THURSDAY, AUGUST 11, 1904.

NATURAL HISTORY OF THE MALDIVES AND LACCADIVES.

The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Edited by J. S. Gardiner. Vol. i., parts ii. to iv.; vol. ii., parts i. to iii. (Cambridge: C. J. Clay and Sons, 1902–4.)

AS the general scope and character of this important work were referred to at some length in a notice of the first part which appeared in NATURE for April 3, 1902 (vol. lxv. p. 514), it will suffice on the present occasion to confine attention to some of the more generally interesting of the numerous memoirs contained in the parts now before us. By generally interesting, we mean reports which deal more especially with questions connected with morphology, development, the limitations of species, reef-formation, &c., rather than those devoted to systematic zoology, and it is on these grounds that we pass over papers like those by Messrs. Borradaile and Lanchester on crustaceans, and the one by Mr. E. Smith on molluscs (important as they are from their special point of view) in favour of some of those of the former type.

Especial interest concentrates, of course, on the chapters (vol. i., parts ii. and iv.) devoted by the editor to the origin and mode of formation of the two archipelagoes under survey. In the chapters included in part ii., Mr. Gardiner, when stating his general views on this part of the subject, definitely and unhesitatingly rejects the theory that the two archipelagoes can have been formed by the subsidence of a large central island, the topography of the central deep plateau being, in his opinion, unfavourable to such a view. On the contrary, he maintains the former existence of continuous land over the area, which was planed down by the action of currents to an almost flat plateau at a depth of about 160 fathoms, and that on this plateau the different banks originated independently by the slow growth of deep-sea corals, assisted in some small degree by nullipores, &c., but completed by the subsequent growth of a superficial reef formed by true corals and nullipores, aided by a general outward extension of the growing reef by current-borne detritus. When the superficial reef approached the surface, it is considered probable that some land was formed by elevation, or by a change in the level of the ocean. Finally, in the individual atolls the lagoon was formed partially by the more rapid growth of the organisms on the edge of the bank, thereby building up an encircling reef, and partially by the subsequent erosion of the central area. The author adduces evidence to show that certain kinds of coral will grow freely at depths of considerably more than 200 fathoms, and he adds that his views with regard to reef and atoll formation hold good for the islands of the Pacific as well as for those of the Laccadive and Maldive Archipelagoes. In the chapter in part iv. details are given of the various atolls, with remarks on apparent recent changes in the archipelagoes and on the death of corals.

Passing on to the purely zoological reports, we may notice that in dealing with the Chætognatha (Sagitta and its allies), Mr. Doncaster comments on the unstable character of the species in this group, several of which seem to graduate into others. Most remarkable is the fact that such species do not appear to be separated either geographically or in habit, closely allied forms living in the same locality under similar conditions. Consequently, it is difficult to believe that they can have been differentiated by natural selection. In his notice of the echinoderms, Prof. F. J. Bell corroborates previous observations as to the loss of the upper surface of the disc in many feather-stars (ophiurids), and further points out that if gonads are set free by the loss of this disc, and a new disc and new gonads are subsequently formed, the question of germ-plasm may be regarded as answered.

Another group which has yielded results of special interest is that of the alcyonarian polyps, the collection made by Mr. Gardiner's expedition serving to show, according to Prof. Hickson, the untrustworthy character of species formed on the evidence of single specimens. The large series of examples now for the first time available demonstrates the variation in form, colour, and other features of what appears to be one and the same specific type when collected over a large area. If, for instance, a specimen of organ-pipe coral (Tubipora) were collected in Celebes and a second in the Maldives, there is little doubt that they would be regarded as representing two distinct species, but a walk at low tide along a Maldive reef would reveal the existence of a number of intermediate types connecting the two supposed species by imperceptible gradations. These organisms, in fact, exhibit a number of "facies," which have not local limitations.

"If each facies," observes Prof. Hickson, "represents a species, then we have the remarkable phenomenon of a number of closely related species distributed over a wide area and competing in the struggle for existence, with approximately equal success, in many localities of this area. If, on the other hand, all the facies represent but one species, then we have a species capable of extraordinary variation in circumstances apparently identical."

Without recourse to cross-breeding, it is impossible to demonstrate which of the two propositions is true, and the only practical course is therefore to regard as species all the unconnected types.

The species question is resumed in the chapters on madreporiform corals (vol. ii. part iii.), where Mr. Gardiner remarks that he has found much less difficulty in finding the limitations of species among the Astreidæ than was experienced by Mr. Bernard in the case of the perforate group. The puzzle will, he thinks, in both cases be solved by definitely ascertaining which variations are discontinuous and which continuous. Here occasion is taken to notice the favourable conditions presented by corals for the study of variation, owing to the fact that the larvæ have no choice in their environment. Unless there be real action on the part of the local environment in producing discontinuous variation in the gametes of new immigrants, it will be obvious that the species must remain approximately constant.

Another report demanding special notice is the one by Mr. R. C. Punnett on the Enteropneusta, the collection brought together by Mr. Gardiner being the most extensive hitherto made in any one locality. This richness has enabled Mr. Punnett to attempt the study of the variation (that is to say, the development of local forms) displayed by certain members of the group, this having never been previously practicable. In addition to the description of new species of Ptychodera and Balanoglossus, the author takes the opportunity of describing a new generic type from Zanzibar, for which the name *Willeyia bisulcata* is proposed, characterised by its large size and the great length of the proboscis and collar. After discussing many debatable structural features connected with these curious organisms, Mr. Punnett takes occasion to express his opinion of the importance of Willey's theory as to the origin of gill-clefts, which he believes to obtain further support from the evidence of this group. To recapitulate the author's views in detail would occupy too much space, and it can only be mentioned that the gonads are suggested as being the prime factors in the segmentation of the Chordata, each gonad having ultimately acquired an independent aperture of escape from the body, which became subsequently used for respiration, and thus a gill-cleft.

If we pass over the accounts of the Chordata by Messrs. Cooper and Punnett, it is only from lack of that space necessary to do anything like justice to one of the most important biological and physiographical works of our time. To conclude without expressing our opinion as to the business-like manner and thoroughness with which both the expedition itself and the examination and description of the specimens and the codifying of the general results have been carried out (so far as they are yet published) would, however, be alike ungracious and unappreciative. R. L.

JOHN PARKINSON'S "PARADISUS."

Paradisi in Sole Paradisus terrestris. By John Parkinson. Faithfully reprinted from the edition of 1629. Pp. 1+612. (London: Methuen and Co., 1904.) Price 2*l.* 2*s.* net.

THIS is a handsome reprint of a notable book, which, even in its original form, never made so brave a show as does this facsimile, with its fine type, excellent paper, rough edges, and grey paper boards. The page illustrations suffer somewhat in sharpness, owing to the process by which they have been reproduced, in comparison with the cuts in the older editions, which were worked from the blocks themselves. It is a genuine reprint; with the exception of a half-title and the title-page set out above, the old herbalist's book is left to tell its own tale. We are glad to be spared the modern editor's introduction, which in this instance would have been an infliction.

John Parkinson, King's Herbalist, was born in 1567, and with John Gerard occupies a special position in our literature as one of our herbalists. Gerard's "Herball" was based upon Continental work, and very few cuts were due to him; Parkinson's books were his own, woodcuts and text alike. Gerard's "Herball" was edited and much improved by Thomas Johnson in 1633, and was reprinted in 1636; Parkinson's "Paradisus," which came out in 1629, when the author had passed his sixtieth birthday, was reprinted in 1656, six years after his death, practically unaltered. He regarded the "Paradisus" as constituting three parts of a comprehensive treatise on plants—the garden of pleasant flowers, the kitchen garden, and the orchard. Eleven years later, the fourth part, his "Theatrum," appeared, devoted chiefly to medical plants, but in bulk much exceeding his previous publication.

