origin of closely allied species and genera. His faith is more robust than that of the majority of his colleagues. He accepts implicitly Ameghino's speculations concerning the independent origin of mankind in South America. Although the reviewer regards the majority of Prof. Sergi's opinions as ill-founded, he is only too willing to admit that it would be presumptuous, in the present state of our knowledge of extinct forms, to refuse them a most careful investigation.

A. K.

Vicious Circles in Disease. By J. B. Hurry. Second edition. Pp. xiv+280. (London: J. and A. Churchill, 1913.) Price 7*s.* 6*d.* net.

IN the issue of NATURE for May 18, 1911 (vol. lxxxvi., p. 374), an extended review by Sir T. Clifford Allbutt was published of the first edition of Dr. Hurry's book. The present edition has been revised, and six new chapters have been added in the hope of covering the ground more adequately. Most of the material of these additions has appeared already in the medical Press.

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.*]

Soil Fertility.

DR. RUSSELL begs the whole question in two lines of his letter in NATURE of January 16, when he terminates para. 7 with "the increased gain in plant growth on such highly heated soils can be largely attributed to this cause," viz. to the formation of ammonium and other simple soluble nitrogen compounds on heating soils to 170°.

If this were true, then the effects of heating soils, whether to the temperature of "partial sterilisation," viz. 98° (as in Dr. Russell's experiments) or (as in mine) to 170°, could be imitated by adding in, say, daily doses, suitable solutions containing ammonium compounds and nitrates.

I have repeatedly tried this with various combinations of salts, both in pot experiments and in the field, and have invariably found that the increased growth due to heating the soil previously was never even approached in extent by that in any of the plots or pots to which the manures were added.

It appears to me that the increased growth in Dr. Russell's experiments can only be safely ascribed to the manufacture of soluble nitrogen compounds by bacteria when in parallel sets of pots and plots the same effect is shown to be produced by artificially dosing unheated soils with such nitrogen compounds.

F. FLETCHER.

Rewika Ranch, Kyambu, British East Africa, March 6.

I AM not at all surprised that Mr. Fletcher failed to reproduce the conditions of a strongly heated soil by simply adding frequent doses of ammonium compounds to an unheated soil. Soil suffers considerable decomposition when heated to 170° C., and changes markedly in chemical composition, physical properties, suitability as a medium for the growth of bacteria, moulds, and other organisms, and as a habitat for the higher plants. Experiments become extraordinarily difficult to interpret when so many factors change simultaneously, and for this reason I have always preferred to adopt very much milder methods, treating the soil with antiseptic vapours (*e.g.* toluene), or heating to as low a temperature as possible (60° to 95° C.). Here less complication arises, because the decomposition effects are at a minimum, and one can study the various factors one at a time.

Increases in productiveness equal to those brought about by treatment with antiseptic vapours or heating to 65° C. can be obtained on our normal untreated soils by additions of sodium nitrate or ammonium sulphate. Further, partial sterilisation has failed to bring about increased productiveness when the treated and untreated soils are subsequently so liberally treated with nitrogenous plant food that the nitrogen supply is no longer a limiting factor. In "sick" soils, however, there is another limiting factor, the presence of disease organisms and pests, and this also is put out of action more or less completely by partial sterilisation. Here addition of nitrogenous plant food (which leaves the pests unaffected) does not make the untreated soil equal in productiveness to the partially sterilised soils. We could get no evidence of the toxin suggested by Mr. Fletcher, and, this being the case, I do not see how we shall advance matters by assuming its presence as a third limiting factor.

E. J. RUSSELL.

Rothamsted Experimental Station, Harpenden.

Induced Cell-reproduction in the Protozoa.

I WAS interested in Mr. T. Goodey's letter under the above heading in NATURE of March 13, but should like to make a few remarks thereon. Hay infusion, which Mr. Goodey states caused the excystation of *Colpoda cucullus*, is prepared from dried grass, and here we have the products of cytolysis, and, in consequence, should expect the presence of auxetics. As a matter of fact, any vegetable infusion contains auxetics, the presence of which can be demonstrated by the jelly method on human lymphocytes, as described by Dr. H. C. Ross, "Induced Cell Reproduction and Cancer" (London: John Murray, 1910). Encysted forms of Colpoda cannot be compared with the winter spores of Polytoma, as in Colpoda there is, so far as I can gather from Mr. Goodey's letter, no conjugation prior to the encystment, and consequently no real development is necessary for the excystation, but only rupture of the cyst-wall. In Polytoma, however, the cytoplasm within the spores has to undergo several complex changes, leading ultimately to division of sarcode, formation of envelopes round the products of division, and the development of flagella. Thus, I take it that in Colpoda there is no reproductive process in the excystation, and consequently no necessity for auxetics; anything that will cause the rupture of the cyst-wall being sufficient, although, as already shown, auxetics were certainly present in the hay infusion.

With regard to the "pure distilled water," Mr. Goodey should remember that this is pure only so long as he adds nothing else to it. Directly organisms are added, auxetics would be present, as, apart from the fact that some of the culture fluid would be introduced with the organisms, even if this were not so, auxetics would be present, as there would be necessarily some death-rate. The same phenomenon also occurs in pond Amœbæ, the encysted forms of which can also be caused to undergo excystation by incubation with distilled water.

Whether auxetics are necessary for any form of cell-reproduction to occur is a point which will require further research to determine. It is, however, a striking fact that Dr. H. C. Ross was able for the first time to induce divisions in human leucocytes by means of auxetics, and was also able to demonstrate that the ova of *Ascaris megalocephala* will undergo division if incubated with auxetics. Dr. Fansham has also shown that *Entamoeba coli* can be caused to divide through many generations by means of these substances, whilst Dr. E. H. Ross has demonstrated that auxetics have a very remarkable action on trypanosomes.

From the foregoing facts it is clear that auxetics are *a cause* of cell-reproduction, and, although we cannot as yet state positively that there are no other causes, yet, judging from other biological examples, it is extremely probable that they are the sole cause, as it is very unlikely that a complex function like cell-reproduction should have more than one direct cause. With regard to the presence of auxetics and kinetics in pond water, I may say that I am at present investigating this point, and have definite proof of the presence, not only of auxetics, but also of kinetics or augmentors, in such waters, the latter bodies apparently varying according to the season, and also being dependent on the amount of albuminoid ammonia present.

Besides the presence of auxetics in hay infusion, there is one further point to be mentioned, viz. that if by the action of an enzyme, the cyst-wall in Colpoda were dissolved, quite enough auxetic would probably be liberated to cause division, were such necessary for development. This was well shown by Dr. H. C. Ross, who found that substances not themselves auxetics may yet have auxetic action by causing limited cell death immediately within the walls of ova, thus setting free enough auxetic to cause cell-division.

AUBREY H. DREW.

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Units of Pressure in Vacuum Work.

REFERRING to the letter by Mr. Shaw in NATURE of March 20 (p. 95), I beg leave to remind readers that we have already a convenient unit of pressure which, as fitting in an absolute system of units, is preferable to the micron of mercury, viz. the dyne per cm.^{2}, or the barye of the c.g.s.-system. In fact, Prof. Knudsen has used it in all his later researches on molecular phenomena. In article V10 of the "Encyklopaedie der mathematischen Wissenschaften," p. 628, note 19 (Communications from the Physical Laboratory at Leyden, Suppl. No. 23, p. 14), by Prof. Kamerlingh Onnes and myself, we have given practically the same unit under the name of *millitor* as convenient for such pressures as those in Röntgen vacua.

In doing this we have followed the lead of the commission of the International Association of Refrigeration (*Bull. de l'Ass. internat. du froid. 2*, 1911, p. 38, rapporteur M. Ch. Ed. Guillaume). This commission proposed to accept the metre-kilogramme-second system for general use, this one having better chances than the c.g.s.-system, and accordingly to introduce as an absolute unit of pressure the m.k.s.-unit. As a practically identical realisation of it the commission proposed to introduce the *international centitor* (abbreviated for centi-torricelli), the international kilotor being equal to the pressure of a column of practically 75 cm. of mercury under normal gravity (for further particulars see the article quoted above). Practically 1 millitor = 1 dyne/cm.^{2}, or barye, and within the accuracy of experiments in the domain of these vacua 1 millitor = 0·75 μ of mercury.

Seeing how simple this proportionality factor is, the work of reducing, say, McLeod gauge readings to millitors will not cause any appreciable trouble, whereas the indications by Prof. Knudsen in dynes/cm.^{2} are without any reduction expressed in millitors. For the highest vacua the *microtor* = 10^{-3} millitor = $0{\cdot}75 \times 10^{-6}$ mm. of mercury would be convenient. As abbreviations, mtor may be written for millitor, μtor for microtor.

W. H. KEESOM.

Physical Laboratory, Leyden.

Reflection of X-Rays and X-Ray Fringes.

ACCOUNTS of the reflection of X-rays and of X-ray fringes contributed to NATURE by Messrs. Bragg, Moseley, Barkla, Hupke, Keene, and others induce me to send you some results that I have obtained recently in the same direction.

I think that the appearances observed by Messrs. Laue, Friedrich, and Knipping are really due to the same cause as the reflected spots; they present quite a similar distribution and general character.

Fig. 1 shows the pattern obtained with a beam of Röntgen rays falling at an incidence of 80° upon a face of a cube of rock-salt, the photographic plate being at right angles to the reflected beam. The reflected spots are similar to the transmitted spots, and present fringes perpendicular to the plane of incidence; they are situated on an elliptic curve, to which belongs also the point of impact of the primary beam. The spot on the main axis is regularly reflected; the others are symmetrically disposed, and possibly due to reflection on the planes of the corresponding octahedron, dodecahedron, &c., which are in suitable positions. Fluorine gives the same pattern.

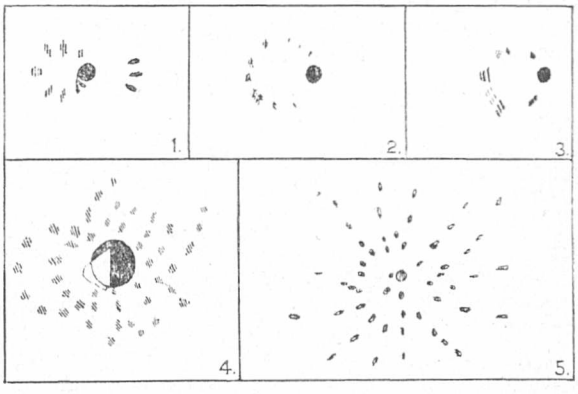

Fig. 2 is obtained with a beam (incidence 80°) falling upon the triangular face of an octahedric crystal of magnetite. The reflected spots show two systems of fringes, one of which is approximately perpendicular to the plane of incidence.

It seems of importance to pay attention to the angle between the intersection of the plane of incidence and the quaternary axis situated in the cubic face of reflection. Fig. 3 shows that when this angle (which was 0 in Fig. 1) becomes 45°, the curve of spots is deflected, the regularly reflected spot being no longer on the main axis but following the ordinary law of reflection; the distance of the fringes is probably slightly changed in this case.

I have often observed fringes in the transmitted spots obtained by Laue's methods. With octahedric magnetite (Fig. 4) all the spots (more than 100) were striated by parallel fringes; and on a plate (Fig. 5) obtained with fluorine the transmitted spots, the number of which was also very large, are all doubled in a radial direction.

I may add that one obtains quite similar phenomena with ordinary light and two ordinary (200 lines per millimetre) gratings, when the incident beam forms similar angles of incidence with the plane of the gratings. M. DE BROGLIE.

Increase of Definition in a Moving Telescope.

I HAVE received several suggestions, for which I wish to express here my indebtedness, as to the probable explanation of the increase of definition in a moving telescope, referred to in my letter in NATURE of March 27. They are chiefly based on the principle of "contrast" as described by Mr. G. W. Butler in NATURE of April 10, but Mr. W. H. Robinson, of Oxford, attributes the increase of definition to "averted vision," by which a faint source of light is better seen if the eye be directed a little on one side of it. This, at first, seemed to me the correct explanation, the more satisfactory that it involves but a well-known physiological property of the eye. By moving the telescope the object is continually eluding the eye, and visibility by continuous unconscious "averted vision" would be the result. I, however, satisfied myself that there must be some other cause, as a *deliberate* use of "averted vision" failed entirely to show me the time-ball when I tried it after receiving Mr. Robinson's letter, while I noticed that, as soon as the sweeping motion had begun, it was plainly visible by *direct vision,* my eye following it all the time. Mr. Butler's suggestion seems therefore more plausible, although less definite.

M. E. J. GHEURY.

Woolwich Polytechnic, April 15.

THE NINTH INTERNATIONAL CONGRESS OF ZOOLOGY AT MONACO.

THE ninth International Congress of Zoology terminated its session under the presidency of his Serene Highness the Prince of Monaco at Monaco on Saturday, March 29. Altogether, the meeting was an unqualified success, not only on account of its numbers, which, as already stated, were greater than on any previous occasion, but also for the general interest of the contributions, which, although no single one can be selected as absolutely outstanding, were all of very high quality, and demonstrated the result of much serious and useful work by zoologists during the past three years. The beauties of the Côte d'Azur doubtlessly attracted many from northern lands, and although the weather was not all that could be expected for the Riviera at this season, yet the rather copious rainfall settled and washed away the dust and refreshed the herbage, which was the more brilliant during the intermittent periods of bright sunshine. The chief attraction, however, was the noble Oceanographical Museum, which crowns the cliffs of the rock upon which the town of Monaco with its palace is situated, and the fact that the congress was to hold its chief meetings within its precincts, with its founder as their president.

The opening reception in the museum, the holding of many of the meetings of the congress within its walls or only across the other side of the road at the Lyceum, and the fact that members were entitled to visit all its galleries and its aquarium at any time during the whole congress enabled everybody to become thoroughly acquainted with the museum and its interesting collections. Since its opening in 1910 there have been great developments and additions, thanks to the indefatigable energy of Dr. Jules Richard, its able director, and his assistants. A very full account of the museum was given soon after its opening in the columns of NATURE by Mr. J. Y. Buchanan; it is not, therefore, necessary to repeat what he has said, but since that time there have been many developments, and among others the opening up of a large new gallery in the western wing of the building. Zoologists were especially delighted, not only in seeing the excellent cetacean collection—whales mostly captured by the Prince himself—but also the really marvellous collection of well-mounted deep-sea fishes, which were familiar to many as figures, but the original specimens of which they now saw for the first time, and the same may be said of the invertebrates. A particularly useful and instructive arrangement is that side by side of each specimen is placed, where possible, the original painting of the animal taken from the fresh specimen, or the reproduction of such a coloured drawing as presented in the unique plates appearing in the Prince's publications. This is specially valuable, since it is impossible to preserve the original colours of animals in alcohol and because a better idea of the form of the fresh animal is given.

Besides the Prince's collections were also shown the first fruits of exchange with outside collections, and notable among these was a case containing many of the deep-sea and shallow animals taken by the *Scotia*. There is also a well-mounted case of penguins taken by the French Antarctic Expedition, as well as seals, birds, and eggs taken by the *Scotia* in the antarctic regions.

The collection of instruments and various forms of fishing appliances, nets, trawls, dredges, traps, hooks, &c., used not only for scientific but also for economic fishing, was also a source of attraction, and not least of all the aquarium with its wonderful living forms of Mediterranean fishes and invertebrates, each more wonderful than its neighbour, and which only those who had previously visited such stations as Villefranche and Naples had seen before, but were more than ready to see again.

Some days before the opening of the congress many zoologists made their appearance, and on Monday, March 24, practically the complete roll of 723 members, including more than eighty British representatives, was signed, and members had received their insignia, cards, and papers. On Tuesday afternoon there was a meeting of the permanent committee for the election of vice-presidents of the congress and presidents of the sections, Lord Walsingham being chosen first vice-president. At 6 p.m. the congress was formally opened by the Prince, who, dressed in the official uniform of the Institut de France, delivered his inaugural address. The president

was supported by the delegates of twenty-four Governments, the only Government not being officially represented being the British Government; very appropriately, however, the Prince recognised Lord Walsingham, one of the trustees of the British Museum, as the official representative of Britain.

In an eloquent address the Prince suggested that by their meeting at Monaco, zoologists marked the importance of the study of marine animals, that they conceived that marine zoology possessed the principal elements necessary to elucidate the history of life and the origin and evolution of its different forms. They had considered this temple of oceanography worthy of an assembly which dealt with these subjects. These congresses, he said, should be encouraged because they brought about a *rapprochement* of men of all shades of opinion from countries representing occupations of intelligence. They measured the force of production of different human communities, and gave young people an opportunity of associating rapidly with the general progress of ideas. The study of zoology was of the greatest significance, because it dwelt upon the history of life, effacing illusions of ignorance. Above all, the study of marine zoology was precious in relation to the investigations of the origin of life. He believed that the ocean was the origin of life, and that there was ancestral colonisation from the waters to the land. The Prince emphasised that, in the study of oceanography, it was important to investigate the regions that lay above the surface of oceans; hence his investigations of the higher atmosphere. Finally, he asked the congressionists before leaving the old rock of Monaco, still scarred by old buildings which marked the law of force, to consider well the edifice constructed to arbitrate in favour of science. Below was the savage instinct which was now surmounted by progress, time giving dominion to creative force over the vain rivalries of man. He emphasised how these developments had taken place in a country long protected by peace.

The Prince was followed by Dr. Perrier, director of the Natural History Museum of Paris, the eminent president of the permanent commission of the congress. Dr. Perrier dwelt on the importance of oceanographical research to zoology, paid well-merited eulogy to the Prince for his great and lifelong services to oceanography and zoology, and also to the epoch-making work of Guyon, Jeffreys, Wyville Thomson, and William Carpenter. In the evening there was a reception given by the president in the museum, which gave the first opportunity of congressionists meeting each other and discussing various matters of common interest—a feature, indeed, which is perhaps, after all, the great result of all such meetings, for one hears of some fellow man of science and one knows something of his work, reading much perhaps that he has published and probably having also corresponded with him, but now for the first time one meets him face to face, discusses knotty points to the immense advantage of each, often clearing away misunderstandings and sealing a bond of friendship. This was especially the case at Monaco regarding the long discussion on nomenclature.

More than 150 papers were given by different authors, and most of these were given in abstract, in many cases being illustrated by lantern or kinematograph. Time, however, curtailed many authors, and compelled others to have their contributions held as read. British zoologists were on this account deprived of hearing Prof. Ewart give an account of the new zoological gardens to be opened in July in Edinburgh by the Zoological Society of Scotland, which promises to be one of the finest, if not the finest, zoological garden in Europe.

Among British contributions was one by Prof. Elliot Smith, of Manchester, who gave an account of the homologies of the cerebral cortex in vertebrates. Prof. J. Arthur Thomson, of Aberdeen, gave an important communication on Alcyonarians recently collected by H.S.H. Prince Albert I. of Monaco, illustrating his remarks by a series of finely executed paintings which are to form the plates of his monograph. Mr. G. P. Mudge, of the London Hospital Medical College, gave an interesting communication on some problems of hybridisation, whilst Dr. Scharff, of Dublin, gave a paper on zoogeography, giving an account of his most recent researches in a subject to which he has devoted so much attention with such excellent results. Prof. Hull, late director of the Geological Survey of Ireland, discussed recent discoveries in the physical features of the North Atlantic Ocean, as confirming the view of the distribution of European animals by land connection in Tertiary times.

Dr. W. S. Bruce, of Edinburgh, summarised the zoological results of the *Scotia*. He pointed out that the leading feature of the *Scotia's* work was her investigations in great depths in high southern latitudes by means of trawl and vertical plankton net. The percentage of new species taken in great depths down to 2645 fathoms was very high. Out of about a thousand *Scotia* species described more than 25 per cent. were new to science. The zoological researches of the Scottish naturalists disproved bipolarity, those species which had a bipolar distribution having also universal distribution. They tended also to show that antarctic fauna was not circumpolar, at least to the extent that arctic fauna was, but that it was subdivided into regions, which appeared to be associated with the south polar "deeps" separated by those "rises" which probably indicate former connections of Antarctica with the more northern continental land masses.

The Indian Museum, Calcutta, accounted for a goodly number of interesting communications. Dr. Nelson Annandale gave an important paper on the African element in the fresh-water fauna of India. He showed there was a strong affinity,

extending even to species in some cases, between fresh-water sponges, Hydrozoa (Limnocnida), and Polyzoa of India and of tropical Africa. In some instances this affinity extended to South America. The same phenomenon existed in other groups, and indicated former land connection. So far as the invertebrates were concerned, there was little evidence of any African element in the aquatic fauna of the Jordan valley, although many African fishes are found in that district. The difference between the African element in the fresh-water fauna of India and that in the fresh-water fauna of Palestine is probably due to the fact that the geographical connection was broken at a comparatively early date in the case of India, and that the climate and the composition of the water of the Jordan at present differ greatly from those both of India and Africa. Captain R. B. Seymour Sewell, I.M.S., surgeon-naturalist to the Indian Marine Survey, gave a communication on the post-larval development of the Copepoda. The collections on which these observations were based were from three estuarine regions on the coast of Burma and Bengal. In their post-larval development the Copepoda follow Brooks's law, and under suitable conditions apparently may be dimorphic in both sexes, thus resembling Amphipoda and Ostracoda.

Prof. Roule, of Paris, described a new species of abyssal fish, to which very great interest is attached, because it was captured by the Prince of Monaco in the great depth of 6035 metres, a depth in which no fish had previously been caught. Prof. V. Dahlgren, of Princeton, gave an account of his recent researches in a remarkable polarity in the motor nerve cells of the electrical apparatus of *Tetronarce occidentalis*. Prof. Th. Mortensen, of Copenhagen, described a new genus and species of a sessile Ctenophore, upon which Prof. Ziegler, of Stuttgart, made some important comments. Miss Foot and Miss Strobell, of New York, showed the results of crossing three Hemiptera species with reference to the inheritance of an exclusively male character. Prof. J. Petersen, of Copenhagen, gave a paper entitled "Determination of the Quantities of Animal Life in the Sea: its Communities and their Geographical Value." Prof. C. Wardell Stiles, of Washington, gave an account of the distribution of *Nector americanus* in the United States, its medical and economic importance, and the campaign for its eradication. This formed one of a series of important papers on applied zoology.

Dr. Jacques Liouville, of Paris, emphasised the importance of constructing a faunistic chart of the artarctic regions, especially in relation to the continental shelf. His suggestion was specially supported by Prof. J. Arthur Thomson, who thought Dr. Liouville should be thanked for taking the initiative in this matter. Mr. Heron-Allen and Dr. Bruce also supported the suggestion. Dr. Liouville suggested taking up the French section, and Dr. Bruce agreed to take the Scottish section, suggesting that others should similarly be asked to join, and further that the president of the congress should be asked for his patronage, and also be requested to allow the publication of the chart to appear in his publications. This was afterwards further approved of in the general section.

M. Henri Bourée gave two kinematograph and colour photograph lantern demonstrations, illustrating the work of the Prince and his staff on board the *Princesse Alice*. The series of pictures is excellent in every respect, the colour pictures of animals being exquisite, and the kinematograph pictures showing sounding, trawling, fishing, and whaling operations being most instructive.

The subject of zoological nomenclature played a large part in the proceedings. It had been feared that there might be a battle royal between the advocates and opponents of the law of priority, carried out to the bitter end, but happily preliminary discussions of a more or less informal kind led to the adoption of a *via media*. A resolution was adopted which empowered the nomenclature commission to suspend the rules in cases where it would cause great confusion to carry them out. This power is, however, safeguarded by such stringent conditions that there is no fear of its being used except in very urgent cases. Prof. Brauer opened the discussion on nomenclature, presenting the well-known views of the German Zoological Society, and was followed by the Hon. Walter Rothschild and Dr. Hartert, of Tring, M. Oberthur, of Rennes, Prof. E. Ziegler, of Stuttgart, Prof. S. W. Williston, of Chicago, Prof. Fauvel, of Angers, Prof. Th. Mortensen, of Copenhagen, Lord Walsingham, of the British Museum, Dr. Hoyle, of Cardiff, Dr. J. A. Allen, of New York, and Dr. Ch. Wardell Stiles, of Washington, the secretary of the permanent committee.

In proposing a resolution "That an international commission on entomological nomenclature be appointed, whose powers and authority shall be equal to those of the existing commission on zoological nomenclature, and who shall report their decisions and recommendations annually to the Zoological Congress," Lord Walsingham emphasised that the principal object of zoological nomenclature was to give to all zoologists the means of acquiring and imparting information about the subjects of their studies. The aim should be to establish an accepted system ensuring simplicity and finality in nomenclature. This had to be attained on the basis of the law of priority. He supported Dr. Ernst Hartert against certain proposals put forward by the German Zoological Society which, if adopted, would be fatal to any attempt to obtain uniformity or finality in nomenclature. The first principles of the law of priority must be adhered to. Let revision be gradual, and proceed on well-considered lines, subject to the final authority of the International Zoological Congress, acting on the recommendations of its two equal commissions —that of general zoology and that of entomology.

The Hon. Walter Rothschild emphasised the point that any society or individual proposing such an important change as that proposed by the German Zoological Society ought, if they wanted serious consideration at all, to put their meaning in absolutely clear and unequivocal language. He stated that the time quoted, "twelve" years, as being sufficient to judge of the need of the "law of priority" was absurd, as it would take at least two generations for the law in question to settle nomenclature in general, and at least one generation before we could judge of its effects. Mr. Rothschild also stated that a progressive list of exceptions to that law, namely, one to be augmented from congress to congress, would lead to utter chaos. He was opposed to any exceptions whatever, but would be willing to see, in cases where confusion was likely to arise, that names for a long time employed for one genus or species, and which under the rules must be transferred to another, should be dropped altogether, and that names differing only in one letter from any already in use should be treated as inadmissible. He was also in favour of using larval names, and those founded on a single phase only, being used in that sense only, and not under the law of priority used for the adult in another phase.

Finally, it was resolved—that plenary power is herewith conferred upon the international commission in zoological nomenclature acting for this congress to suspend the *règles* as applied to any given case, where in its judgment the strict application of the *règles* will clearly result in greater confusion than uniformity, *provided,* however, that not less than one year's notice shall be given in any two or more of the following publications, namely, *Bulletin de la Société Zoologique de France, Monitor Zoologica,* NATURE, *Science* (N.Y.), and *Zoologischer Anzeiger*; that a question of the possible suspension of the *règle* as applied to such cases is under consideration, thereby making it possible for zoologists, particularly specialists in the group in question, to present arguments for and against the suspension under consideration; and *provided* also that the veto of the commission is unanimously in favour of suspension if not less than two-thirds be present. The commission is hereby instructed to report the facts to the next succeeding international congress.—It was also resolved "That the congress fully approves of the plan that has been inaugurated by the commission of conferring with special committees from the special groups involved in any given case, and that it authorises and instructs the commission to continue and extend their policy." Altogether, the conclusions arrived at appear thoroughly satisfactory, especially as the plenary power of the commission is very adequately safeguarded.

The invitation of the Government of Hungary to hold the congress of 1916 in Budapest was accepted, and Prof. Hovarth, of Budapest, was elected president.

THE INTERNATIONAL CONGRESS OF HISTORICAL STUDIES.

THE members of the International Congress of Historical Studies have been holding their meetings in London, under the presidency of Mr. James Bryce, who was, however, unfortunately absent throughout the proceedings. Five years ago, the congress held very successful meetings in Berlin, and ten years ago it assembled under favourable auspices in Rome. If the London meeting has attracted less notice in the country of its assembling than the two preceding ones, it has none the less produced some excellent papers, and it must be accounted a real loss to the general public that the very faulty organisation of the congress, combined with our insular aloofness and the ignorance of modern languages which is an accepted item of English education, has prevented the meetings from receiving their due share of attention.

The congress has covered so large a field of historical studies that any general survey of its deliberations would be impossible in this place. It has discussed the philosophy of history and the history of historical studies, while other sections have met daily to exchange views on Egyptian, classical, Byzantine, and Oriental history, as well as on matters pertaining to military, naval and colonial, religious and ecclesiastical, legal and economic, mathematical and scientific, studies.

The President of the Board of Education (Mr. J. Pease) directed attention to the frequent connection that has existed in England between history and politics, citing the names of Clarendon, Gibbon, and Macaulay, and, at the present time, of Bryce and Trevelyan. The advantages of such a connection may perhaps be questioned. From it has resulted the habit of treating history as a branch of politics rather than of considering politics as a department of history. The current text-book treatment of the English civil war and the American revolution—to give but two instances—has probably suffered much in its accuracy from the fact that the principal English historians have been primarily Whig politicians. To the popular conception of the politician as the sufficient and efficient historian, we may perhaps attribute the neglect by successive Governments of the marvellous series of records—the admiration and envy of other European nations, and the best material for history—which belong to this nation. No one knows better than Prof. C. H. Firth, who dealt with the subject of English records, how badly kept, how inaccessible, how uncalendared, are a great proportion of our English public documents.

It was entirely characteristic of the English politician-historian that, at the Oxford dinner, Lord Morley of Blackburn should warn his hearers against laying too much stress on research in diplomatic archives and parish registers, and should remind his audience that, fortunately or unfortunately, sentiment and prejudice have had far more to do with the making of history than reason and precedent.

The president's address, read in his absence by Dr. A. W. Ward, of Peterhouse, contained references to the importance of recent discoveries regarding the early Mediterranean civilisations, and laid stress on the value of modern critical ethnology for the correct understanding of the foundations of present-day movements in Europe; while Mr. D. G. Hogarth's paper on Hittites and the Hittite civilisation showed that a beginning has been made in attacking an outstanding problem bearing on the same subject. Prof. E. Bernheim spoke of history as a record of the variation of intellectual viewpoint at different epochs of time. Prof. von Gierke dealt with the evolution of the idea of the right of a numerical majority to control the government of a country. Prof. Pirenne gave a suggestive account of the stages in the growth of capitalism from the twelfth to the nineteenth centuries, and described the change from mere subsistence industry and husbandry to the creation of capitalism as an engine by which the advancing intelligence can obtain an increase in knowledge, in material resources, and in control over the forces of nature.

In the subsection devoted to the exact sciences, natural history, and medicine, papers were read by Sir Clifford Allbutt on Palissy, Bacon and the revival of natural science; by Prof. Loria on mathematics in Great Britain; by Prof. Silvanus Thompson on the history of the compass card; by Prof. H. H. Turner on Aristarchus of Samos, and by Mr. Rouse Ball on Newton's Principia and also on magic; Dr. Norman Moore gave an account of the Royal College of Physicians, Prof. L. C. Miall illustrated seventeenth-century research by the life of Peiresc, and Mr. W. C. D. Whetham read a paper on the historical method in natural science.

PUBLIC VETERINARY SERVICES.