We have before us copies of all the issues; the original issue of 1629, with its thin, foxed paper and striking woodcuts, and its reprints. Parenthetically it may be remarked that these blocks, measuring ten inches by six, do not appear to be built up, as boxwood blocks, but were cut along the grain, and consisted of pear-wood. The actual blocks are not extant, but judging from woodcuts of the same century we are justified in assuming that Parkinson's illustrations were produced as we have said. The old authors were economical of their blocks; Dodoens, Clusius, and their contemporaries were apt to square off their plants to fit the block, or to twist the plant to come within the limits available. Here we find many specimens displayed on the same block, sometimes ingeniously arranged in a give-and-take manner. No book gives a better idea of the gardens of the time, with their plans and plants, than the volume before us; the author starts with general principles of laying out or "ordering" his garden, and then goes on to describe what should grow in it—hardy flowers nearly all, but the variety of tulips, iris, narcissus, and similar plants strikes a modern reader. Many little touches of human personality shine through the accounts given; old colleagues and benefactors by whom certain bulbs or seeds were introduced are mentioned; some of those named may be found in the works of other authors, and we greet them as old friends; some of them appear in connection with their favourite flowers, as "John Tradescant his great Rose Daffodill," or "Mr. Wilmer's great double Daffodill." It is largely due to the revived love for hardy garden flowers, especially the narcissus, that Parkinson's book has of recent years become almost impossible to get, the price having risen from shillings to nearly as many pounds within one generation.

The second issue varied from the first by having a printed title-page in front of the engraved one, and although it boasted of being "much Corrected and Enlarged," many of the printer's errors noted in the first were not corrected in the second edition; the pages are not precisely the same, nor are the tables at the end, and the only noticeable enlargement is the letterpress title-page just mentioned.

The third issue is that now under review, but the publishers seem to have failed to notice the pun in the title, which at length runs thus:—

"Paradisi in Sole Paradisus Terrestris. Or a Garden of all sorts of pleasant flowers which our English ayre will permitt to be noursed upp: with A

Kitchen garden of all manner of herbes, rootes, and fruites, for meate or sause used with us, and An Orchard of all sorte of fruit-bearing Trees and shrubbes fit for our Land together With the right orderinge, planting and preserving of them and their uses and virtues. Collected by John Parkinson, Apothecary of London, 1629." It will be observed that the first five words mean "of Park-in-Sun the Earthly Paradise," and this play upon his own name is missed in the special title of the reprint.

It is impossible even to indicate the charm of this old book; a long notice would still be inadequate, while to those who love old garden flowers and these quaint notices of them, this reprint will afford a new delight. B. D. J.

MODERN ELECTRIC PRACTICE.

Modern Electric Practice. Edited by Magnus Maclean. In six volumes. Vol. i., pp. viii+270. Vol. ii., pp. vi+297. Vol. iii., pp. vi+285. (London: The Gresham Publishing Co., 1904.) Price 9s. net per volume.

THESE volumes have been published with the intention of providing a comprehensive treatise on the subject of modern electrical engineering, a subject now so large and so diversified that it is beyond the power of one man, however expert, to deal with it in all its aspects. The plan has therefore been adopted of inviting the collaboration of a number of authors, each writing of that section with which he is particularly conversant, and thus producing a sort of encyclopædia of electrical engineering which might be compared with such books as Watts's "Dictionary of Chemistry." It is difficult to form an estimate of the value of a book of this kind, which depends as much upon the skill and discretion which are shown in the selection and arrangement of the material as upon the merits possessed by the individual contributions.

Regarded as a whole we consider this compilation disappointing in the extreme. A really standard work of reference on electrical engineering would be a very welcome addition to electrical literature, a book to which a man could turn for information about any matter which happened to crop up in the course of his work, certain of finding a thorough *résumé* of the subject sufficient to give him the outlines of existing knowledge and to put him on the track of more detailed information if he required it. The volumes before us unfortunately cannot claim any such position; indeed, as a work of general reference they are almost useless. A series of text-books by different writers on different subjects does not make a comprehensive treatise because these text-books are bound between the same covers and "not sold separately." No serious effort seems to have been made to coordinate the material properly, and, in fact, almost the only attempt at uniformity which can be discovered is in the direction of print and paper. A single quotation from the preface is enough in itself to support this contention; the editor there says, "rises of temperature are given sometimes in degrees Fahrenheit and sometimes in degrees Centigrade; dimensions of machines occasionally in feet and inches but more often in centimetres; magnetic flux density in lines per square inch in one article, and in lines per square centimetre in another." We can see no way in which to regard this paragraph other than as a confession of careless editing, as we should have thought the very first thing the editor would do would be to adopt a uniform system of units and notation throughout. Other instances of more serious carelessness might be quoted, but we will content ourselves by giving one example. In the three volumes already published we have come across two tables giving the relative conductivities and temperature coefficients of various substances; in one the values of the resistivities are given, in the other the relative conductivities. A very cursory examination shows that the two tables do not agree, and if they are compared more carefully we get results of which the following are specimens (the conductivity of iron being taken as the standard for comparing the two tables):—

Relative conductivity of iron			Table I. 16·2	Table II. 16·2	
,,	,,	copper	,, 97·5	,,	90 & 92
,,	,,	mercury	,, 1·65	,,	1·56
,,	,,	platinum	,, 19·0	,,	13·4
,,	,,	aluminium	,, 52	,,	55

The agreement between the temperature coefficients is equally bad. We have purposely only compared above the figures for elementary substances, as those for alloys such as German silver, manganin, &c., which are in even worse disagreement, are valueless in one table as the percentage composition is not given. Comment on figures of this sort is needless.

Enough has probably been said to show that as a standard treatise on electrical engineering the value of these volumes is little or nothing. This is the more to be regretted as they have been produced in a style which may be described as lavish, and several of the contributors are in the front ranks of the profession, able to write with an authority on their particular subjects which cannot be called in question. It would not have required very much more trouble and care to have converted the publication into a first-class addition to the electrical engineer's library instead of leaving it as a book only to be valued on account of the occasional articles of exceptional merit which it contains. Space would not permit us to review these in detail here even were it profitable to do so. Suffice it to say that there are several contributions which thoroughly deserve to be read, some because of the admirable way in which they treat their subject-matter, and others because, in addition, they are practically the only existing English text-books on the subject. On the whole, however, we think the level is not very high, especially if scientific treatment be looked for; there is a general tendency for too much description, too much of an account of what the practical engineer has made, and too little of the theoretical principles on which his practice is based. It is evident, of course, that the book does not aim at discussing the theoretical side of electricity and magnetism, but even "modern practice" must be studied, if it is to be properly studied, with a certain

amount of theory as a basis, and a book which does not supply, in each branch, the necessary minimum hardly deserves to claim the title of a "comprehensive treatise." MAURICE SOLOMON.

PIONEER IRRIGATION.

Pioneer Irrigation for Farmers in the Colonies. By E. O. Mawson, M.Inst.C.E. With Chapters on Light Railways, by E. R. Calthrop, M.Inst.C.E. Pp. xvi+260. (London: Crosby Lockwood and Son, 1904.)

THE preface states that "this book has been written with the object of supplying pioneer farmers, in arid countries, with information which may assist them in conserving the precarious rainfall, and utilising it for the irrigation of crops"; also that "only the most homely contrivances, such as can be constructed and worked without professional advice or skilled labour are suggested"; and that the object "throughout the volume has been to demonstrate, in the simplest possible manner, how the available water-supply—whether surface-flow or underground—can be used for irrigating crops by means of works easily constructed at a small expenditure, without fear of danger in case of failure." The book, however, is not in reality confined within these prescribed limits; for it refers to earthen dams, with puddle trench, waste weir, and outlet valve tower, masonry dams of moderate height for forming reservoirs in gorges, a masonry aqueduct of several spans, and a barrage or weir across an apparently wide river, closed along the upper portion by a series of automatic sluice-gates. The works, indeed, shown in some of the woodcuts, and especially on plates 3 to 8, 10, and 19, could not possibly be regarded as homely contrivances, capable of being easily carried out by pioneer farmers, without skilled labour, at a small cost, and without danger to the neighbourhood in the event of failure.

The chapters on the value of irrigation and sources of water-supply, underground waters, methods of irrigation, and the cultivation of irrigated crops, vegetables, and fruit trees, contain much information which would be very useful to persons engaged in the cultivation of arid districts; but most of the works described in the chapters on dams and weirs, canals, sewage irrigation, and automatic sluice-gates, would be wholly beyond the resources of pioneer farmers. The storage of rainfall, the collection of the run-off of water in the rainy season by open tanks formed in depressions enclosed by low banks, and the drawing of underground waters from wells, are works which can be readily undertaken with great benefit by cultivators of arid lands; but the formation of large reservoirs by damming up valleys, and the raising of the water level of rivers and the conveyance of the water considerable distances in irrigation canals, constitute works which have to be carried out by a company, the local authorities, or the Government, for the irrigation of large tracts of land. Sewage irrigation, moreover, can only be made use of in the neighbourhood of large communities, and is not available amongst the sparse population of a newly-settled agricultural district.

In a chapter on automatic sluice-gates, a system of hinged gates or shutters is advocated for raising the water level of reservoirs and rivers, which has apparently been patented by one of the authors; but it is not stated that the design has been put into operation; and such automatic contrivances, as in the case of the movable shutter weirs employed long ago for the canalisation of some rivers in France, are liable to be very irregular in their action. The two concluding chapters furnish some interesting particulars about light railways, which are introduced with the view that the conveyance of the produce of irrigated lands to a market is second only in importance to the supply of water. Such works, however, with the great advantages that they afford, have to be carried out in the midst of a thriving community, where both capital and revenue are available; and they are beyond the scope of pioneer farmers who are extending cultivation into new, unoccupied districts. A long appendix is given at the end of the volume, containing various memoranda, tables, and particulars about materials and tools, which may be of service in irrigation works and farming. The book is, in fact, a short manual on irrigation works in general, with some account of the construction, suitable gauges, and rolling-stock of light railways.

OUR BOOK SHELF.

Lehrbuch der Stereochemie. By A. Werner. Pp. xvi+474. (Jena: Gustav Fischer, 1904.) Price 10 marks.

THIS book had its origin in the courses of lectures on stereochemistry delivered during recent years by Prof. Werner in the University of Zurich. The systematic form of the lectures has been adhered to, but by the addition of numerous tables and many hundreds of references to original sources, the author has produced a comprehensive handbook which must prove of great utility, not only to the general chemist who wishes to know something of the advances made in stereochemistry since the conception was first put forward, but also to the specialist whose work is directly concerned with the subject. Notwithstanding the wealth of detail, the book is of moderate compass, and whilst compression in the theoretical portions is occasionally carried to such an extent as to interfere somewhat with intelligibility, yet the book is on the whole both readable and easily comprehensible. The eminence of the author as an investigator in some of the most obscure fields of stereochemical research is sufficient guarantee of his mastery of both theory and material.

The work is composed of two chief parts, of which the first deals with stereoisomerism, divided into subsections according to the elements involved. The first subsection is naturally devoted to the stereoisomeric carbon compounds, and occupies about half of the whole book. In it are treated, amongst other matters, the theory of the asymmetric carbon atom, mirror-image isomerism, racemism and the resolution of racemic compounds, determination of configuration in open chains (more particularly in the sugars and related substances) and in closed chains, the quantitative relations between rotation and the nature of the asymmetric carbon atom, *cis-trans* isomerism in cyclic compounds, and the geometric isomerism of ethylenic compounds. The

succeeding subsection deals with the stereoisomeric carbon-nitrogen compounds, such as the oximes, and is followed by a subsection on the substances that owe their stereoisomerism to the configuration of nitrogen atoms. The first part closes with an account of the optically active sulphur, selenium, and tin compounds, and of the geometric isomerism exhibited by the cobalt and platinum compounds with ammonia and the organic bases.

The second part of the work is concerned with stereochemistry unaccompanied by stereoisomerism, under which head are treated such matters as the stability of carbocyclic and heterocyclic chains, the stereochemical formulæ of benzene, and the influence of space-arrangement on the speed or possibility of chemical reactions, *e.g.* esterisation, formation of amides from esters, formation of triphenylmethane dyes, reduction of nitro-groups. Perhaps this part of the book will be found as useful as any, for it marshals under one point of view a great array of facts otherwise scattered and difficult of access.

Prof. Werner's book should be in the possession of every organic chemist.

The Fauna of British India, including Ceylon and Burma. Published under the authority of the Secretary of State for India in Council. Edited by W. T. Blanford. Rhynchota, vol. ii., part ii. Heteroptera. By W. L. Distant. Pp. i–iv, xi–xvii, 343–503; figs. 168–319. (London: Taylor and Francis, 1904.) Price 10*s.*

THE first part of vol. ii. of this work was published in December, 1903, and was noticed in NATURE for February 25, 1904, and we have not had long to wait for the second part, completing the volume, the preface of which bears date April, 1904. The total number of species described in the second part is 511, bringing up the total number of species described in the first two volumes of the work to 1471. The second part of vol. ii. completes the great family Reduviidæ (subfamilies Acanthaspidinæ to Nabidinæ), which is fam. 12 of Mr. Distant's arrangement. The volume also includes the families Saldidæ, Ceratocombidæ, Cimicidæ, and Capsidæ. This completes the land bugs, with the exception of the Anthocoridæ. These, with the two last families of the Gymnocerata (Hebridæ and Hydrometridæ), which are aquatic or subaquatic, are left over to be included with the Cryptocerata, all of which are aquatic, in the third volume, which will complete the work so far as the Heteroptera are concerned. The Homoptera will also be commenced in vol. iii.

Other volumes of this series in preparation are to include certain families of Coleoptera (especially those of economic importance), the butterflies, and the land mollusca.

Analytical Chemistry. Vol. ii., *Quantitative Analysis.* By F. P. Treadwell, Ph.D. Translated from the second German edition by William T. Hall, S.B. (New York: Wiley and Sons; London: Chapman and Hall, Ltd., 1904.) Price 17*s.* net.

IT is a little curious that this volume, which appeared in German in 1901, should have reached a second edition before finding an American translator, as one might suppose that its many excellences would have hastened the fate which has overtaken a number of less valuable German treatises.

The author states in the preface that the majority of the methods which he describes have been submitted to careful examination in his own laboratory, a fact clearly evident from the minutiæ which are introduced at every step. This is precisely what gives a work on analytical chemistry a real value. There is an introductory chapter on general manipulation, details, and apparatus, including the use of the Gooch crucible, that ingenious and time-saving combination of filter and crucible which is much too little known and used.

The subsequent chapters deal with gravimetric and volumetric estimations of inorganic materials, including such methods as are specially applicable to certain minerals, ores, and metals, and there is a final chapter on gas analysis.

It should be added that the book is one for reference and is not a graduated course of instruction for students. It is, in fact, an abbreviated Fresenius without the undesirable quality of superficial comprehensiveness which characterises that exasperating classic. J. B. C.

Arnold's Home and Abroad Readers. Book i. Glimpses of the Homeland. Pp. 135. Book ii. Glimpses of the Globe. Pp. 152. Book iii. England and Wales. Pp. 200. Book iv. The British Dominions. Pp. 232. Book v. The World's Great Powers—Present and Past. Pp. 228. Book vi. The World's Trade and Traders. Pp. 228. (London: Edward Arnold, n.d.) Prices from 10*d.* to 1*s.* 6*d.*

THE aim of the anonymous author of these volumes appears to have been first of all to secure the interested attention of his young readers, and then incidentally to teach them a great deal about the physical features of the countries of the world and of the manners and customs of the peoples of the globe. The readers are skilfully graded, well illustrated with maps and pictures, and excellently printed. The books are likely to be popular in elementary schools.

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.]*

Chemical Action Produced by Radium.

VARIOUS chemical investigations relating to the chemical action of radium bromide have been in progress in this laboratory during the past session, an account of which will shortly be published.