A DEPARTMENTAL Committee on the Public Veterinary Services was appointed last August by Mr. Runciman to inquire into the requirements of the public services with regard to the employment of officers possessing veterinary qualifications, and to consider whether any further measures can with advantage be adopted for the selection and training of students with a view to such employment. The committee, the report of which has recently been published (Cd. 6575), consisted of Sir A. Hopkinson (chairman), Sir T. H. Elliott, Sir T. W. Holderness, Mr. H. J. Read, and Major G. F. MacMunn. In October Sir T. W. Holderness resigned, and Mr. F. C. Drake succeeded him.

In all twenty-one witnesses were examined, together with a number of written statements of representatives of self-governing Dominions and universities who for various reasons were unable to attend in person. Evidence was given on behalf of the Departments employing veterinary officers, viz., the Colonial Office, India Office, War Office, and the Board of Agriculture and Fisheries; also on behalf of the five veterinary colleges, the examining and diploma-granting body (the Royal College of Veterinary Surgeons), and various British universities.

After considering the present system of veterinary education, the committee is of opinion that the standard appears sufficient for the purposes of private practice, but not for the public services, for research and administrative work. The army veterinary department has no difficulty in finding suitable candidates, and, moreover, the first two years of the young officer's service are devoted to the improvement of his education, and to training him for his future work.

The demand for the other public services of veterinary officers has increased, and will almost certainly increase still further. Already great difficulty has been encountered in procuring suitably trained men for the posts, alike at home, in the Colonies, and in India. The most important steps to be taken to improve the quality and quantity of candidates are (1) to encourage a larger number of young men who have continued their general and scientific education beyond secondary-school age to enter the veterinary profession; (2) to provide for men who have qualified as veterinary surgeons increased facilities to extend their knowledge, more especially in the direction of specialisation in one branch of veterinary science; and (3) to improve the system of notifying vacancies.

With these objects in view the committee recommends that: Students possessing a suitable science degree should be exempted from one of the four years at present required for veterinary qualifications; that twelve scholarships should be offered each year of the annual value of 80*l.* each, tenable at a veterinary college for three years, with a view to encourage a number of men who have received a good scientific education to enter the veterinary profession; scholarships of an annual value of not less than 100*l.* and not exceeding 150*l.* should be offered each year to enable qualified veterinary surgeons to undertake advanced study and laboratory work at suitable institutions at home or abroad, where special facilities for such studies exist. The committee further recommends that increased State aid should be given to institutions devoted to veterinary education, the efficiency of which is of great importance to the State. It is of opinion that the Royal College of Veterinary Surgeons "is performing a work of great national importance, and that its efforts to maintain a high standard of veterinary education in this country are worthy of every encouragement."

NOTES.

THE International Congress of Zoology at Monaco and that of Geography at Rome are over, but another interesting meeting of representatives of the nations took place on April 5, at the Zoological Station, Naples. The occasion was the unveiling of a memorial tablet to the illustrious founder of the station, Prof. Anton Dohrn. The tablet, in bronze, which has been fixed above the fountain on the north side of the

central court between the two great laboratories, was unveiled by Prof. von Graff, who spoke on behalf of the International Zoological Congress, at the meeting of which at Graz it was decided to erect and place within the station a monument to the late Anton Dohrn. Von Graff, in his appreciation of Dohrn's work, referred more especially to the international character which the station has developed under the distinguished direction of its founder. The tablet having been unveiled, Prof. Todaro, of Rome, an old personal friend of Dohrn's, spoke on behalf of the Accademia dei Lincei and the Italian Department of Public Education. Dr. Wever, Consul-General for Germany in Naples, made a speech representing the Foreign Office and the Department of Public Education in Berlin. Marchese del Carretto, Mayor of Naples, spoke of the advantages enjoyed by the town from the aquarium and marine station, and Admiral Raggio Ducarne referred to the connection between the Italian Navy and the zoological station. Wreaths were placed at the base of the monument by the speakers mentioned, and by many of the delegates. After a speech by Prof. Reinhard Dohrn, son of the late Anton Dohrn, and now director of the station, the ceremony concluded.

WE regret to see the announcement of the death, on April 14, of Herr Karl Hagenbeck, the owner of the famous zoological park at Stellingen.

THE death is announced, at forty-eight years of age, of Mr. Percival Spencer, the well-known balloon manufacturer and aëronaut, who made many notable journeys by balloon, and was closely associated with developments of aërial navigation.

AT the annual general meeting of the Selborne Society, to be held in the theatre of the Civil Service Commission, Burlington Gardens, W., on Monday next, April 21, there will be an exhibition by Mr. John Glen of the portrait recently discovered which claims to be that of Gilbert White.

THE death is announced of Prof. V. Dwelshauvers-Dery, correspondant of the Paris Academy of Sciences, in the section of mechanics, and of M. Louis Henry, correspondant in the section of chemistry. Prof. Dwelshauvers-Dery was born at Dinant in 1836, and studied engineering at Brussels and Liège, obtaining his degree as doctor of physical sciences at the latter place in 1861, where he afterwards took charge of the course of applied mechanics, and established a laboratory. He gave particular attention to the study of steam engines.

SIR EDWARD T. CANDY, formerly judge of the Bombay High Court, whose death at Great Shelford, near Cambridge, on April 13, in his sixty-eighth year, is announced, took an active share in the work of the Bombay University, and was Vice-Chancellor for five years (1897–1902). He was chairman of the provisional committee of the Indian Research Institute now established at Bangalore through the munificence of the late Mr. J. N. Tata. On his retirement in 1903 he settled at Great Shelford, and he took a keen interest in the affairs of Cambridge University.

A PIONEER in telegraph engineering has been lost by the death, at the age of eighty-two, of Mr. E. B. Bright, on April 14. From an obituary notice in the Engineering Supplement of *The Times* we learn that with his young brother, afterwards Sir Charles Bright, he joined the Electric Telegraph Company in 1847. Within a year of entering this new field both became inventors. Perhaps the most important of their early inventions was the system, devised in February, 1849, of testing insulated conductors to localise faults from a distant point, by means of a series of standard resistance coils of different values, brought into circuit successively by turning a connecting handle. In 1851 Charles left the Electric Company, and shortly afterwards became engineer to the British Telegraph Company, while Edward joined the Magnetic Telegraph Company, of which, in 1852, when only twenty-one years old, he became manager. The brothers soon found it necessary to devise fresh apparatus to compensate for the inductive discharge resulting from the long underground circuits by discharging to earth and thus neutralising the recoil currents. From that time until the spring of 1854 they carried out a series of experiments on the great lengths of subterranean wires under their control in order to investigate this novel phenomenon. Edward Bright was largely responsible for the establishment of telegraphic communication between the West Indian Islands by some 5000 miles of submarine cable. He was a member of the Institution of Civil Engineers and a member of council of the Institution of Electrical Engineers.

THE Royal College of Surgeons has awarded the triennial prize, with which is given the John Hunter medal, to Dr. W. Blair Bell, of Liverpool, for his dissertation on the anatomy and physiology of the pituitary body. The subject of the prize for the next period is "The Human and Comparative Anatomy and Physiology of the Cerebellum." The Jacksonian prize for the year 1912 has been awarded to Mr. F. W. Goyder, of Bradford, Yorks, for his dissertation on the embryology and treatment of cleft palate. The subject of the prize for the year 1914 is "The Pathology, Diagnosis, and Treatment of Trigeminal Neuralgia."

A JOINT session of the Aristotelian Society, the British Psychological Society, and the Mind Association will be held in London on June 7 and 8. In the afternoon of June 7 there will be a symposium, "Are Intensity Differences of Sensation Quantitative?" to which Messrs. C. S. Myers, Dawes Hicks, H. J. Watt, and Wm. Brown will contribute. In the evening there will be a discussion of a paper by Dr. Arthur Robinson on memory. The subject of a symposium on June 8 will be, "Can There be Anything Obscure or Implicit in a Mental State?" and Messrs. Henry Barker, G. F. Stout, and R. F. A. Hoernle will take part.

WHATEVER may be the subsequent effect, if any, of the removal of the Royal Geographical Society from its old centrally situated premises in Savile Row to the "West End," there can be no question as to the enhanced convenience and amenities afforded by the new home at Kensington Gore, which the Society

opened on Monday last, after an enforced sojourn in temporary quarters at Cromwell Gardens since the beginning of the year. The house, formerly known as Lowther Lodge, has proved excellently adaptable to its new purpose. The ground floor provides a museum and lounge, in addition to two map-rooms and a council-room—a change indeed from the conditions at Savile Row. The accommodation on the first floor serves for the library, for various rooms for the convenience of fellows, and for offices; on the second floor is the surveying school, with students' and draughtsmen's rooms, while the roof provides space for an observatory for the purposes of the school. The intention is to dispose of a considerable portion of the land attached to the house, but sufficient will be retained to form a pleasant open space on the south side of the building.

THREE evening lectures (the Chadwick Public Lectures, 1913) on the evolution of epidemics are being given by Dr. J. T. C. Nash, at the Royal Society of Medicine, 1 Wimpole Street, W. In his first lecture Dr. Nash pointed out that, although measles is so constantly with us, and smallpox is generally so distinctive, and is yet common enough in various parts of the world, no causal germ has yet been definitely recognised for either disease. Certain other specific diseases have been found to be due to the life-processes within the blood and tissues of higher forms of life than mere bacteria. Malaria is an example of such. In pre-vaccination days smallpox in Great Britain showed a periodic intensity of prevalence every three, four, or five years, but during the latter half of the nineteenth century, since vaccination was made compulsory in 1851, only one widespread epidemic occurred, in 1871–72, when smallpox overran Europe and America; but it must be remembered that vaccination was not the only measure in force, and compulsory notification, disinfection, isolation, "following up" of contacts throughout the incubation of the disease, all assisted in limiting the spread of infection and widening out the inter-epidemic periods. In commenting upon the second Chadwick Lecture, delivered on Monday last, Sir Richard Douglas Powell, who presided, said that Dr. Nash's arguments were of great importance in leading to a salutary speculation on the true character and possible removability of endemic, as well as epidemic diseases. May it not be that the bovine, avian, and human forms of tubercular diseases are distinct only from the fact that for many generations the micro-organisms have been cultivated in the special environments of beasts, birds, and mankind, and that the root-ancestor of all was a fungus dwelling in the earth and ever ready to spread into animal soil? Dr. Nash's lectures should do much to lead students of the etiology of tuberculosis to look back into long-forgotten factors, such as that of soil, which were discussed by Buchanan and other men of medicine in his (Sir Douglas Powell's) early years. The next lecture will be given on Monday next, April 21, when Sir William J. Collins will preside.

IN June Dr. F. W. Mott, F.R.S., will give a course of Chadwick Public Lectures at the Royal Society of Arts, under the title of "Nature and Nurture in Mental Development." Among the lectures in contemplation for the provincial cities are those on the public milk supply—some criticisms and suggestions from the public health point of view, by Prof. Henry R. Kenwood, at Cardiff; on water supply, with exhaustive consideration of sources, collecting works, conveyance, and distribution, by Mr. E. P. Hill, at Birmingham; and on infant welfare, by Prof. Karl Pearson, F.R.S., at the School of Economics, May 16, 23, and 30. Glasgow, Bristol, and other cities of the kingdom will also be provided with Chadwick Public Lectures during the year. All the lectures will be free and open to the public, but will be of a character to attract post-graduate and advanced students of engineering, medicine, and other cognate sciences. The secretary to the trust, to whom all communications should be addressed, is Mrs. Aubrey Richardson, 8 Dartmouth Street, Westminster.

THE Eugenics Record Office, which was established at Cold Spring Harbor, Long Island, in October, 1910, by Mrs. E. H. Harriman, with the additional assistance of Mr. John D. Rockefeller and others, has recently entered upon a new stage of its development. A board of scientific directors has been organised, comprising Dr. Alexander Graham Bell, chairman; Dr. William H. Welch, professor of pathology, Johns Hopkins Hospital, vice-chairman; Prof. Irving Fisher, Yale University; Prof. Lewellys Barker, of Johns Hopkins Hospital; Prof. E. E. Southard, of Harvard University, and director of the Psychopathic Hospital, Boston; and Dr. C. B. Davenport, secretary of the board and resident director. The board met at Cold Spring Harbor on March 21, and organised its work. The aim of the Eugenics Record Office was defined to be as follows:—(1) To promote researches in eugenics that shall be of utility to the human race. This part of the programme includes the study of America's most effective blood lines and the methods of securing the preponderance and relative increase of the best strains; the study of the origin of and the best methods of restricting the strains that produce the defective and delinquent classes of the community; the study of the method of inheritance of particular traits; the study of the consequences of the marriages of close kin; the study of miscegenation in the United States; the study, both in that country and abroad, of the family histories of permanent immigrants. (2) To publish the results of these researches. (3) To provide a fireproof building for the preservation of eugenical records, including genealogical works and town histories. (4) To provide an administrative office and staff to carry out the work.

IN the third part of his useful periodical, *Visvakarma*, Mr. Ananda K. Coomaraswamy gives a further selection of examples of Indian sculpture. The present instalment is devoted to specimens from Java, Cambodia, and Ceylon, all of which betray Hindu influence, while two fine examples from Sarnáth, near Benares, and from Nepal are excellent illustrations of the local art. The photographs are now more artistically reproduced than in the first number of the

series, and the collection will be of interest to artists and students of the religions of the East.

WE recently deplored the lack of encouragement and support received by the Royal Anthopological Institute of Great Britain and Ireland from the State and the public of this country. When we turn to America the case is very different. From the forty-sixth report of the Peabody Museum of American Archæology and Ethnology, connected with the Harvard University, we learn that steps are being taken to complete the museum buildings according to the original plans prepared fifty-three years ago by Louis Agassiz. The plans provide for the addition of five exhibition halls, each 100 by 60 ft., a stack-room for the library, several workrooms and offices, a photographic room, a lift, and other conveniences. These important extensions are needed to supply accommodation for the vast collections of material which are being collected by parties of explorers at work in all parts of the country, under the guidance of the museum authorities, and the large donations presented to the institution by members of the public.

IN *Man* for April Mr. T. C. Hodson discusses the question of seasonal marriages in India. During last February the Kadva Kanbis of Gujarat celebrated, after an interval of some ten years, the weddings of all the marriageable youths and girls in the tribe. A similar custom prevails among a group of the Madras Chettis, and among some Karens in Burma it is only when an official visits their country and orders a wedding to take place that the ceremony is performed. This custom may be an extension of the human pairing season which has been discussed by Prof. Westermarck. At present, among the Kanbis, it seems to be the result of a system of hypergamy —the desire to marry a girl in a grade higher than her own—which results in a scarcity of bridegrooms and increase of the bridegroom price. But it may have originated in some belief connected with astrology, or some tribal custom the cause of which is now obscure.

The Journal of Genetics for February (vol. ii., No. 4) contains three papers, two of which are more of the nature of general reviews and discussions than records of original observation. Dr. A. H. Trow discusses "Forms of Reduplication"—the phenomena more generally known as gametic coupling and repulsion. He points out that if there are factors A, B, C, in which there is coupling between A and B and between A and C, then there will of necessity be secondary coupling between B and C. He works out formulæ for the "secondary reduplication" and compares them with actual cases already recorded. Mr. Clifford Dobell reviews the present knowledge of mutation in bacteria, devoting the greater part of his paper to physiological mutations, *i.e.* inherited changes in the power of producing ferments or pigments. He shows that such mutations have been frequently described, that many of them are apparently spontaneous, but that in some cases at least they are due to change of environment, and that in this case they are not rarely adaptive. Mr. K. Toyama gives a detailed account of the inheritance of egg-characters in the silkworm (*Bombyx mori*). There are a number of definite characters (shape, colour, &c.) in various breeds, and his most important result is that the majority of these characters, even when they depend upon the embryo and not upon the shell, are determined by the constitution of the female parent, and not by that of the embryo. For example, a female of a breed having eggs with the recessive character, mated with a male of a breed having eggs with the dominant character, produces eggs of the recessive character, but the females reared from these eggs, however mated, lay eggs with the dominant character.

"DOMINANCY in Nature" is the title of the presidential address (of which we have been favoured with a copy) delivered by Mr. J. W. Taylor at the annual meeting of the Yorkshire Naturalists' Union, held on December 14, 1912. The author holds the view that western and central Europe was the birthplace, or dispersal centre, of nearly all groups of animals.

IN an account of the manner in which bees collect pollen, published as Bulletin No. 121 of the Entomological Bureau of the U.S. Department of Agriculture, the author, Dr. D. B. Casteel, states that the articles published by Mr. F. W. L. Sladen in 1911, 1912 (one of which appeared in our own columns, February 29, 1912, p. 586), afforded the first true explanation of the function, and that his own observations have confirmed the accuracy of Mr. Sladen's work. "Pollen," he writes, "may be collected by the worker upon its mouth-parts, upon the brushes of its legs, and upon the hairy surface of its body. When the bee collects from small flowers, or when the supply is not abundant, the mouth-parts are chiefly instrumental in obtaining the pollen. The specialised leg-brushes of the worker are used to assemble the pollen, collecting it from the body-parts, to which it first adheres, and transporting it to the pollen-baskets, or corbiculæ, of the hind-legs. In this manipulation the fore-legs gather pollen from the mouth-parts and head; the middle-legs from the fore-legs and from the thorax; the hind-legs from the middle-legs and from the abdomen. . . . A little pollen is loaded directly from the middle-legs into the baskets when these legs are used to put down the pollen-masses."

IN the March number of *The American Naturalist* Prof. Kellogg, of Stanford University, reviews the results of his laborious investigations into the geographical and "host" distribution of the external parasitic insects commonly known as bird-lice (Mallophaga). Despite their popular name, nearly 100 out of the 1500 known species are parasitic on mammals, although none of those infesting mammals visits birds, or *vice versâ*. Indeed, with a few exceptions in a couple of genera, the mammal-infesting species belong to families distinct from those parasitic on birds; the members of the former group, in adaptation to a life spent among fur instead of feathers, having discarded one of the two terminal claws of the limbs. After referring to the fact that the various species of these parasites are to a great extent restricted to

particular species or groups of kindred species of hosts, the author directs attention to the remarkable fact that certain kinds of these lice are to be found on hosts completely sundered from one another by geographical barriers. The European and the American avocets have, for example, two species in common, while the Old World and New World bitterns have one. To explain this the author suggests that the parasitic species has been handed down practically unchanged to its present hosts from their common ancestor, and consequently that the species of bird-lice are much older than the birds they infest.

IN a report on wheat experiments in the United Provinces (Bull. 32, 1912, Agricultural Research Institute, Pusa), Mr. H. Martin Leake and Ram Prasad direct attention to the high yields often obtained. Whereas the average outturn of grain per acre for the Fatehpur area is given as 1250 lb. for irrigated, and 600 lb. for non-irrigated land, yields of 1700 to 2000 lb. were often obtained in these experiments, whilst a yield of 2200 to 2400 lb. may be expected under favourable conditions. These relatively high returns are not attributable to the use of manures or to rich soil, but are probably due to the adoption of hot-weather cultivation. Actual experiments show the value of this practice and indicate it to be cumulative in effect.

AN interesting account of experiments on the utilisation of pasteurised milk for Cheddar cheese-making has been published by Messrs. J. L. Sammis and A. T. Bruhn (Research Bulletin 27, Univ. Wisconsin Agric. Exp. Stat.). In practice, the processes of cheese-making have been subject to daily variation on account of qualitative and quantitative differences in the initial bacterial flora of the milk, and the resulting product has varied accordingly. The above investigators have now devised a method by means of which these initial differences are eliminated. The milk is first pasteurised at 160° to 165° F., whereby about 99 per cent. of the bacteria are killed; the reaction of the milk is then corrected, by the addition of hydrochloric acid, to 0·25 per cent. acidity (stated as lactic acid); a pure culture of lactic acid bacteria is added, and all subsequent processes can be carried out according to a time schedule. It is also claimed that the quality of the product is more uniform than that of cheese produced by the ordinary method; the cheese may be safely stored at high temperatures; the losses of fat are lower, and the average yield is higher than under ordinary conditions. In addition to providing a means of destroying pathogenic organisms contained in the milk, the method may prove of value in connection with research on the processes of cheese-ripening.

AN article by Mr. N. Mori, on the formation of "tree-frost" in northern Japan, appears in the February issue of the Journal of the Meteorological Society of Japan. The author distinguishes this from hoar-frost, which is formed at or about freezing-point, observing that "tree-frost"—which appears on various objects, but principally upon the branches of trees—follows on early morning mist and a temperature of from 10° to 30° below freezing-point. In appearance "tree-frost" is quite different from hoar-frost, resembling white blooms. The author regards the phenomenon as due to the direct freezing on to the tree-branches of the minute watery particles of mist formed at a temperature below freezing-point. Mr. R. Hirano, of the Tadotsu Meteorological Station, has an article on *shigure*, or drizzling rain, in which he seeks to draw scientific deductions from references to the subject in Japanese poetry ranging over a period of more than a thousand years. Among other matters of interest is an account, by Baron Yoshida, of a cloud pillar observed in Kaga province, on the Japan Sea coast, on the afternoon of December 25, 1912. Snow had been falling and covered the ground to a depth of 4 or 5 in., but had ceased, and the sky was clear, with the exception of some cumulo-stratus clouds. Among them a curious ash-white cloud made its appearance, and from this suddenly was seen to rise a whirling column, which moved off in a northerly direction. A smaller column was formed in its rear and followed it at an equal distance. Both columns vanished in about eight minutes, the smaller being the first to disappear.

IN the issue of NATURE for July 28, 1910 (vol. lxxxiv., p. 118), attention was directed to the method of treating storage cells seriously reduced in capacity by sulphating, which had been used with great success by Mr. J. O. Hamilton, of the Kansas State College. At a recent meeting of the American Electrochemical Society, Messrs. C. W. Bennett and D. S. Cole, of the electrical engineering department of Cornell University, described the results of applying a similar method to the college battery of fifty-two cells, which, owing to sulphating, had a capacity of only 30 instead of its rated capacity of 60 ampere hours. The acid was removed from the cells and replaced by a 10 per cent. solution of pure sodium sulphate. The battery was then charged for 53 hours, and the plates removed, washed, and replaced in their proper acid. The capacity was found to be increased to 58 ampere hours, and the total cost of the treatment worked out at 10*d.* per cell. An abstract of Messrs. Bennett and Cole's communication will be found in *The Electrician* for March 28.

THE Journal of the Franklin Institute for March contains an article by Mr. H. T. Herr, of the Westinghouse Machine Company, on recent developments in steam turbines. This article gives an excellent account, with drawings, of the present turbine practice of the Westinghouse Company. The author states that scarcely any turbine of anybody's make ever gave trouble due to blades breaking or coming out because of centrifugal force. Breakages are accounted for by vibrations, and until lashing of the longer blades was resorted to, breaking was caused by individual vibration. The lashing, or shrouding, must not be continuous, as provision for unequal expansion due to heating must be taken account of; hence, all lashed blades must be arranged in segments not exceeding 2 ft. for large diameters. These segments may vibrate as a whole, but the lashing has the effect of increasing the frequency and

diminishing the amplitude of the vibrations. Lashing or shrouding is therefore a palliative against vibration, and not a cure. It is the practice of the Westinghouse firm to lash all reaction blades above 1 in. in length, and very long blades may have three or four rows of lashing wire.

As is well known, air in excess of that which is required to ensure complete combustion of the fuel under a boiler carries away heat wastefully to the chimney, and the boiler and its flues are less efficient in absorbing the heat which has been produced. Engineers, therefore, test flue gases for carbonic acid, as an unduly small proportion of this corresponds to unnecessary excess of air. This is generally done by ascertaining the reduction in volume of the flue gas after treatment with a solution of caustic soda. These wet chemical methods, of course, work well enough, but the lower-grade type of engineer does not take kindly to them. The Underfeed Stoker Co., Ltd., of Coventry House, South Place, E.C., however, has put on the market, at a cost of five guineas, an extremely neat pocket apparatus, called the CO_2 thermoscope, in which no liquids are used. A measured charge of the gas is passed through a charge of powdered caustic soda contained in a copper cap looking like a detonator, but sealed at both ends. The ends are first pricked and then the cartridge is placed within the hollow bulb of a mercurial thermometer contained within the instrument. The zero of a sliding scale is then set to the mercury index and the piston of the instrument is pushed home so as to drive the gas through the cartridge of caustic soda. This heats up the cartridge, and the thermometer, acting as a calorimeter, shows directly on the scale the proportion of CO_2 present. Provision is made for eliminating the effect of temperature on the volume of the gas taken. As in the wet process, SO_2 counts as CO_2, but in this case in a higher degree in consequence of the greater heat of combination.

OUR ASTRONOMICAL COLUMN.

THE QUESTION OF RADIUM IN THE CHROMOSPHERE.—Bulletin No. 27 of the Kodaikanal Observatory contains an important statement by Mr. Evershed regarding the recent communications concerning the presence of radium and the elements of the inactive group in the chromosphere. One of the recent communications concerned a comparison made by Mr. Dyson of the lines of radium and the emanation with the bright lines in the chromospheric spectrum as observed at eclipses; this comparison indicated many apparent coincidences of wave-length, and he suggested that these elements may be revealed by their emission lines, although not by their absorption lines, as is the case of helium. In the first part of the paper Evershed deals with the comparison of the chromospheric lines with those of radium and the emanation. He employs for the chromosphere the spectra he obtained during the eclipse of 1900 for the ultra-violet region of the spectrum and the spectra (glass positives from the original) secured by Dr. Mitchell at the eclipse of 1905; these latter are, as he states, "the finest that have ever been obtained in the less refrangible region." In the second portion he devotes his inquiry to the question of the presence of neon or argon in the chromosphere, using the wave-lengths of the chromospheric lines as obtained by himself, Lockyer, and Dyson, and discusses the spectra thoroughly.

The result of his inquiry, to use his own words, is to show "that with the best eclipse material now available and the most recent measurements of the lines of the elements in question, the evidence is of a distinctly negative character as regards radium and the emanation, as well as neon and argon, and the probability is that not one of these elements can be recognised in the sun by a study of the emission spectrum of the chromosphere any more than by a comparison with the solar absorption spectrum." He further states that he has also examined the spectra of krypton and zenon, and also finds no evidence for their presence in the chromosphere.

DEDICATION OF THE NEW ALLEGHENY OBSERVATORY.—The corner-stone of the new buildings for this observatory was laid by Mr. John A. Brashear on October 20, 1900. The director at that time was Prof. F. L. O. Wadsworth. The work of building and transference has been completed, and the observatory dedicated with religious solemnity and handed over to the trustees of the University of Pittsburgh. We have lately received (Misc. Sci. Papers, Alleg. Obs., N.S., vol. ii., No. 2) an account of the dedicatory exercises and presentation which took place on August 18 of last year, and were referred to in NATURE of September 19, 1912 (vol. xc., p. 89). It is a pity that such stimulating scenes do not mark the history of astronomy in England. The various speeches are given in full, and in an appendix is given the speech made when the corner-stone was laid. Happily, Mr. John Brashear, to whose personal endeavours the new observatory owes so much, has lived to see crowned the works he then put in progress.

GENERAL INDEX TO THE MEMOIRS OF THE SOCIETY OF ITALIAN SPECTROSCOPISTS.—The fortieth anniversary of the above society and the completion of forty volumes (1872–1911) of the memoirs have been celebrated in a manner "modesta ed utile" by the preparation and publication of an *Indice Generale delle Memorie*. The index is made "per Autori e per Materia." The latter part is not an alphabetical list of titles juggled on the change-ringing system adopted in some catalogues, but consists of a number of natural divisions of the subject forming heads of lists of papers arranged chronologically under author's names. Prof. A. Ricco is responsible for the grouping. Other members of the staff of the Astrophysical Observatory of Catania have assisted.

NATIONAL ASPECTS OF EDUCATION.

SEVERAL notable utterances relating to our national scheme of education have recently been made by Lord Haldane and other members of the Government. Apparently the intention of the Government is to introduce a measure which will organise our educational institutions and forces on a national basis, and in the spirit worthy of a great modern State. Among the developments adumbrated are the raising of the leaving age of compulsory attendance at primary schools, the abolition of the "half-time" system, compulsory attendance at continuation schools, the correlation of primary and secondary schools, improvement of the status of teachers, increased number of provincial universities and of facilities for entering them.

The development of national education along such lines as these signifies a substantial increase of expenditure; and as the contributions from rates for educational purposes have reached breaking-point in

most districts, the main part of the increased burden will have to be borne by the State. Since 1870, the proportion of the cost of education borne by the rates, in comparison with that contributed from national sources, has grown very considerably; and a readjustment of the load is imperative. Lord Crewe referred to this disproportion in the course of a speech at a dinner given to Lord Haldane by the Eighty Club on April 4, and he remarked:—"We cannot coordinate our system without incurring a heavy cost, and the question the Government will have to put is: Is the country prepared, when it has seen our proposals, to say that the benefits which those proposals offer justify a further expenditure, which cannot be small, upon national education." Lord Haldane has also acknowledged (in his speech at Manchester in January last) that "One thing is quite certain—what is about to be done for the coming generation must not be done at the expense of the ratepayer." In various speeches since the opening of the campaign at Manchester he has referred to the national responsibility for the development of our educational resources, and the national advantages which will accrue from it. Speaking at a joint meeting of secondary-school and technical teachers at the University of London on March 29, he said:—"The expenditure on education is productive expenditure, which we are justified in making a sacrifice to incur with the certainty that we shall get it back with compound interest."

It is refreshing to find our Ministers accepting the principle that increased provision for education must come from the State, and that the nation will benefit by the additional expenditure. Not many years ago Lord Haldane, in an introduction to Sir Norman Lockyer's collection of addresses on "Education and National Progress" (1906), suggested that the private donor should be encouraged, but that the motto of the Chancellor of the Exchequer as regards expenditure upon matters connected with higher education and research should be *Festina lente*. "I do not mean," he wrote, "that the Government ought not to spend public money generously upon the universities. I mean that it should not be spent unless and until a case for the necessity of such expenditure has been clearly made out."

We may be permitted to conclude from his recent utterances that Lord Haldane is now of the opinion that a case has been made out for increased national provision for our educational forces. He knows as well as anyone that the great advances being made in education in other countries constitute a formidable menace to ourselves, and that the State can wait no longer for like developments if it desires to maintain a leading position among progressive peoples. What Lord Haldane and other members of the Government have been saying recently as to the responsibility of the State for educational progress has not only been said in New South Wales, but put into practice by the Labour Government now in power. The official pronouncement of the New South Wales Government upon education may appropriately be quoted here; it reads:—

"The present Government, recognising that economic reforms are of little value without increased educational facilities, attaches supreme importance to educational reforms. 'A man might have access to land, facilities of travel, industrial energy, credit, economic security, and justice, and yet true equality of opportunity might be lacking. The society where all these liberties have been won might be sunk in the stagnation of conservatism, and might even breed new forms of inequality and tyranny.' Every improvement in economic conditions should be accompanied by an effort to raise the standard of intelligence, and this will only be achieved by the State recognising its ever-increasing responsibility to provide increased educational facilities."