But one of these investigations has yielded results so extraordinary that we think it well to direct attention to the results. On the Rutherford-Soddy hypothesis of the disintegration of the radium atom, an enormous amount of energy is evolved, and at least one simpler product is formed, namely, helium, which is slowly produced during the disintegration of the emanation, which Mr. Soddy and one of the authors have shown to be a gas, following Boyle's law; and with Dr. Collie the spectrum has been investigated.

It has, of course, often suggested itself that such a change should be reversible; that is, that by imparting a sufficient charge of energy to any atom, it should be transformed into different matter, probably by the building up of a more complex structure. Now the only known source of energy in such a concentrated form is that which is given off by radium and its products during their disintegration. The facts which we have to chronicle appear to point towards such a synthesis.

During experiments on the emanation, about 105 milligrams of radium bromide, dissolved in water, were kept in small glass bulbs, connected to a pump. To protect the bulbs against accident, each was surrounded with a small beaker, one of potash-glass and two of soda-glass. The former was coloured brown in the course of some six months, the latter violet. On altering the apparatus these beakers were discarded.

They were all found to be radio-active on both surfaces,

and, what is most remarkable, *the radio-activity was removed by washing with water*. The solution contains an emanation, for on bubbling air through it, and cooling the gas with liquid air, the issuing gaseous air is only feebly active; the main part of the activity was retained in the cooled bulb. This substance can be carried into an electroscope by a current of air, and when the current passes, the electroscope is discharged; but the period of decay of the emanation is very short, and in that respect resembles the emanation from actinium.

The research is not sufficiently advanced to permit of a complete account of the other products, but it may be mentioned that from the solution which has lost all emanating power further active products are obtainable, some of which are precipitable along with mercurous chloride, some along with mercuric sulphide, some with ferric oxide, and some with barium sulphate. The behaviour is different, according as potash- or soda-glass is used. That this is not a case of a body being thrown down by *any* precipitant has been abundantly proved; for example, precipitation along with mercurous chloride or sulphide failed to remove the activity from one sample, while the precipitation of ferric hydroxide in the solution completely threw down the radio-active material. There appear to be several radio-active bodies present which can be separated by the ordinary processes of qualitative analysis.

These substances, it must be remembered, are the products of β and γ rays in conjunction with the material on which they impinge. A silver crucible, too, becomes radio-active on the exposed surface only when placed in the path of β rays. It is important to note that these changes are not due to the material having been in contact with radium or any of its products; they are solely due to the β and possibly to the γ rays. The order of the activity is the same as that of 1 milligram of old uranium oxide, U_3O_8.

WILLIAM RAMSAY.
W. TERNENT COOKE.

University College, London, July 30.

Atomic Structure in the Light of Secondary Spectra.

IN making some determinations of the capacity necessary just to produce secondary spectra, I have found that this critical capacity increases very rapidly with decreasing wave-length. The primary spectrum does not go over suddenly as the critical capacity is reached, but the red and yellow portions go over first, then finally, at a much greater capacity, the violet. Critical capacity as a function of wave-length is well represented by the exponential $e^{\frac{6}{\lambda-\lambda}}$, approaching a constant value in the infra-red and the value infinity in the ultra-violet, perhaps not farther out than $250\mu\mu$.

Consider the radiation from a nitrogen atom. When subjected to feeble electrical excitation its (primary) spectrum is banded, each band being composed of numerous lines not showing the Zeeman effect. But when subjected to excessive excitation, as it is when a large condenser is connected in shunt with the conducting gas, its (secondary) spectrum consists of numerous heavy lines, showing the Zeeman effect, and expressible in Kayser-Runge series.

Runge, having in mind the Zeeman effect, supposes that primary spectra are due to positive ions while negative electrons give secondary spectra, but it is hardly conceivable that feeble excitation should all go to the positive ions while more intense excitation all goes to the negative.

I would suggest that an atom composed of rotating rings of electrons according to recent theories might easily exhibit just such radiating properties as would give primary and secondary spectra, together with the variation of critical capacity with wave-length. Suppose that there are as many rings as there are bands in the primary spectrum. With moderate excitation these rings would vibrate radially and tangentially as well as perpendicularly to their planes, and these vibrations would give rise to the lines comprising each band. Such lines would not show the Zeeman effect. Excessive excitation would break up the rings and allow the electrons to move independently. Radiation from such free electrons would constitute the secondary spectrum, and would show the full Zeeman effect. The larger rings would be the first to break up; the smallest rings, perhaps, could not be broken up at all, hence critical capacity would vary with the wave-length and become infinite for moderately short waves. Metallic atoms have ring systems that are so easily broken up that it is impossible to obtain any primary spectrum from them at all.

Washington, D.C. P. G. NUTTING.

The Flowering of the Bamboo.

CAN your botanical readers give me any information about the flowering of the bamboo? Until recently I was not aware that it presented any extraordinary features, but about the middle of April the bamboo in this locality produced flowers, to the great astonishment of everyone long resident here. The peasants, and many of the more ignorant townspeople, regarded the event with much superstitious terror. It is supposed by them to portend a failure of the crops, and possibly even more serious disasters. A small anti-tax rising, some distance away, appeared for a few days to be a serious matter, and as it was in progress during the time at which the bamboo flowers appeared, many were inclined to exaggerate enormously the danger of the situation. These superstitious terrors (closely resembling the fears formerly aroused in Europe on the appearance of a large comet) sufficiently show the rarity of the phenomenon.

On making inquiry, I could only hear of one man (I did not myself meet him) who had ever seen the bamboo in flower before.

I am told that a species of bamboo in southern California flowers annually, the flower being at the top of the plant only. In the species growing here the flowers were at all heights, arranged at frequent intervals along almost every branch of the plants. I obtained a photograph of a spray in flower, but unfortunately it is so small that the distinction between leaves and inflorescences is very imperfect.

A. TINGLE.

Imperial Provincial College, Chinanfu, Shantung, China, May.

As regards the point raised by your correspondent, I may say that the feeling of alarm aroused in the natives by the flowering of the bamboo seems to be widely spread in the East. I have myself heard of it when in India.

The fact is that the bamboo only flowers once and then dies, and as a rule the whole lot of plants, often covering large areas, bloom together.

The reason of this is that the individuals of a species are commonly gregarious, and are all of the same age, having taken simultaneous possession of ground rendered vacant, perhaps, by a previous and similar depopulation.

A somewhat analogous case is presented by some of the Strobilanths of tropical Asia. These plants live for about seven years, then all burst out into a glorious mass of blue flower, and then die away, leaving, it may be, hundreds of acres of ground destitute of the luxuriant vegetation it previously supported.

Dr. O. Stapf, in a most interesting article that appeared in the *Gardener's Chronicle* this year (Nos. 907–910), gives an account of the introduction into Europe of two bamboos that have suffered a similar fate.

In 1847 seeds of *Arundinaria Falconeri* (and another species) were received at Kew, and were thence distributed to various gardens, some finding their way to the Continent. The plants flowered (and then died) in France in 1875, and in the following year all the English plants, growing in different localities, shared the same fate.

J. B. FARMER.

Claremont House, Wimbledon Common, August 2.

The Organisation of Zoologists.

MAY I be allowed to direct the attention of the readers of NATURE to the fact that a meeting of zoologists will be held in the comparative anatomy lecture room at Cambridge on Wednesday, August 17, at 4 p.m., to consider a scheme for organisation suggested by the committee that was appointed in London on January 4. The suggested scheme has been printed and widely circulated, but as it may have failed to reach some of the zoologists of the country, I have been requested to state that all who are interested in zoology and anxious to promote its progress will be welcome.

SYDNEY J. HICKSON.

The Victoria University, Manchester, August 3.

THE BRITISH SCIENCE GUILD.

AN organisation is being formed, under the name of the British Science Guild, with the object of insisting upon the importance of applying scientific methods to every branch of the affairs of the nation. A memorandum which describes briefly the objects, methods, and proposed organisation of the Guild is now being circulated, and is as follows :—

It has been a frequent subject of comment that, although the contribution of this country to the progress of science has been second to that of no other nation, the English people do not manifest that interest in, and belief in the powers of science which is noticeable among the peoples of the Continent, or of America. In spite of the efforts of many years, the scientific spirit, essential to all true progress, is still too rare, and, indeed, is often sadly lacking in some of those who are responsible for the proper conduct of many of the nation's activities. It is with the view of attempting to remedy this evil, and to bring home to all classes the necessity of applying scientific treatment to affairs of all kinds, that the proposal is made to bring together those convinced of this necessity by founding "The British Science Guild."

The objects and organisation of the Guild, which will be entirely disconnected from party politics, are as follows :—

OBJECTS.

(1) To bring together as members of the Guild all those throughout the Empire interested in science and scientific method, in order, by joint action, to convince the people, by means of publications and meetings, of the necessity of applying the methods of science to all branches of human endeavour, and thus to further the progress and increase the welfare of the Empire.

(2) To bring before the Government the scientific aspects of all matters affecting the national welfare.

(3) To promote and extend the application of scientific principles to industrial and general purposes.

(4) To promote scientific education by encouraging the support of universities and other institutions where the bounds of science are extended, or where new applications of science are devised.

Methods of Attaining these Objects.

(*a*) By publications.
(*b*) By meetings.
(*c*) By conferences and lectures.
(*d*) By deputations.

ORGANISATION.

Admission of Members.

All British subjects, both men and women, are eligible for membership of the Guild; it is expected, however, that its members will be recruited principally from the following :—

The House of Lords.
The House of Commons.
Colonial Legislatures.
County, District, Borough, and Parish Councils; Municipalities; Educational Committees.
Scientific and Literary Societies and Organisations.
Commercial and Industrial Chambers and Organisations.
The Learned Professions.
Universities, Colleges, Educational Bodies and Graduates of all British Universities.
Representatives of Labour.

At a meeting of the promoters of the Guild, held, by permission of the officers, at the rooms of the Royal Society on April 20, it was decided that the steps preliminary to the formation of the Guild should be taken by an organising committee, of which the following were appointed members, with power to add to their number :—

LORD AVEBURY, F.R.S.
PROF. W. E. AYRTON, F.R.S.
SIR GEORGE SYDENHAM CLARKE, K.C.M.G., F.R.S.
CAPTAIN E. W. CREAK, R.N., C.B., F.R.S.
MR. CLIVE CUTHBERTSON.
DR. WILLIAM GARNETT.
MR. SIDNEY LEE.
SIR NORMAN LOCKYER, K.C.B., F.R.S.
LADY LOCKYER.
MR. N. MACCOLL.
PROF. RAPHAEL MELDOLA, F.R.S.
SIR GILBERT PARKER, M.P.
PROF. J. PERRY, F.R.S.
SIR WILLIAM RAMSAY, K.C.B., F.R.S.
DR. W. N. SHAW, F.R.S.
PROF. S. P. THOMPSON, F.R.S.
DR. AUGUSTUS WALLER, F.R.S.
SIR HENRY TRUEMAN WOOD.

The organising committee has elected Sir Norman Lockyer president, Lord Avebury honorary treasurer, Lady Lockyer honorary assistant treasurer, and Mr. C. Cuthbertson honorary secretary.

It was resolved that life members of the Guild shall pay, on admission, two guineas, which includes a registration fee of 2*s*. 6*d*., and that annual subscribers shall pay, on admission, 5*s*., and in each subsequent year 2*s*. 6*d*. It was also resolved that donations may be accepted.

The committee is now engaged in communicating with those corporate bodies and individuals whose support and sympathy are desired.

A general committee will be appointed, which will subsequently select from among its members an executive committee for the management of the affairs of the Guild. The executive committee will meet from time to time as their chairman may direct, and will formulate such rules as experience may suggest for the approval of the general committee.

The general committee will probably take power to appoint or approve local and special committees, which will act as branches of the Guild.

The following have already signified their general approval of the objects and proposed organisation of the Guild :—

THE RIGHT HON. LORD ALVERSTONE, G.C.M.G.
THE RIGHT HON. LORD AVEBURY, F.R.S.
PROF. AYRTON, F.R.S.
SIR JOHN WOLFE-BARRY, K.C.B., F.R.S.
DR. W. T. BLANFORD, F.R.S.
SIR JAMES BLYTH, BART.
MR. BRABROOK, C.B.
SIR GEORGE BIRDWOOD, K.C.I.E.
SIR JOHN BRUNNER, BART.
SIR LAUDER BRUNTON, F.R.S.
MAJOR-GENERAL SIR OWEN TUDOR BURNE, G.C.I.E.
SIR EDWARD BUSK.
MR. R. H. CAIRD.
SIR WILLIAM CHURCH, BART., K.C.B.
SIR GEORGE SYDENHAM CLARKE, K.C.M.G., F.R.S.
THE HON. SIR JOHN COCKBURN, K.C.M.G.
CAPTAIN CREAK, R.N., C.B., F.R.S.
MR. CLIVE CUTHBERTSON.
PROF. W. E. DALBY.
DR. FERRIER, F.R.S.
SIR MICHAEL FOSTER, M.P., F.R.S.
DR. WILLIAM GARNETT.
SIR ARCHIBALD GEIKIE, F.R.S.
SIR ROBERT GIFFEN, K.C.B., F.R.S.
MR. HAMMOND-CHAMBERS, K.C.
PROF. HERDMAN, F.R.S.
PROF. J. LARMOR, F.R.S.
DR. SIDNEY LEE.

SIR NORMAN LOCKYER, K.C.B., F.R.S.
LADY LOCKYER.
DR. LOCKYER.
MR. MACCOLL.
PROF. R. MELDOLA, F.R.S.
SIR A. NOBLE, BART., K.C.B., F.R.S.
SIR GILBERT PARKER, M.P.
PROF. PERRY, F.R.S.
SIR WILLIAM RAMSAY, K.C.B., F.R.S.
THE LORD REAY, G.C.S.I.
SIR WEMYSS REID.
SIR WILLIAM RICHMOND, K.C.B., R.A.
MR. E. ROBERTSON, M.P.
SIR HENRY ROSCOE, F.R.S.
SIR A. RÜCKER, F.R.S.
DR. W. N. SHAW, F.R.S.
MR. ALEX SIEMENS.
THE LORD STRATHCONA AND MOUNT ROYAL.
SIR L. ALMA TADEMA, R.A.
PROF. SILVANUS P. THOMPSON, F.R.S
DR. A. D. WALLER, F.R.S.
FIELD MARSHAL VISCOUNT WOLSELEY, G.C.B.
SIR HENRY TRUEMAN WOOD.

NEW REGULATIONS OF THE BOARD OF EDUCATION.

NO system of national education is complete which fails to recognise the essential importance of the work of the satisfactory secondary school. Its importance, that is, both as providing a means by which the exceptionally well endowed boys and girls of the elementary schools may continue their education under better conditions, and also as affording an adequate preparation for those pupils who later will become technical students and university undergraduates, or who will without further instruction enter upon the active duties of life. The recent Education Act gave an official recognition to what has long been urged by those who understand our educational needs, that true education from beginning to end is an organic whole. The duty has, in fact, been laid upon the Board of Education of superintending and promoting the supply by local education authorities of education other than elementary. The Board is now the final court of appeal in all matters pertaining to the administration of secondary education.

It is considerations such as these which lead us to regard the regulations [1] recently issued by the Board of Education for the government and administration of English secondary education as one of the most important of the educational documents of recent years. For, since the Board is in a position to reward by substantial grants a due adherence to the regulations here formulated, it is clear that the principles advocated officially will, whether they are right or wrong, exercise a profound influence upon the curriculum and ideals of the schools.

Such being the case, it is gratifying to find that on the whole the regulations are framed on broad and liberal lines, though, as we shall have occasion to indicate, there are dangers which it is imperative those in authority should avoid, and indications that the claim of instruction in scientific method to a place in every stage of education may be disregarded if certain phrases in the regulations are followed too literally.