The article by Prof. H. S. Carslaw in NATURE of April 3 shows how the policy outlined in this manifesto has now been carried out in New South Wales; and the reforms there instituted are much the same as those urgently needed in the mother-country. To attempt to describe in detail the many directions in which our educational system requires organisation, improvement, and extension would take the present article beyond reasonable limits, but reference may be made to a few matters mentioned in recent speeches.

Much has been said of the work of the elementary school in relation to after-life. The great difficulty here is to know what the life after school is to be. More than 40 per cent. of the boys leaving London schools go into irregular employment; not so much perhaps on account of any want of fitness to learn a trade as because of the ease with which such "blind-alley" occupation can be found, and the relatively higher wages which can be obtained. It is not the province of the elementary school to prepare for any particular occupation, but so far as possible to guide the child to appreciate what is best in life, to train his hand and eye to work together, and to make him trustworthy, alert, and adaptable in whatever calling he may be placed. There should certainly be more manual work in schools, but its aims and methods should be educational and not technical. To attempt specialisation in an ordinary school, from which the boys leave to enter fifty or more different occupations, would lead to hopeless confusion. Manual dexterity can be trained in schools at an age when it is most easily acquired without attempting to teach the processes of particular occupations. The effect of giving more time and attention to work of this practical nature would perhaps be to increase the dignity of manual labour, and to lead ambition into industrial rather than clerical directions.

In rural districts the difficulty in making the elementary-school curriculum less bookish is the teacher, who frequently has no special aptitude for the work, and has rarely received a special training. So long as there is no inducement for teachers to qualify themselves for work in rural schools, no improvement can be anticipated. At present the rate of pay is lower than in town schools and the opportunities of advancement are fewer; so that young teachers naturally object to become earmarked for country schools. Exceptional qualifications are demanded without any inducement being offered to teachers to obtain them. The teacher in a rural school is expected to have the spirit of a naturalist, the manual dexterity of an artisan, the experience of a horticulturist, and the culture of a university graduate, and for these admirable qualities he will receive the pay of a second-rate clerk. It is unreasonable to expect that many men and women possessing such attributes will have no higher ambition than that of teaching in country schools.

One of the reforms contemplated by the Government is the raising of the age below which attendance at school is compulsory, and the abolition of the "half-time" system. At present, a child can leave school immediately it reaches the age of fourteen years, irrespective of the standard in which it may be at that time. About 10 per cent. of the children in public elementary schools leave each year, and they are usually in Standard VI., so they have had the full opportunities of whatever education the schools are giving. Partial exemption from school in order to go to work during certain hours of the day can be obtained at the age of twelve by obtaining an attendance certificate, or at eleven in agricultural districts

if the standard of exemption fixed by the local education authority has been passed. This is the "half-time" system, and in the year 1910–11 the number of children who took advantage of it was 71,475, 80 per cent. of whom belong to the districts of Lancashire and Yorkshire engaged in textile industries. The total number of pupils in attendance at public elementary schools of England in the year 1910–11 was nearly 5,000,000, so that the "half-timers" form only about 1½ per cent. of the children under instruction, and since the year 1907–8 the number has been continually decreasing.

Little can be said in favour of the "half-time" system from the point of view of the child's physical, mental, and moral development, all of which are sacrificed by it to the interests of some parents and employers. The facts described in the work on "Continuation Schools in England and Elsewhere," edited by Dr. M. E. Sadler, provide an unanswerable indictment of the system by which child-labour is exploited because it is cheap and the educational discipline of school is minimised at a period when it is most needed.

Several attempts have been made to abolish the half-time system, the most recent being the Education (School Attendance) Bill, which was introduced in the House of Commons last year, and was afterwards sacrificed. The Bill provided that no child under the age of thirteen should be allowed to leave a public elementary school, and that a child should only be allowed to leave school before the age of fourteen for the purpose of entering into some beneficial employment. It was left to the local education authority to decide whether the conditions of the proposed employment were suitable to the child, and whether it was likely to lead to permanent employment and to afford useful training.

It may be possible to find arguments in favour of permitting a child to leave school relatively early in order to enter employment which will make him a skilled workman, but no amount of special pleading will prove that a child of twelve is benefited by working six hours in a mill each day and attending school for two and a half hours as well. When the school curriculum is of a more practical character than it is at present—and many education authorities are making it so—it will not be reasonable to urge, as Sir William Anson did last year, that the mechanical drudgery of the mill-room is more valuable for after-life than instruction in educationally-graded courses of manual work and housecraft.

The great majority of children who leave the elementary schools receive no further school training. The following table, based upon the statistics prepared for the Board of Education by the Continuation Schools Committee which was appointed in 1907, gives some indication of the numbers of adolescents receiving no regular education :—

Boys and Girls (England and Wales), 1906–7.

Age	Population	Not at school (either day or evening)	
		No.	Per cent.
12 ...	687,300 ...	14,424 ...	2·10
13 ...	690,300 ...	155,871 ...	22·58
14 ...	691,000 ...	442,950 ...	64·10
15 ...	682,100 ...	523,383 ...	76·73
16 ...	649,200 ...	532,016 ...	81·95
17 ...	664,900 ...	557,632 ...	86·87

It is a common complaint that what is learnt in school is soon forgotten in after-life. This is true of most subjects and of most children; and the loss of the knowledge is usually the result of disuse. The above table shows that a very small proportion of children from elementary schools continue their education by attendance at continuation schools, the result being that in most cases they are unable after a couple of years to perform the simplest arithmetical calculation or show evidence of having received instruction in any ordinary subjects other than reading and writing. This is a bad beginning for after-life, and the nation will benefit by any measure which will bring pressure to bear upon parents and employers to ensure attendance at continuation schools. In Germany, twenty-seven States have adopted the compulsory continuation-school system, which imposes the statutory obligation on all employers of labour to give their employees under eighteen years of age such leave of absence from work for the purpose of attending the schools as the local authorities may prescribe. It is time that similar measures were adopted in our own country. The years of youth and adolescence, when supervision, discipline, and guidance are particularly needed, are at present left unguarded by the State. It is true that we have in the three-quarters of a million students who attend evening and similar schools an army of voluntary students of which any nation may be proud, but nearly one-fifth of these students fail to complete the small minimum of attendances (from thirty to sixty hours) required to enable grants to be claimed towards their instruction, and most of the remainder only receive very elementary instruction, comparable perhaps with the work of continuation and trade schools in Germany, but forming no satisfactory substitute for the highly developed system of secondary and technical education in that country.

We do not suggest that the education system of Germany is adapted to the needs of our own country and people, but we do believe that until a national system of our educational institutions has been formulated comparable with that of our chief competitor, it will not be possible to inspire confidence in the expenditure of large sums of public money on education. We go to Germany for our illustrations because there the result of organisation by the State has been to raise education out of the slough of commercialism and make the people appreciate its advantages to the nation and the individual. If comparison with Germany is permissible in the case of armaments, it is much more so in connection with education, in which we ask, not for two schools to one, but an approach to equality.

In true secondary schools, high-grade technical institutions, and advanced university students lie our weaknesses as compared with Germany. There are nearly 1000 recognised by the Board of Education as efficient secondary schools in England and Wales, and they are attended by about 170,000 boys and girls, three-fifths of whom are from public elementary schools. Three-quarters of these pupils are, however, under fifteen years of age, and if pupils under twelve years of age be left out of consideration the average length of the secondary-school life is less than three years. Germany has in its secondary schools more than twice as many pupils as are in our State-aided secondary schools, and all taking courses lasting six or nine years, leading to definite goals and linked up closely to the public life. The leaving certificate obtained after passing through a nine-years' course qualifies for entrance into any German university, and to any of the learned professions. We have no such general certificate for the pupils of our secondary schools, and the standard of the certificate could not be passed successfully by the majority of the students in our universities, while to apply it to the product of our schools at present would be impossible.

With few exceptions, our technical institutions also

will not bear comparison with the technical high schools of Germany, either as regards number of students or nature of the instruction. The total number of day technical students in English polytechnics, technical schools, and colleges, and in universities and university colleges recognised as technical institutions by the Board of Education, is about 4000; and less than one-fifth have passed a university matriculation examination or its equivalent upon entrance. Less than 2000 day students are taking full courses of instruction in technical institutions in England and Wales, though this number includes students of technology in several provincial universities or university colleges. The technical high schools of Germany and Zurich have together more than six times as many day students taking full four-year courses, after having completed a full secondary-school course and obtained the leaving certificate. If the same standard were required for entrance to our technical institutions, most of them would cease to exist.

Our position as regards university students is equally unsatisfactory when compared with that of Germany. In the whole of the universities of England, including Oxford and Cambridge, there are about 17,000 full-time students, whereas Germany has four times as many. The University of Berlin alone has 10,000 matriculated students; Leipzig 5000; Bonn, Breslau, and Halle more than 3000 each, and six other universities more than 2000. We have a long journey to make before we can approach the position occupied by Germany as regards secondary, technical, or university education, and it is the State which must take the lead if we are to make up our leeway. The first requirement is to organise our educational institutions into a truly national system; that is to say, upon a system which has the well-being of the nation as its main object, and in which facilities are offered to every individual to secure the highest instruction if he is qualified to take advantage of it.

The raising of the leaving age of elementary schools, the abolition of the "half-time" system, the establishment of compulsory continuation schools, and the coordination of elementary and secondary schools are reforms for which England ought no longer to wait, but of greater importance from the point of view of national progress is the development of higher technological instruction and research in our technical colleges and universities. The importance of this was emphasised by Mr. H. G. Wells in three articles contributed to *The Daily Mail* on April 7, 8, and 9. Mr. Wells's theme was the nature of our naval and military armaments and the national expenditure upon these preparations for war; and he urged that too much confidence is placed in obsolescent instruments of destruction and far too little encouragement given to organised technical research, military and naval experiment, and other means by which a secure position can be obtained by the aid of science. "I will suggest," he said, "that we have the courage to restrain and even to curtail our monstrous outlay upon war material, and that we begin to spend lavishly upon military and naval education and training, upon laboratories and experiment stations, upon chemical and physical research, and all that makes for knowledge and leading, and that we increase our expenditure upon these things as fast as we can up to ten or twelve millions a year." The arts of peace, no less than those of war, require the production of as many highly educated, inventive, investigating men as the nation can obtain from all classes of the community. The future of every modern State depends upon the work of its men of science and engineers. Let us hope that this will not be forgotten when the Government gives attention to the organisation of education, and that consideration will be given not only to the acquisition of knowledge by students of various grades, but also to its increase.

R. A. GREGORY.

VARIATIONS IN ATMOSPHERIC CIRCULATION IN TEMPERATE LATITUDES.

DR. A. DEFANT contributes a long paper to the *Sitzungsberichte der K. Akad. der Wiss. in Wien*, March, 1912, in which he discusses the variations in the meteorological elements in temperate latitudes in both hemispheres. In an introductory section he outlines the theoretical conclusions on which he bases his method of investigation. Briefly stated, they are as follows. If a region is a region of rising pressure, a "Steig-gebiet" in the nomenclature of Ekholm, the mean temperature of the atmosphere is below normal, and *vice-versa* if it is a region of falling pressure; but the precipitation is a maximum if the temperature of the atmosphere is above the normal over the region, and a minimum if the temperature is below the normal. Consequently oscillations in the precipitation correspond with oscillations in the variation of pressure, and if the first are periodic, the second will have the same periods.

The argument is ingenious, and would be unquestionably valid if the correlations were complete, but the question naturally suggests itself: "Why not investigate directly the records of pressure, which is less subject to local influences than is the amount of rainfall?" The paper appears to contain no adequate reason against adopting the direct method, but as rainfall is a more important climatic factor than pressure, the results of the investigation have an interest of their own, apart from the theoretical development.

The author has taken the daily weather reports for South America and Australia for the year 1904, added together the published values of rainfall for each day for all stations, and taken the total so obtained to represent the daily rainfall of the region considered. The totals are then written down in series, and the number of maxima during the year is counted and divided into the number of days. In this way an approximate period is obtained. The variation of this period is then eliminated, and the process repeated to give the next period. The method is clearly a rough one, and some discussion of the significance of the periods obtained appears to be necessary. Nevertheless, the results are interesting, and suggest that the application of Schuster's method of analysis to the search for comparatively short periods would repay the labour involved. Defant obtains periods of about seven, twelve, sixteen, and thirty-one days for the southern hemisphere, and by using the values for 1909 finds corresponding periods of about six, thirteen, and twenty-five days in Europe. It may be noted that Turner found evidence of a period of twenty-five days in his analysis of the Greenwich records.

Using some results of Exner's on the effect of the different thermal conditions over land and water, the author finds that a continent is the source of a series of pressure waves which travel from west to east with a velocity independent of the wave-length, and he connects this series of pressure waves with the variation of rainfall. The most important waves are those of which the lengths in degrees of longitude are 360°, 180°, 120°, &c., while next in importance are those of which the length is half the width of a continent or ocean. Their velocity is about 11° of longitude per day in the southern hemisphere, 14·5° per day in the northern. It is clear that if the results of the author's investigations are valid, they will be of great importance in long-distance forecasting.

E. GOLD.

GYROSTATS AND GYROSTATIC ACTION.[1]

I NOW suspend the gyrostat from the horizontal beam by means of this chain terminating in a hook (Fig. 8), which engages, as you see, in a central recess of the rim attachment. The chain, you observe, carries a ball-bearing race. I place the gyrostat with its axis horizontal and leave it to itself. The centre of gravity of the gyrostat lies vertically below the hook, and under those conditions there is no couple tending to tilt the instrument. I transfer the hook to one of the side recesses, set the gyrostat so that its axis is horizontal, and leave it to itself, when instead of falling down it turns its axis in a plane which is nearly horizontal. If I delay the precessional motion the gyrostat descends, if I accelerate the precession the gyrostat ascends. I transfer the hook to

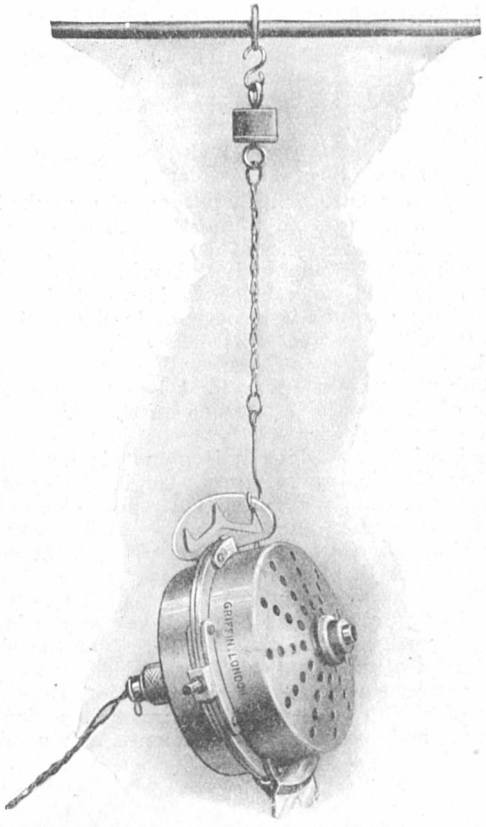

FIG. 8.—Motor-gyrostat precessing on chain support.

the opposite side recess, place the gyrostat so that its axis is horizontal, and again let go. The gyrostat precesses as before, but in the opposite direction. Again I hurry the precession, and again the gyrostat rises; again I delay the motion, and the gyrostat descends.