It will serve to give a clearer idea of the influence the regulations are likely to exert if an attempt is made first to review some of the definitions put forward in the official publication. A secondary school is described as

"any Day or Boarding School which offers to each of its scholars, up to and beyond the age of sixteen, a general education, physical, mental and moral, given through a complete graded course of instruction of wider scope and more advanced degree than that given in Elementary Schools."

Explaining what should be the characteristics of a secondary school course of instruction, the prefatory memorandum to the regulations states that it should be general, complete, and graded in its various branches. The explanation as to the precise meaning to be attached to the description "general" deserves —both because of its fairness and catholicity—to be quoted in full :—

"The instruction must be general; *i.e.* must be such as gives a reasonable degree of exercise and development to the whole of the faculties, and does not confine this development to a particular channel, whether that of pure and applied Science, or literary and linguistic study, or of that kind of acquirement which is directed simply at fitting a boy or girl to enter business in a subordinate capacity with some previous knowledge of what he or she will be set to do. A Secondary School should keep in view the development and exercise of all the faculties involved in all these different kinds of training, and will fail to give a sound general education to its scholars in so far as it sends them out, whether to further study or to the business of life, with one or other of these faculties neglected, or with one developed at the expense of the rest. Specialisation in any of these directions should only begin after the general education has been carried to a point at which the habit of exercising all these faculties has been formed and a certain solid basis for life has been laid in acquaintance with the structure and laws of the physical world, in the accurate use of thought and language, and in practical ability to begin dealing with affairs."

Secondary education such as is outlined in this paragraph will meet with the approval of every man of science. Education conducted on scientific lines is that which gives a "reasonable degree of exercise and development to the whole of the faculties." If the Board takes care that in interpreting its regulations in the schools the inspectors strive to secure this all-round, healthy mental development of English boys and girls, the hearty cooperation and sympathy of men of science may be depended upon. For to ensure the exercise and development of all the faculties, a training in experimental science is necessary, just as a course in literary and linguistic studies is essential. As the quotation shows, the Board of Education is aware that for a complete education many studies are required, each with its own object and special work. It is important to bear in mind also that the main groups of studies cooperating for the complete education of the child are of equal importance. Just as the study of literature and language can promote the growth of and strengthen some faculties to which practical studies are unable to appeal, so a training in experimental science is the best and only means of ensuring the healthy unfolding of other sides of the human brain. The classical scholar ignorant of the laws and phenomena of nature is an uneducated man, just as is a man of science who has no knowledge of the literature of his own and other countries.

This view of true education is admirably set forth in the statement prepared by the president of the British Association, and revised by a committee including the deputy Vice-Chancellor of the University of Oxford, the Vice-Chancellor of the University of Cambridge, and representatives of the modern English universities, for presentation to the Prime Minister by the recent deputation which waited upon him with reference to increased State aid for university education.

"The men upon whom the nation must chiefly depend for aid under the complex conditions of the modern world must not be entirely untrained in the study of the nature and causes of the things which surround them, or of the

[1] "Regulations for Secondary Schools (from August 1, 1904, to July 31, 1905)." [Cd. 2128.] Price 2*d*.

forces which have to be utilised in our daily life; their training and education in humanities must also have been of the widest.

"Such men cannot be produced either by a university which neglects science or by a technical college which neglects the humanities.

"Hence the universities must be enabled to combine these two sides of a complete education, and they must also be enabled to foster research along both lines, for research is the highest and most important instrument of education, as well as its most valuable result."

And what is true of higher education is true also of secondary education upon which it rests.

It is desirable thus to recapitulate these important truths in view of section viii. of the memorandum. This paragraph is likely to lead to misapprehension and to create doubts in the minds of some men of science as to how much of the declaration of faith quoted with approval above is to be regarded as more than the mere expression of a pious hope. Section viii. informs us that all types of secondary schools fall into three main classes, and that in respect of the kind of education they offer they may be discriminated roughly as the literary, the scientific, and the commercial types of school. The boys from the literary, or first-grade school—the section goes on to explain—proceed to the university; the boys of the scientific, or second-grade school, are educated to the age of eighteen or nineteen but do not proceed to the university; the boys of the commercial, or third-grade school, leave at sixteen years of age and go into business and commerce, train to become teachers, or proceed into technical and industrial pursuits. The objects of these schools as set forth in this extraordinary paragraph must be placed before the reader:—

"The first of these paying special regard to the development of the higher powers of thought and expression, and that discriminating appreciation of what is best in the thought and art of the world, in other ages and countries as well as in our own, which forms the basis of all human culture; the second, to the training of the intellect towards understanding and applying the laws of the physical universe; and the third, to the equipment of the scholars for practical life in the commercial and industrial community of which they are members."

After studying this section one is led to believe that it has crept in by mistake; it may safely be said to have been written by somebody other than the author of the definition of general secondary education given earlier. Here we detect the old pestilent heresy that culture is the prerogative of the classical man alone, and that "a discriminating appreciation of what is best in the thought and art of the world" is forever impossible to boys from first- and second-grade schools. If the secondary education in all types of school is to give "a reasonable degree of exercise and development to the whole of the faculties," why are not all boys and girls—whether they leave school at sixteen or eighteen—each in their degree cultured?

The future in life allotted in this section to the products of each grade of school is equally preposterous. The paragraph makes it appear as if all the useful work of the world is done by people who leave school at sixteen, and as if all university men spend their lives in indulging their "discriminating appreciation of what is best in the thought and art of the world."

As readers of NATURE at least know, the sorry figure this country has cut recently in the industrial competition of the nations, and in another direction in South Africa, is precisely because of the disposition in times past, on the part of those responsible for English education, to regard "the training of the intellect towards understanding and applying the laws of the physical universe" as the work of some special kind of school instead of being a necessary and important part of every grade of education. It is surely time that it was recognised on all hands that "practical life in the commercial and industrial community" needs and deserves as good and careful an education on the part of those who pursue it as any other sphere of human activity. But, as we have said, this maladroit section viii. is an incongruity so far as the regulations as a whole are concerned, and we trust the inspectors may be instructed to ignore it.

To turn to the question of the grants to be awarded to secondary schools recognised as efficient by the Board of Education. As the sum is limited which Parliament at present places at the disposal of the Board for grants in aid of education other than elementary, the grants payable under the new regulations are to be made in respect of a four years' course only. The average age of the scholars in any class commencing the course must not be less than twelve years. The earlier education leading up to this course, and the further education, if any, given beyond it, are to be regarded as forming together with it a single organic and progressive system. Subject to certain conditions, a grant will be paid on account of each scholar attending the approved course in accordance with the new regulations on the following scale:—in the first year of the course, 40*s*.; in the second, 60*s*.; in the third, 80*s*.; and in the fourth, 100*s*.

The definition of rational secondary education occurring in the prefatory memorandum is not the only guide given to schoolmasters as to the subjects which must be taught to boys taking the grant-earning course between the ages of twelve and sixteen years. In section iv. of chapter i. the subjects of the course are enumerated. We find:—

"The course should provide for instruction in the English language and literature, at least one language other than English, geography, history, mathematics, science and drawing, with due provision for manual work and physical exercises, and, in a girls' school, for housewifery. Not less than 4½ hours per week must be allotted to English, geography, and history; not less than 3½ hours to the language where only one is taken or less than 6 hours where two are taken; and not less than 7½ hours to science and mathematics, of which at least three must be for science. The instruction in science must be both theoretical and practical. Where two languages other than English are taken, and Latin is not one of them, the Board will require to be satisfied that the omission of Latin is for the advantage of the school."

Most practical schoolmasters, and men of science too if they are acquainted with the actual conditions of school work, will admit that we have outlined in these sections a rational curriculum which, in the hands of properly trained teachers, will lead to good results. We are sorry, however, to find the distinction made between theoretical and practical instruction in science; it would be better to insist simply that the time allotted to science should be devoted to experimental science. It is difficult to understand, also, why in enumerating, in section ii., the subjects of the curriculum for a course of work preparatory to that of the grant-earning years, no mention is made of science, since modern practice has demonstrated that useful preliminary work in science may be begun in the lowest forms of a secondary school.

But however admirable the regulations drawn up for the government of a secondary school, and however logical and complete the statement as to its curriculum, the success of its work in educating its pupils depends finally upon the masters to whom its work is entrusted. If these men have themselves received a broad education and have been trained for their duties along scientific lines, the boys proceeding from the school will leave it properly equipped to occupy the station to which they will be called. The training of teachers

for any and every kind of school is, in fact, the most difficult and far-reaching of all the tasks which fall to the lot of educational administrators. A second publication of the Board of Education[1] published last month assumes in consequence especial importance, and will be consulted throughout the country with the greatest interest. It is true its instructions and rules apply at present only to the preparation for their career received by teachers destined to rule in elementary schools, but it is useful as indicating the subjects which in the opinion of the Board of Education should engage the attention of the prospective teacher. Moreover, the general principles which apply to the training of teachers for elementary schools are in a large measure applicable to the professional training of their secondary school colleagues. The new regulations for the training of teachers may surely then be taken as indicating what, in the opinion of the Board of Education, should be regarded as of vital importance in any scheme for the professional preparation of every grade of teacher.

It is consequently satisfactory to find that the place of greatest prominence in the group of studies which is to engage the attention of the budding schoolmaster is given to a training in scientific method. To quote the regulations :—

"Much of the instruction which is given in all subjects must necessarily be founded upon the statements and the experience of other persons; but every education which deserves to be called complete must include some training of the student in those systematic methods of enquiry which are necessary for any assured advance in knowledge, and which are the most truly educative of all mental processes.

"If this scientific spirit is to find its right expression in the teaching given in elementary schools it must be made to imbue the whole study of the intending teacher during his course in the Training College. It must not be confined to any one branch of the curriculum. It is true that, partly as the result of tradition and partly from other reasons, the term 'scientific method' has come to be associated more particularly with the study of natural phenomena. But as a matter of fact, scientific method is of equal importance, and is indeed of ancient application, in the field of history, literature, language and philosophy; and wherever knowledge of these has made advance, it may be discerned that the essential processes of scientific enquiry have been employed."

The specific references to the kind of instruction in science which the Board intends to encourage are deserving of even higher commendation, and if these wishes are carried into effect in the colleges in the case of each and every student in training, it will not be many years before a distinct improvement will be noticed in the teaching given in elementary schools. To refer to the regulations again :—

"But in addition to all this, and particularly in view of the courses which have for many years existed in most of the Training Colleges, a certain special regard must be given to this aspect of instruction and training, in the case of the Natural Science portions of the curriculum. It is in this branch of study that the student can in some ways learn most effectively to depend in some measure upon his own powers, and discover that he need not take everything unverified and on trust upon the statement of text books or lecturers. For by wisely planned and supervised laboratory work the student may be brought into immediate touch with the facts of nature, and learn to find some things out for himself, and to form conclusions upon the results of his own observations. For these reasons the student's work in science should be so arranged that his experiments in the laboratory will precede and lead up to such generalisations in the formal lectures as can safely be established upon what the student has himself observed."

[1] "Regulations for the Training of Teachers and for the Examination of Students in Training Colleges." [Cd. 2134.] Price 4*d*.

It seems to us that the Board of Education has shown a generous appreciation of the value of scientific studies both in the professional training of teachers and in the work of the secondary school. We are promised exactly that for which men of science have frequently and consistently pleaded in these columns. It only remains now to look for the loyal cooperation of school governors and headmasters, and the reproach as to the absurdly bookish nature of English education will soon become merely a matter of history. We earnestly hope that the inspectors and other interpreters of the regulations will be inspired by the same spirit which prompted the framer of most of the sections of the prefatory memoranda to these official publications.

PHYSICAL DETERIORATION.[1]

ELEVEN months ago the large percentage of rejections for physical causes of recruits for the Army led to the appointment of this committee. The members were the clerk of the council, the inspector of physical training, and the principal assistant secretary to the Board of Education, inspectors of reformatory and industrial schools and of marine recruiting, the assistant secretary of the Scotch Education Department, a representative of the General Registry Office, and a secretary.

The committee was directed "(1) to determine, with the aid of such counsel as the medical profession are able to give, the steps that should be taken to furnish the Government and the nation at large with periodical *data* for an accurate comparative estimate of the health and physique of the people; (2) to indicate generally the causes of such physical deterioration as does exist in certain classes; and (3) to point out the means by which it can be most effectually diminished."

This committee, composed of members of high critical faculty, has been able to focus much of the knowledge of sanitary and social science of the past generation as presented to them by wisely selected witnesses, and has evidently produced an epoch-making report.

A few items from this panorama of lives of women and children of the poorest classes may be quoted as samples of the thoroughness of this report.

While bad physique practically centres round feeding, great care has been exercised in proposing the remedies for underfed children at school, and the report states :—"Education is a great social need which individual citizens are, as a rule, not able to provide for their children on a sufficient scale, but food like clothing and lodging is a personal necessity, which in a well ordered society it is not inherently impossible for parents to provide, and the effort to supplement their deficiencies and to correct the effects of their neglect should aim in the first instance at the restoration of self-respect and enforcement of parental duty."

In the course of a full memorandum by the principal lady inspector of factories referring to employment of mothers in factories and workshops, we read :—"It is impossible, however, not to be impressed by the universal preference amongst the women for factory over domestic life. I was continually being told how greatly they preferred their work in the factory to the minding of children, and how depressed and out of health they became if they were obliged to remain at home. Surprising as this appears at first, it becomes less so on consideration. At thirteen years of age the majority of these women would have begun to work in a factory, to handle their own earnings,

[1] Report of the Inter-departmental Committee on Physical Deterioration. (Eyre and Spottiswoode, 1904.) Price 1*s*. 2*d*.

to mix with a large number of people with all the excitement and gossip of factory life. They would thus in most cases grow up entirely ignorant of everything pertaining to domesticity. After marriage, therefore, it is hardly probable that they would willingly relinquish this life to undertake work of which they are in so large a measure ignorant, and which is robbed of all that is to them pleasant and exciting. Until as girls they have been taught to find a pleasure in domestic life, and until there is a greater supply of healthy and suitable recreations and amusements in the reach of all women, to counteract the prevailing squalor and gloom of these pottery towns, it is useless to expect them to relinquish factory life."

Under the heading of alcohol, its devitalising effects are duly noted, and finally attention is directed to their steady decrease owing to wise legislation in Norway and Sweden. "The reverse of the picture presented by France is complete, seeing that besides a diminution in crimes, suicides and deaths from alcoholism and syphilitic diseases, the percentage of conscripts refused has been steadily reduced, showing an elevation in the standard constitution of the people. Thus in Sweden the consumption of spirits containing 50 per cent. of alcohol in 1830 was 46 litres, and in 1890, 6 litres per head. The percentage of rejection of conscripts in 1845 was 34·46, and in 1885, 19·61."

The evidence generally is of a cogent character, and has led to many recommendations for the common weal such as seem to be at present opportune. These are summarised under no less than fifty-three headings, which fill eight pages of the Blue-book.

We may quote in full two recommendations which are made with emphasis :—

"The Committee are emphatic in recommending the creation of an Advisory Council, representing the Departments of State, within whose province questions touching the physical well-being of the people fall, with the addition of members nominated by the medical corporations and others, whose duty it should be, not only to receive and apply the information derived from the Anthropometric Survey and the Register of Sickness, but also to advise the Government on all legislative and administrative points concerning public health in respect of which State interference might be expedient; and to them might be remitted for consideration and report all the problems affecting public health which the requirements of a complex social organisation are constantly bringing to the front. Such a Council, the composition of which might be modelled to some extent on *Le Comité Consultatif d'hygiène publique de France*, would be, the Committee believe, of great assistance, especially to the Local Government Board, and would be calculated to supply the knowledge and stimulus which are necessary in order to give to the Public Health side of the Board's administration a prominence which the multiplicity of its other functions may have tended to obscure, and to attract to its work that measure of public interest and support which has perhaps been lacking hitherto."