In these experiments, when the hook engages in either of the side recesses there is a couple due to gravity tending to produce angular momentum in a vertical plane. The axis of spin-momentum turns towards an instantaneous position of the couple-axis at right angles to it, at angular speed ω say. If μ be the spin-momentum, and the top has been properly started, angular momentum *about the couple-axis* is being produced at rate $\mu\omega$ by this turning, and this is equal to the moment of the couple. The precessional motion remains at the value required to give just the rate of production of angular momentum corresponding to the couple. This is the point generally missed in popular explanations of gyrostatic action.

It is important to notice, however, that, as these experiments are usually carried out, the precession, though apparently steady to the eye, is not, strictly speaking, perfectly steady. There is a very slight alternate rise and fall of the axis. To get quite steady motion the top must not be simply spun and then left to itself; it must be started with the right amount of precession.

I now place the gyrostat within this wooden tray (Fig. 9). The pivots carried by the rim of the gyrostat engage on bearings provided in the tray, and these are on a level with the centre of gravity of the whole. I hold the tray so that its plane is horizontal, and carry it round in a horizontal circle. Nothing happens. Still holding the tray so that its plane is horizontal, I carry it round in a horizontal circle in the reverse direction. The gyrostat immediately turns a somersault, and is thereafter stable. If I reverse the direction of rotation of the tray again the gyrostat turns a somersault, and remains again quiescent.

The gyrostat is stable, with its axis vertical, so long as the direction of spin coincides with that in

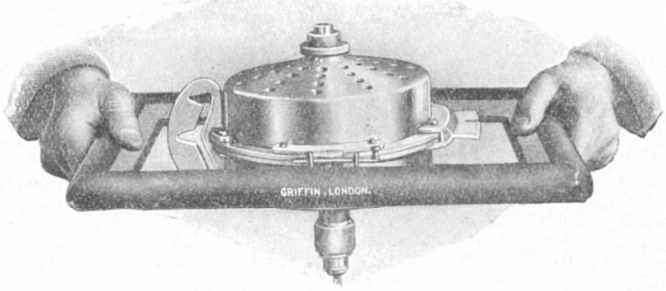

FIG. 9.—Motor-gyrostat mounted to demonstrate the principle of the gyrostatic compass.

which the tray is being turned. If this latter direction is reversed the gyrostat turns a somersault so as to render the two directions coincident. It appears as if the arrangement had a will of its own, and refused to be carried round against its direction of spin.

The theory of this experiment is very instructive. Both cases are represented by one differential equation, but in one case there is a real period of vibration about the vertical; in the other the period is mathematically unreal, and the gyrostat axis moves further away from the vertical. No better illustration of the two cases of the equation can be found.

The behaviour of the tray-gyrostat is exemplified also in the gyrostatic compass. A heavy and rapidly rotating flywheel is mounted so that its axis is maintained horizontal by means of an elastic support. Under these conditions the equilibrium position of the flywheel under the horizontal component of the turning velocity of the earth (which corresponds to the turning of the tray) is arranged to be that in which the axis of rotation points due north and south. If time permitted, I should be glad to make an experiment with a carefully balanced motor-gyrostat which would not only show the turning of the earth under the gyrostat, but enable the rate of turning to be measured.

[1] Discourse delivered at the Royal Institution on Friday, February 14, by Prof. Andrew Gray, F.R.S. The motor-gyrostats described are the invention of Dr. J. G. Gray and Mr. G. B. Burnside. The gyrostatic tops and combinations used in the latter part of the lecture are due to Dr. Gray. Continued from p. 153.

I would now direct your attention to this motor-gyrostat, which forms the bob of an ordinary compound pendulum (Fig. 10). The tube carrying the gyrostat is attached, by means of a universal joint,

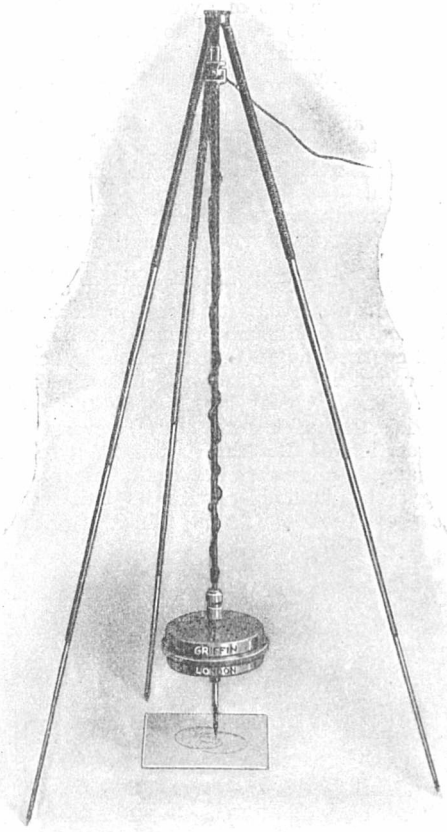

FIG. 10.—Motor-gyrostat fitted up as a gyrostatic pendulum.

to the apex of a triangular stand, made of telescope tubing. The gyrostat is attached to the lower end of its supporting tube by means of a special cap provided with spring contact pieces to allow the current to be led into the motor, and the flywheel is free to rotate about an axis coincident with the rod. Screwed to the lower side of the gyrostat is a pen, which presses lightly on a card placed below.

We have now the pendulum rod in the vertical position. I draw the pendulum to one side and let go, when you see that it vibrates to and fro, and the pen traces out a straight line on the paper. The flywheel has as yet no spin. I start the flywheel revolving, draw the pendulum to one side, and let go, either from rest, or with a certain amount of sidelong motion, when you observe that the pen describes a flower-shaped path (Fig. 11). The path is shown for different amounts of sidelong motion. The peculiar appearance of these curves is due to the rapid falling off of amplitude produced by friction.

When the flywheel is revolving there are, in general, two couples acting on the pendulum, one due to gravity, the other due to gyrostatic action. At an instant at which the axis of the gyrostat is vertical the former couple is zero and the latter one is a maximum, for at that instant the angular velocity with which the axis of the gyrostat is changing direction is greatest. When the pendulum is at one extremity of its swing the former couple is a maximum and the latter one is zero. At that instant the deflection of the bob from the vertical is a maximum, and it is at rest, or is moving sideways, according to the mode of starting, except in so far as the initial conditions have been interfered with by friction. By this relation of the couples the form of the path can be explained.

Another mode of motion is possible which has a very intimate connection with the theory of the vibrations of light-emitting molecules in a magnetic field, as indeed I pointed out here several years ago in a Friday evening discourse (see NATURE, April 13, 1899, and August 24, 1899). The bob can be made to move in a circle about the vertical through the point of support either with or against the direction of rotation of the flywheel. The two periods are different, and the motions correspond to the circularly polarised light of two distinct periods, which molecules, situated in a magnetic field, are found to emit. Thus the gyrostatic pendulum gives a dynamical analogue of the cause of the Zeeman effect.

In 1907 Herr Otto Schlick introduced a method of employing a gyrostat to counteract the rolling of a vessel at sea. The gyrostat is carried on bearings placed athwart the ship. These bearings are in line with the flywheel, and a weight is attached to the frame of the gyrostat in a position in line with the axis. It will be seen that when the ship is on even keel the gyrostat rests with its axis vertical, and with the weight vertically below the centre of gravity of the flywheel. Heeling of the ship in one direction causes the gyrostat to precess in one direction on the bearings on which it is mounted; heeling in the other direction causes precession in the opposite direction, and couples resisting the rolling motion are brought to bear on the ship. The device may be employed in two ways. In the first place, if the bearings on which the frame of the gyrostat is carried within the ship are smooth, the effect of the gyrostat is to resist the rolling force of the waves, and to bring about a lengthening of the free period of the ship, according to a mathematical theory which, when put in the proper way, is really very simple. Excessive rolling of a ship is due to the cumulative action of the waves, and such cumulative action is only possible

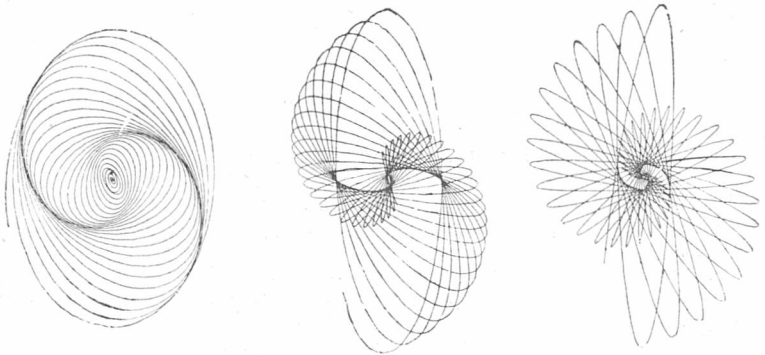

FIG. 11.—Some curves obtained with the gyrostatic pendulum.

where the period of the ship and that of the waves are of about the same order. A large ship has a very long period, and synchronism of the ship and the waves is impossible. The effect of introducing a gyro-

static control, operated in the manner just described, is to endow the small ship with the period of a very large one.

In the second mode of operating the gyrostat, friction is introduced at the bearings on which the frame of the gyrostat is mounted. With this addition the ship is forcibly prevented from excessive rolling. In the trials of the device it was found that with the control in operation the angle of roll of the ship did not exceed 1° in a cross-sea which produced a total swing of 35° when the control was out of action. It is interesting to notice that, contrary to the opinions which were expressed when the device was first suggested, the preventing of the rolling of a ship does not result in the waves breaking over her; a ship controlled by a gyrostat is, I believe, a dry one.

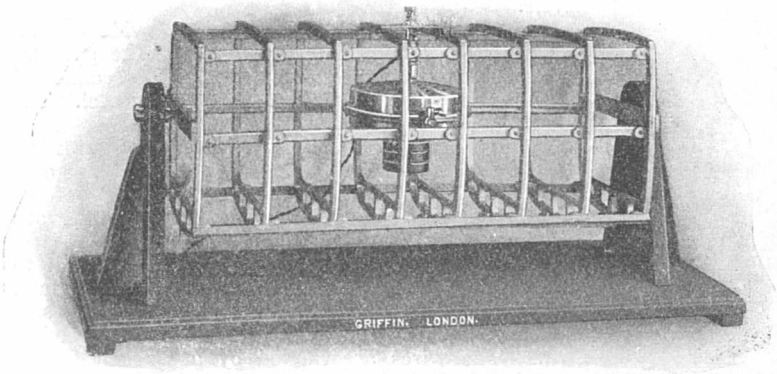

FIG. 12.—Motor-gyrostat fitted up to demonstrate Schlick's method of steadying a ship in a cross sea.

I have here a motor-gyrostat fitted within a skeleton frame representing a ship (Fig. 12). The frame is mounted on two bearings arranged on wooden uprights, and may be made to oscillate on these bearings, so as to imitate the rolling of a ship in a cross-sea. The frame of the gyrostat is mounted on two bearings placed athwart the frame, and a weight is attached to the outside of the case in a position in line with the axis of the flywheel. The centre of gravity of the gyrostat is in line with the bearings. A clip-device is provided which allows the gyrostat to be clamped to the skeleton frame, and provision is made whereby a graded amount of friction may be applied at one of the bearings.

I now set the skeleton frame vibrating with the flywheel at rest. You observe the period. I start the motor-gyrostat, and repeat the vibrations, with the gyrostat clipped to the frame. The ship rolls precisely as before. I free the gyrostat from the frame, and again set the ship rolling, when you see that not only is the period vastly increased, but the rolling motion is quickly wiped out.

When the gyrostat is clipped to the frame it produces no effect upon the rolling motion. The couples opposing the rolling motion arise from the precessional motion, and hence the gyrostat must be given freedom to precess. In this connection it is interesting to observe that in 1870 it was proposed by Sir Henry Bessemer to obtain a steady cabin for a cross-channel steamer by placing it on a gyrostat with its axis vertical and supported on fore and aft trunnions. This plan was bound to fail. The dependence of the effect on freedom of the axis to precess in a direction which is not that of rolling was not understood. We now see that the object would have been attained by supporting the cabin on fore-and-aft trunnions and mounting the gyrostat, within the cabin, on trunnions placed athwart the ship.

Here is a monorail top of new design (Fig. 13). The frame on stilts represents the car, and mounted on pivots placed across the frame is a gyrostat. Carried by a rod fixed to the frame of the gyrostat, and in line with the axis of the flywheel, is a weight. When the frame is placed on the table so that the legs and axis of the gyrostat are vertical, with the weight above the flywheel, the arrangement is doubly unstable without rotation; the system of gyrostat and weight is usually mounted on the pivots, and the entire structure is unstable about the line of contact of the feet with the table. When the flywheel is rotating, however, the top balances on the table. The two non-rotational instabilities have been stabilised.

I now place the top on the table with the legs and axis of the flywheel vertical, but with the weight below the gyrostat. You observe that the arrangement is unstable. Here there is only *one* instability without rotation, and the result is instability with or without rotation.

Here is a stilt top similar to the one just shown, but provided with wheels adapted to engage on a stretched wire. You observe the remarkable balancing power of the arrangement.

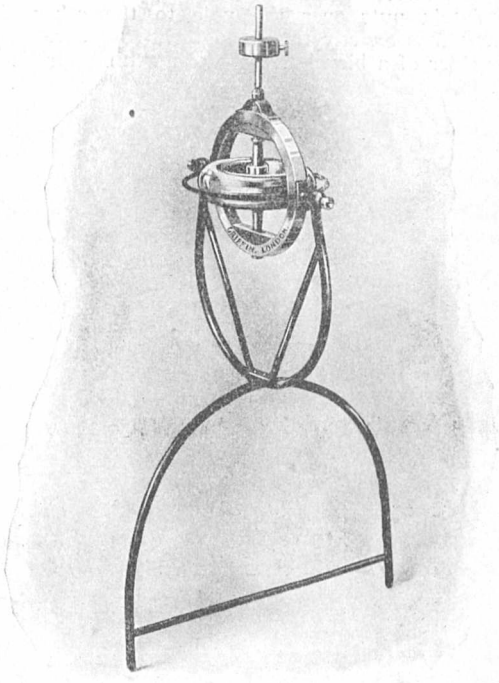

FIG. 13.—New monorail-top.

In this top (Fig. 15) a gyrostat is pivoted within a structure which represents a tight-rope balancer. The structure terminates in wheels adapted to engage on the wire. Attached to the gyrostat are two arms, and carried by these is a light rod weighted at both ends

My assistant spins the flywheel and places the structure upon the wire with the legs vertical and the pole horizontal. The top, as you observe, balances on the wire. If the top tilts over on the wire towards me the gyrostat precesses in the direction which carries

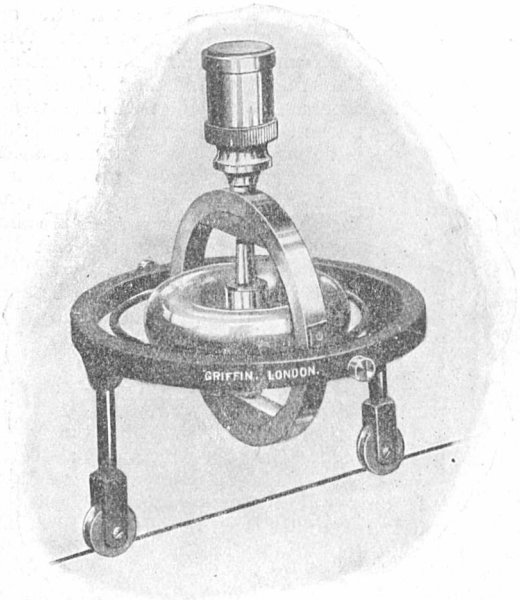

FIG. 14.—Monorail-top on wire.

the pole over towards you, and *vice versâ*. That is, if the balancer begins to fall over to one side it immediately puts over the pole to the other side. The action is exactly that of a tight-rope acrobat.

The rider of a bicycle keeps the machine upright by

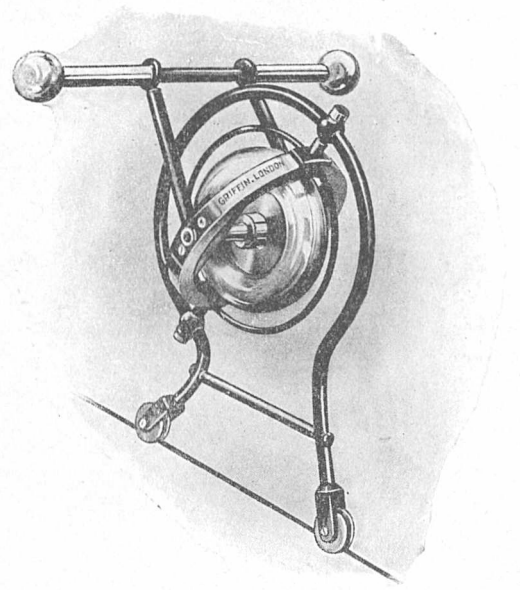

FIG. 15.—Pole-balancing top.

operating the handle-bar. If the machine tilts over to the left the rider turns the handle-bar to the left, and the forward momentum of the bicycle and rider, aided by the gyrostatic action of the wheels (a relatively small factor in this case) results in the erection of the machine. Similarly, if the machine tilts to the right the front handle-bar of the machine is turned to the right.

Here I have a small bicycle of the old-fashioned "high" type provided with a gyrostatic rider. When the gyrostat is spinning rapidly you observe that the top is completely stable. The gyrostat operates the front wheel, just as does the rider on the ordinary bicycle.

Again, here is a small safety bicycle provided with a gyrostatic rider (Fig. 16). In this case the gyrostat is mounted above the back wheel, and is connected by arms to the handle-bar of the front wheel. The action is the same as in the other model.

The tops I have shown you are very interesting from the fact that in each case the gyrostat not only detects but sets about correcting any tendency of the top to fall over. It behaves as if it had both a nervous and a muscular system.

I have also here a gyrostat which can be made to progress in space by a reciprocating motion—in fact, a walking gyrostat (Fig. 17). The gyrostat is suspended by two chains from two horizontally stretched wires. The wires are carried by a wooden frame, which is mounted, as you see, on two trunnions carried

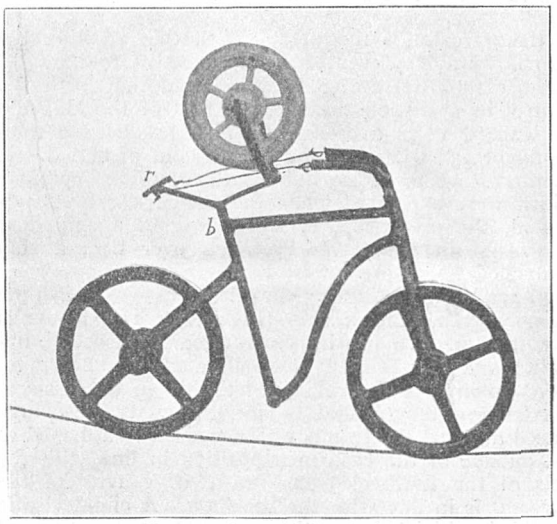

FIG. 16.—Gyrostatic bicycle rider.

by wooden uprights. The chains attached to the arms of the gyrostat terminate in two rings, and these are threaded on the stretched wires.

The gyrostat is spun and replaced on the wires. When the frame is tilted to and fro on the trunnions you notice that the gyrostat walks hand-over-hand along the wires. By the tilting of the frame the weight of the gyrostat is thrown alternately on each of the chains, and in consequence of the precessional motion the gyrostat moves along carrying the chains with it.

At present the spin is great, and therefore the precessional motion is small. The gyrostat proceeds, as you see, with a slow and stately motion. As time goes on the spin falls off, and the rate of walking increases, until finally the gyrostat literally runs along the wires, with considerable loss of dignity. When the gyrostat is enclosed in a box or within an acrobatic figure, the behaviour seems very mysterious.

Here is still another form of acrobatic top, consisting of a large gyrostat, the axis of which is horizontal, and two small ones, with axes vertical, mounted, as you see them, one on each side of the large one, on sleeves threaded on a horizontal bar, as shown in

Fig. 18. My assistant spins the flywheel of the large gyrostat, which is then suspended by means of a string and hook from the upper bar of the frame. At present the centre of gravity of the gyrostat is vertically below the hook, and under these conditions there is no precessional motion. He now spins the two small gyrostats and attaches them to the large one. Each small gyrostat, you will observe, is carried by two sleeves which are threaded on a horizontal bar. The hook is now transferred to one of the side recesses provided in the upper bar of the large gyrostat, and the system is left to itself, when it turns round in azimuth. One of the small gyrostats throws itself up and balances on the bar.

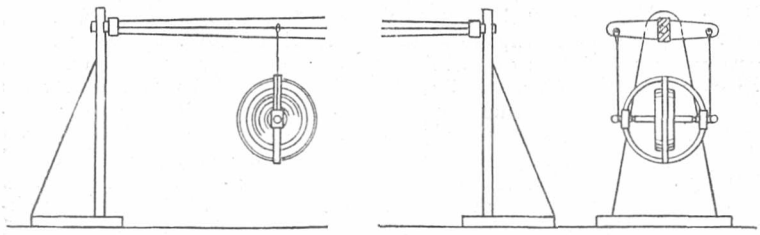

FIG. 17.

The experiment is repeated with the hook engaging in the other side recess, when you observe that the small gyrostat which previously occupied the lower position now rises into the upright one, and the gyrostat which occupied the upright position now occupies the lower one.

This top admits of a large variety of designs. It is easy to imagine a gyrostatic circus rider performing balancing feats on the back of a gyrostatic horse!

I conclude with a gyrostatic model which depends for its action upon an entirely novel and practical method of operating a gyrostat or gyrostats. The method has a very large variety of applications, into which I shall not enter at present. It is here shown applied to a motor-car. The car runs on two wheels in tandem; it can be set to run either in a straight path or a path curved in either direction. You observe that the arrangement includes two parts connected by a vertical or nearly vertical hinge. Each is supported on a single wheel. The front part carries a gyrostat with axis horizontal (in this case), the after-part contains the propelling mechanism. A quasi-gravitational field of force is produced by the propeller behind acting through the hinge.

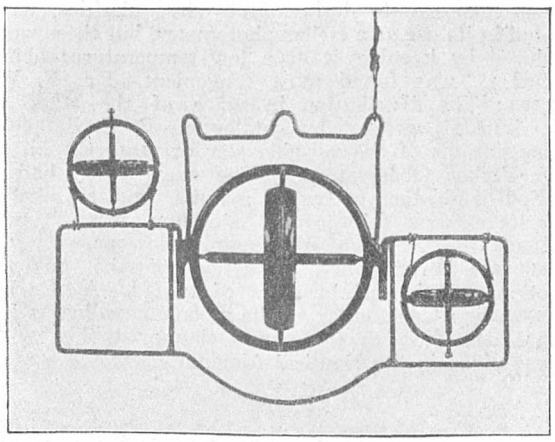

FIG. 18.—Acrobatic top.

The car can be made to go round in any curve by a weight placed on one side, when it will be seen that it leans over to the inside of the curve.

The balancing power is very great; even when a weight comparable with that of the entire car is mounted on a vertical rod carried by the structure, the device does not fall down. In fact, it is dynamically impossible for the car to overturn.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—It is proposed to confer the degree of Doctor of Law, *honoris causâ*, upon Admiral Sir Wilmot H. Fawkes, G.C.B., and Mr. J. S. Sargent, R.A.; and the degree of Doctor of Letters, *honoris causâ*, upon his Excellency Adolph H. G. Wagner, professor of political economy in the University of Berlin; Sir Frederic G. Kenyon, K.C.B., director and principal librarian of the British Museum; Sir John Knox Laughton, professor of modern history in the University of London; Sir James A. H. Murray; Prof. C. Bémont, professor of history in the Sorbonne; Mr. Thomas Hardy, O.M.; and Mr. Reginald L. Poole, keeper of the archives of the University of Oxford.

Sir Robert Rede's lecturer for the present year, Earl Curzon of Kedleston, will deliver the lecture in the ensuing Michaelmas term, not, as previously announced, in the present term.

The Linacre lecture, at St. John's College, will be delivered by Dr. Norman Moore, on Tuesday, May 6, at 5 p.m., in the lecture-room of anatomy and physiology, New Museums. The title of the lecture is "The Physician in English History."

MR. W. W. HORNELL, formerly of the Indian Educational Service, and now of the Board of Education, has been appointed Director of Public Instruction in Bengal.

THE council of the South African School of Mines and Technology has made the following appointments to the staff—Dr. G. S. Corstorphine, consulting geologist, of Johannesburg, to be principal of the school and professor of economic geology; Mr. J. S. Cellier, mining engineer, of Johannesburg, to be professor of mining.

MR. PEASE made his annual statement as President of the Board of Education in the House of Commons on April 10. In the course of his remarks he said that the number of pupils in receipt of free tuition in the 885 secondary schools receiving Government grants last year was 52,563, of whom 49,120 came up from the elementary schools. The staffing of the secondary schools is one teacher to every 32·5; of the elementary schools one teacher to every 13·5. There are twenty training colleges, and their total output of trained teachers last year only reached forty men and 195 women. At the continuation schools only 13 per cent. of the total population under seventeen are in attendance. A course of from two to four years will be established in day trade schools. There is room for twenty more in London and 150 in the country. The 2*l.* 17*s.* per head granted by the Government is wholly inadequate, and Mr. Pease has been able to increase the grant to 5*l.* in land schools and 10*l.* to the various training ships. The Science Museum is about to be built on a site in Exhibition Road, South Kensington. It is proposed to erect the

building in three blocks; the foundations of the first block have already been commenced, and about 110,000*l.* will be spent in the erection. Sir Hugh Bell, Sir Henry Roscoe, and other distinguished men of science have undertaken to advise in connection with the scope of this museum, the organisation of the collection, the policy to be followed in regard to the collection to be placed in the new building, and also as to what should be the relation of the museum to other societies and museums.

THE final report of the Royal Commission on University Education in London has just been issued as a Blue-book (Cd. 6717, price 2*s*.). The following are among the principal conclusions and recommendations:—(1) The Commissioners consider the whole organisation of the University fundamentally defective —(*a*) because of the present relations between the internal and external sides of the University; (*b*) because of the existing combination in the University of a large number of institutions differently related to it. (2) They propose that external students should continue to be admitted to the general examinations in the United Kingdom in all degrees except those in medicine and technology. Pupils still at school, however, would not be admitted, and students in constituent colleges or in University departments would not be admitted to these examinations in any faculty in which a special examination was open to them without the leave of the proper University authorities. (3) The University in future would consist of constituent colleges and University departments. The constituent colleges will be institutions either established by the University or existing institutions which are strong enough in one or more faculties to comply with the conditions for incorporation, and which transfer to the University the financial and educational control of their work in one or more of these faculties. (4) The normal portal of entrance to the University would be a school examination, established on the lines recommended by the Consultative Committee, instead of the present matriculation. (5) In order to reconstitute the University on these lines an additional income of 99,000*l.* would be required. We hope to deal further with the report in an early issue.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 10.—Sir Alfred Kempe, vice-president and treasurer, in the chair.—L. **Hill** and M. **Flack**: The effect of lability (resilience) of the arterial wall on the blood pressure and pulse curve.—Prof. J. H. **Priestley** and R. C. **Knight**: The nature of the toxic action of the electric discharge upon *Bacillus coli communis*. (1) Electric discharge in air is fatal to bacteria exposed to its action. (2) The effect is due to the products of the interaction of the constituents of the air, namely nitric and nitrous acid and ozone. (3) Discharge in air-free hydrogen has no deleterious effect on the organisms, but the presence of small quantities of air allows the formation of a toxic substance, probably hydrogen peroxide, which again exerts a bactericidal action. (4) It, therefore, follows that electric discharges in which the current density does not exceed 10^{-5} amperes per square centimetre do not exert any directly toxic action upon micro-organisms, a result which is contrary to the statements made by some previous investigators.—S. B. **Schryver**: Some investigations on the phenomena of "clot" formations. Part I. The clotting of milk.—Surg-General Sir D. **Bruce**, Majors D. **Harvey** and A. E. **Hamerton**, and Lady **Bruce**: (1) Morphology of various strains of the trypanosome causing disease in Nyasaland. II., The wild game strain. (2) Morphology of various strains of the trypanosome causing disease in man in Nyasaland. III., The wild *Glossina morsitans* strain. (3) Infectivity of *Glossina morsitans* in Nyasaland.

Linnean Society, April 3.—Prof. J. Stanley Gardiner, F.R.S., vice-president, in the chair.—Prof. A. **Dendy**: The calcareous sponges collected in the Indian Ocean on the Percy Sladen expedition. Of more than 400 species of Calcarea known, the present collection consisted of thirteen species, several of which were new to science.—Dr. J. D. F. **Gilchrist**: Larval stages of *Jasus lalandii* (Milne-Edwards).—R. S. **Bagnall**: The classification of the order Symphyla.

Royal Astronomical Society, April 11.—Major Hills, F.R.S., president, in the chair.—Mrs. **Evershed**: Some types of prominences associated with sun-spots. The paper was illustrated by forty slides of photographs of various forms of prominences situated over sun-spot groups; the photographs were arranged in eleven series, to show the successive changes in individual prominences. Their motions are intermittent, and vary in amount, thus differing from the motions observed in spot penumbræ, which are uniform and constant. The outward moving gas frequently falls back upon the chromosphere, sometimes forming massive banks, and sometimes rising and falling like fountains.—Miss **Blagg**: A suggested substitute for Bode's law. The law itself and the various hypotheses put forward to supplement it were explained. The author's theory agreed much better than Bode's law with the actual distances of planets and satellites; it strengthened the view that tidal action had always been small, and that satellites had not greatly altered their distances.—Joel **Stebbins**: The selenium photometer. The principle of the instrument, which was in use at the Illinois Observatory, was founded on the fact that the electrical resistance of selenium varied when exposed to light. Many irregularities were found in its use as a stellar photometer, but these were reduced by keeping it at a low temperature; about −20° C. was found most convenient.—Dr. F. W. **Dyson**: The distribution in space of the stars of Carrington's circumpolar catalogue.—E. E. **Barnard**: Observations of the variable star 97, 1910 Cygni, at the Yerkes Observatory. The star, which had a period of nineteen or twenty months, was remarkable for its extreme faintness at minimum, when it was beyond the reach of the 40-in. telescope.—H. C. **Plummer**: Preliminary discussion of the galactic motions of the bright stars of type I.—A. C. D. **Crommelin**: Comparison of the moon's coordinates for 1914, according to the new Delaunay tables, with those given in the Nautical Almanac.

PARIS.

Academy of Sciences, April 7.—M. F. Guyon in the chair.—J. **Boussinesq**: The application of the formulæ of superficial viscosity to the surface of a spherical liquid drop, falling slowly, with uniform motion in the midst of an indefinite liquid mass in repose and of a density slightly lower than that of the drop.—M. de **Forcrand**: The dehydration and decomposition of the hydrates of uranyl nitrate. The formation of a monohydrate.—Charles **Depéret**: Observations on the geological Pliocene and Quaternary history of the gulf and isthmus of Corinth.—J. **Guillaume**: Observations of the sun made at the Observatory of Lyons during the third quarter of 1912. The results are given in three tables showing the number of spots, the distribution of the spots in latitude, and the distribution of the faculæ in latitude.—Stanislas **Belsetsky**: The stability of equilibrium in a particular case of a piece

with constant curvature.—Emile **Jouguet**: The propagation of deflagrations and the limits of inflammability.—Henri **Chrétien**: A variant of the method of coincidences. In the comparison of two chronometers a curious stereo-acoustic phenomenon was observed by means of which the coincidences of the beats could be accurately observed.—A. **Tian**: A new mode of construction of quartz-mercury vapour lamps. A description of a simple form of mercury lamp, easily constructed in the laboratory out of a small transparent quartz test-tube.—Maurice **Billy**: A simple method for determining the density of mineral powders. The adsorbed air on the particles of powder is replaced by carbon dioxide by evacuating and admitting carbon dioxide to the flask containing the weighed powder. A dilute solution of an alkali of known density replaces the water in the density determination. Any carbon dioxide clinging to the powder is dissolved by the solution. Comparative measurements of the density of a solid before and after powdering showed that the accuracy was of the order of 1 in 3000, or about ten times that of the usual method.—Louis **Dunoyer**: A remarkable case of optical resonance. A description of a resonance phenomenon observed in sodium vapour.—L. **Gay**: The adiabatic expansion of liquids. An account of an experimental method for determining the expansion produced in liquids by adiabatic expansion from 2 to 1 atmosphere.—G. **Wyrouboff**: Some observations concerning the note of Mlle. Feytis on the magnetism of anhydrous and hydrated salts. The author regards a hydrated and dry salt as possessing quite different constitutions, and regards the measurements of Mlle. Feytis as confirming these views.—M. Emm. **Pozzi-Escot**: A new double sulphate of silver and cerium. The new salt has the composition $10Ce(SO_4)_2.6Ag_2SO_4$.—A. **Colani**: The solubility of thorium oxalate. Data are given for the solubilities in hydrochloric and oxalic acids.—Paul **Lebeau** and Marius **Picon**: The action of monosodium acetylene upon the alcoholic iodides. The preparation of true acetylenic hydrocarbons The sodium derivative of acetylene is prepared by the action of acetylene upon sodammonium in solution in liquid ammonia at $-50°$ C. The alkyl iodide is added to this solution and a quantitative yield of the alkylacetylene is obtained. Details of the preparation of allylene and hexine by this method are given.—F. **Bodroux**: Catalytic ester formation in dilute solution; the preparation of ethyl acetate. In presence of a suitable catalyst ethyl acetate is formed from alcohol, and acetic acid in dilute solutions of sulphuric acid.—E. C. **Teodoresco**: The action of high temperatures on dried nucleases of plant origin. The dried nucleases of the three plants studied do not lose all their activity towards sodium nucleate until after thirty minutes' heating to temperatures varying between 141° C. and 162° C.—Maurice **Lenoir**: The commencement of vascular differentiation in the plantule of Veronica.—Marcel **Dubard** and J. A. **Urbain**: The influence of the albumen on the development of the embryo. The albumen is not indispensable to development, but its influence is favourable, especially during the first days of germination.—L. **Armand**: The kinetic phenomena of the heterotypical prophase in *Lobelia erinus*.—M. **Marage**: The inscription of the respiratory movements by means of the hand.—Edgard **Hérouard**: The relations between the depression and formation of the tentacular pseudoplanula in the Scyphistome.—A. **Quidor**: *Lamarckina caligusa* and the evolution of the Lernæidæ.—F. **Picard**: Parthenogenesis in *Phthorimaea operculella*.—Lucien **Cavel**: Sulphur and its variations in the biological treatment of sewage. The determination of combined sulphur in sewage which has passed through various stages of purification throws some light on the proportion of unattacked albumen. The combined sulphur in a sewage effluent should be very small, if the purification has been properly carried out.—M. **Mazé**: The alcoholic fermentation of lactic acid. The organism employed caused the destruction of nearly all the lactic acid present; alcohol and formic acid are the primary products, but the alcohol is acted on and acetic acid formed.—Em. **Bourquelot** and M. **Bridel**: The synthesis of galactosides of alcohols by means of emulsin; β-methylgalactoside and β-allylgalactoside. A description of the preparation and properties of these two galactosides, the latter being new.—Henri **Dominici**, Mme. Simone **Laborde**, and Albert **Laborde**: Study on the injection of radium salts. Radium salts are eliminated from the system with extreme slowness.—Jacques **Deprat**: The succession of the Permian and Carboniferous strata in Indo-China. — Edmond **Bordage**: Researches relating to the extension of the nummulitic sea on the right bank of the Gironde.—A. **Leclère**: The genesis of sedimentary iron minerals.

BOOKS RECEIVED.

Anthropological Report on the Ibo-speaking Peoples of Nigeria. By N. W. Thomas. Part i., Law and Custom of the Ibo of the Awka Neighbourhood, S. Nigeria. Pp. 161+xxx plates. Part ii., English-Ibo and Ibo-English Dictionary. Pp. vii+391. Part iii., Proverbs, Narratives, Vocabularies, and Grammar. Pp. vi+199. (London: Harrison and Sons.)

The Distinction between Mind and its Objects. By Dr. B. Bosanquet. Pp. 73. (Manchester University Press.) 1*s*. net.

Memoirs of the Geological Survey, Scotland. The Geology of Upper Strathspey, Gaick, and the Forest of Atholl (Explanation of Sheet 64). By G. Barrow, L. W. Hinxman, and E. H. C. Craig. With contributions by H. Kynaston. Pp. vi+116+iv plates. (London: H.M.S.O.; E. Stanford, Ltd.) 2*s*.; map, 2*s* 6*d*.

Memoirs of the Geological Survey, England and Wales. (Explanation of Sheet 349.) The Geology of the Country around Ivybridge and Modbury. By W. A. G. Ussher. With a chapter on Altered Rocks by G. Barrow. Pp. vi+137+vi plates. (London: H.M.S.O.; E. Stanford, Ltd.) 3*s*.; map, 1*s*. 6*d*.

Tropical Diseases Research Fund. Report of the Advisory Committee for the Tropical Diseases Research Fund for the Year 1912. Pp. 198. (H.M.S.O.; Wyman and Sons, Ltd.)

Verhandlungen der K.K. Geologischen Reichsanstalt. Jahrgang 1912. No. 1 bis 18. (Vienna: R. Lechner.)

Neue Denkschriften der Schweizerischen Naturforschenden Gesellschaft. Band xlvii. Pp. v+309+ plates. (Zurich: Zürcher and Furrer.)

Forty-fourth Annual Report of the American Museum of Natural History for the Year 1912. Pp. 208+plates. (New York.)

"Red Books" of the British Fire Prevention Committee. No. 173, Fire Tests with Doors. Reinforced-Concrete Doors. Pp. 28. (London: The British Fire Prevention Committee, 8 Waterloo Place.) 3*s*. 6*d*.

Commercial Gardening. Edited by J. Weathers. In 4 vols. Vol. i., pp. xii+239. Vol. ii., pp. xii+235; vol. iii., pp. xii+240; vol. iv., pp. xii+244. (London: The Gresham Publishing Company.) Four vols., 36*s*. net.

Allen's Commercial Organic Analysis. Edited by W. A. Davis and S. S. Sadtler. Vol. iii. Fourth edition. By the Editors, E. F. Armstrong, G. C. Jones, A. E. Taylor, G. Barger, and others. Pp. xi+563. (London: J. and A. Churchill.) 21*s*. net.

Mitteilungen der Naturforschenden Gesellschaft in

Bern aus dem Jahr 1912. Pp. xlvi+349+3 plates. (Bern: K. J. Wyss.)

Ministère de l'Agriculture. Direction Générale des Eaux et Forêts. 2e Partie. Eaux et Améliorations Agricoles. Service des Grandes Forces Hydrauliques dans la Région des Alpes. Tome v. Résultats des Etudes et Travaux à la Fin de 1911. Pp. 530. (Publisher's name not given.)

A Course of Elementary Workshop Drawing. By H. A. Darling. Pp. vi+172. (London: Blackie and Son, Ltd.) 1s. 6d.

The Origin and Antiquity of Man. By Dr. G. F. Wright. Pp. xx+547. (London: J. Murray.) 8s. net.

The Important Timber Trees of the United States. By S. B. Elliott. Pp. xix+382. (London: Constable and Co., Ltd.) 10s. 6d. net.

The Potato. By E. H. Grubb and W. S. Guilford. Pp. 545. (London: Constable and Co., Ltd.) 8s. 6d. net.

Handbuch der Arbeitsmethoden in der anorganischen Chemie. By Dr. A. Stähler. Erster Band. Pp. xii+786. (Leipzig: Veit and Co.) 25 marks.

Annales de l'Observatoire National d'Athènes. By Prof. D. Eginitis. Tome vi. Pp. 333+plates. (Athens: A. Raftanis.)

Abel's Laboratory Handbook of Bacteriology. Second English Edition. By Dr. M. H. Gordon and others. Pp. xi+251. (London: H. Frowde and Hodder and Stoughton.) 5s. net.

Missouri Botanical Garden. Twenty-third Annual Report. Pp. 207+7 plates. (St. Louis, Mo.: The Board of Trustees.)

L'Uomo Attuale una Specie Collettiva. By V. Giuffrida-Ruggeri. Pp. viii+192+xiii plates. (Milan: Albrighi, Segati e. C.) 6 lire.

Mitteilungen aus den deutschen Schutzgebieten. Edited by Dr. H. Marquardsen. Ergänzungsheft, Nr. 6, Ergebnisse einer Reise durch das Zwischenseengebiet Ostafrikas 1911. By H. Meyer. Pp. iii+127+viii plates. (Berlin: E. Siegfried Mittler und Sohn.) 3.60 marks.

Die antike Tierwelt. By O. Keller. Zweiter Band. Pp. xv+618+2 plates. (Leipzig: W. Engelmann.) 17 marks.

The Continents and Their People. Asia: a Supplementary Geography. By J. F. and A. H. Chamberlain. Pp. vi+198. (London: Macmillan and Co., Ltd.) 3s.

DIARY OF SOCIETIES.

THURSDAY, APRIL 17.

ROYAL SOCIETY, at 4.30.—The Luminosity Curves of Persons having Normal and Abnormal Colour Vision: Dr. W. Watson.—The Reflection of X-Rays by Crystals: Prof. W. H. Bragg and W. L. Bragg.—A Fluorescence Spectrum of Iodine Vapour: Prof. J. C. McLennan.—The Relation between the Crystal-symmetry of the Simpler Organic Compounds and their Molecular Constitution. I.: Dr. W. Wahl.

ROYAL INSTITUTION, at 3.—The Progress of Hittite Studies. I. Recent Explorations: Prof. J. Garstang.

INSTITUTION OF MINING AND METALLURGY, at 8.—Notes on Some Bulgarian Mineral Deposits: H. K. Scott.—Notes on the San Francisco Mill, Pachuca, Mexico: J. P. Holcombe.—Errors in Sampling and Assaying Ores due to the Presence of Coarse Gold: F. White.

ROYAL SOCIETY OF ARTS, at 4.30.—The Burma Oil Fields: N. G. Cholmeley.

LINNEAN SOCIETY, at 8.—An Account of the Plants Collected by Mr. M. P. Price on the Carruthers-Miller-Price Expedition through North-west Mongolia and Chinese Dzungaria: M. P. Price and N. D. Simpson.—The Flora of the Island of Shikotan: Hisayoshi Takeda.

FRIDAY, APRIL 18.

ROYAL INSTITUTION, at 9.—Applications of Polarised Light: Dr. T. M. Lowry.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Presidential Address.—*Discussion*: Volute Chambers and Guide-passages for Centrifugal Pumps: Prof. Gibson.

MONDAY, APRIL 21.

ROYAL SOCIETY OF ARTS, at 8.—Antiseptics and Disinfectants. I.: Dr. D. Sommerville.

VICTORIA INSTITUTE, at 4.30.—The Samaritan Pentateuch, and Philological Questions connected therewith: Rev. J. I. Munro.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Production of Steel Sections and their Application in Engineering Structures: A. T. Walmisley.

TUESDAY, APRIL 22.

ROYAL INSTITUTION, at 3.—The Heredity of Sex and Some Cognate Problems. II.: Prof. W. Bateson.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Weeping God: T. A. Joyce.—Prehistoric and Other Antiquities in the Departments of Vienne and Charente, France: A. L. Lewis.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Assuan Dam: Protection of Down-stream Rock Surface, and Thickening and Heightening: M. Macdonald.

ZOOLOGICAL SOCIETY, at 8.30.—The Polyzoa of Waterworks: Dr. S. F. Harmer.—The Marine Fauna of British East Africa and Zanzibar, from Collections made by Cyril Crossland, in the Years 1901–2. Bryozoa—Cheilostomata: A. W. Waters.—Notes on Albinism in the Common Reedbuck (*Cervicapra arundinum*), and on the Habits and Geographical Distribution of Sharpe's Steenbuck (*Raphiceros sharpei*): Major J. Stevenson-Hamilton.

WEDNESDAY, APRIL 23.

ROYAL SOCIETY OF ARTS, at 8.—The Design and Architectural Treatment of Shops: H. V. Lanchester.

GEOLOGICAL SOCIETY, at 8.—The Fossil Flora of the Pembrokeshire Portion of the South Wales Coalfield: H. Goode.—The Halesowen Sandstone Series of the Southern End of the South Staffordshire Coalfield: H. Kay.

AËRONAUTICAL SOCIETY, at 8.30.—Aëroplane Construction: A. R. Low.

THURSDAY, APRIL 24.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: (1) Protostigmata in Ascidians; (2) The Origin of the Ascidian Mouth: A. G. Huntsman.—Experiments on the Kidneys of the Frog: F. A. Bainbridge, S. H. Collins, and J. A. Menzies.—(1) The Probable Value to *B. coli* of "Slime" Formation in Soils; (2) Variation in *B. coli*. The Production of Two Permanent Varieties from One Original Strain by Means of Brilliant Green: Cecil Revis.

ROYAL INSTITUTION, at 3.—The Progress of Hittite Studies. II. Religious Monuments of Asia Minor: Prof. J. Garstang.

SOCIETY OF DYERS AND COLOURISTS (London Section), at 8.—The Chemistry of the Vat Dyes: E. de B. Barnett.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Phase Advancing: Dr. G. Kapp.

CONCRETE INSTITUTE, at 7.30.—Discussion on Reports of the Science Standing Committee on: (1) A Standard Notation for Structural Engineering Calculations; (2) A Standard Specification for Reinforced Concrete Work; (3) Standard Connections and Joints in Reinforced Concrete.

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