"The Committee are emphatic in recommending that a systematised medical inspection of children at school should be imposed as a public duty on every school authority, and they agree with the Royal Commission on Physical Training (Scotland) that a contribution towards the cost should be made out of the Parliamentary Vote. With the assistance of teachers properly trained in the various branches of hygiene, the system could be so far based on their observations and records that no large and expensive medical staff would be necessary. The lines on which the inspection should be conducted are laid down in paragraphs 323–326 of the Report."

Many other recommendations like these make provision to inform the authorities; such are :—register of owners of houses; local sanitary authority to report its action or inaction to Local Government Board; Local Government Board to inform all local authorities what the law and the powers it confers are as to insanitary and overcrowded house property; infant mortality rates to be published for particular areas and for particular industries.

Educational effort is recommended with regard to :—alcoholism; rural opportunities at rural schools; food and cookery; cookery, hygiene, and domestic economy; infant feeding; training of mothers; health associations.

Games, exercises, and physical education form the subject of several recommendations.

Existing legal powers should be employed for :—the enforcement of a standard and drastic dealing with overcrowding in certain of the worst districts; smoke pollution; the remedying of the dearth of country cottages; the precautions to procure the purity of milk supply.

New powers, apparently, are called for in regard to :—labour colonies and public nurseries; smoke pollution from dwelling houses; medical inspection of factories, coal mines, workshops; provision of a grate suitable for cooking in every dwelling let for the occupation of a family; prohibiting the sale of tobacco to children below a certain age.

Upon several points the committee ask for further inquiry to be carried out—over-fatigue in women; sterilisation and refrigeration of milk; and some special subjects.

In conclusion, "the committee hope that the facts and opinions they have collected will have some effect in allaying the apprehensions of those who, as it appears on insufficient grounds, have made up their minds that progressive deterioration is to be found among the people generally. At any rate the committee believe that their labours will result in giving matter for reflection to those who realise the importance of evidence towards the determination of issues of such uncertainty and complexity, and that these persons, who they would fain hope are the larger portion of the thinking community, will await the necessary steps being taken to secure that body of well sifted and accurate information, without which it is impossible to arrive at any conclusion of value as to the general problem.

"It may be argued that there is here no immediate remedy, and that years must elapse before the lack of knowledge is supplied; but in regard to those evils the existence of which is admitted, the committee have recognised what can be done in the interval, and are confident that if their recommendations are adopted a considerable distance will have been traversed towards an amendment of the conditions they have described.

"In the carrying out of their recommendations for the rectification of acknowledged evils, the committee do not rely upon any large measure of legislative assistance; the law may with advantage be altered and elaborated in certain respects, but the pathway to improvement lies in another direction. Complacent optimism and administrative indifference must be attacked and overcome, and a large-hearted sentiment of public interest take the place of timorous counsels and sectional prejudice."

The workmanship shown in the elaboration of this report is stimulating. The recommendations bid fair to inaugurate great social amendment. They appeal to the public as much as to our legislators, and afford to all a view of many fields for doing one's duty to one's neighbour, for encouraging good local government, and for raising the standard of citizenship.

THE ESSENTIAL AUSTRALIAN.[1]

IT is not too much to say that the publication in 1899 of "The Native Tribes of Central Australia" marked an epoch in anthropological research. A lengthy residence amongst savages, who still lived in their original isolation, uncontaminated by European influences, resulted in a remarkable study of a scientific accuracy and completeness hitherto unknown. The authors, both competent ethnologists, the one a distinguished biologist, the other a protector of aborigines, were fortunate in their subject, which proved to be the most interesting section of that most interesting of all primitive peoples, the Australian race. Peculiarities of organisation and belief were revealed which threw new light on many old questions, and reversed many an old theory. In the present work Messrs. Spencer and Gillen supply a sequel to the earlier volume, completing their study of the tribes of the centre by an account of those occupying the country between the Macdonnell Ranges and the Gulf of Carpentaria. The main result is to show a fundamental agreement in important characters between all the central tribes, and the authors repeat their previous conclusion that "the central tribes which for long ages have been shielded by their geographical isolation from external influences, have retained the most primitive form of customs and beliefs." The main features of the Arunta and Urabunna tribes are recapitulated, and we are thus enabled to study comparatively the whole series. Several points in the earlier work are cleared up, and some answer to objections is given by the way. As before, the photographs are excellent and numerous. The new volume possesses the same unique character and value which were conspicuous in "The Native Tribes."

The new types of aborigines present a high average of physical development, but strike one as being less prepossessing in aspect than the Arunta. There are none of the faces which in the other book reminded one of English bishops and fellows of the Royal Society. We are struck by the great number of dialects, each of which has varieties, a fact which must have rendered the task of the investigators very difficult, were it not the case that every blackfellow is, like Ennius, the master of two languages besides his own. As before, the authors point out many fallacies in popular works. For instance, "nothing could be further from the truth" than the notion that "the various tribes were in a state of constant hostility." Again, "there is no such thing as the acquisition of fresh territory"; the blackfellow holds "not only that his country is his by inheritance, but that it would be of no use to anyone else, nor would any other people's country be any use to him." There are no chiefs or head-men; the old men constitute an informal council, which punishes crime, chiefly "bone-giving" and the breaking of marriage-laws, organises the ceremonies, and from time to time inaugurates sound reforms. There is no haranguing of the meeting, which in its etiquette and procedure is the replica of an English committee. "As to the capture of women," the authors state, "we have never in any of these central tribes met with any such thing. . . . What looks like a capture to the casual observer is in reality an elopement, in which the woman is an aiding and abetting party." A good instance this of the necessity of trained and sympathetic inquiry, going far to indicate that many of the old and still accepted theories of primitive culture may be founded on the sands of ignorant and prejudiced mal-observation.

A valuable feature of this, as of the previous work, is the way in which the daily life of the native is visualised for the reader, and in this connection there are two facts which receive especial emphasis. Before initiation, which takes place about the age of fourteen, the boy is free; after this ceremony his life is regulated for him, and is sharply divided into two spheres, the ordinary daily round of food-getting and corroborees, and "what gradually becomes of greater and greater importance to him, the portion of his life devoted to matters of a sacred or secret nature. As he grows older he takes an increasing share in these, until finally this side of his life occupies by far the greater part of his thoughts. The sacred ceremonies which appear very trivial matters to the white man, are most serious matters to him." They are connected with the Great Ancestors of the Alcheringa, "the dream-time," and he believes that his spirit will after death be in communion with them. "It is astonishing how large a part of a native's life is occupied with the performance of these ceremonies, the enacting of which extends sometimes over the whole of two or three months, during which time one or more will be performed daily." In one tribe there is the unique case of a ceremony performed to promote the physical and mental development of the boys and girls. Sometimes a man will, in a similar fashion, induce his bride-elect to grow, or a father will assist the development of his unborn child. In the second place, the food-supply is organised on a most effective system by the cooperation of the totemic groups. "If I am a kangaroo man, then I provide kangaroo flesh for emu men, and in return I expect them to

FIG. 1.—Ceremony of Alkira-Kiuma. Arunta tribe. Throwing the novice up into the air.

[1] "The Northern Tribes of Central Australia." By Baldwin Spencer, M.A., F.R.S., sometime Fellow of Lincoln College, Oxford, Professor of Biology in the University of Melbourne, and F. J. Gillen, Special Magistrate and Sub-Protector of Aborigines, South Australia. Pp. xxv+784; 2 plates, map, 315 figures. (London: Macmillan and Co., Ltd., 1904.) Price 21s. net.

provide me with a supply of emu flesh and eggs, and so on right through all of the totems. . . . It is the duty of every one to supply certain other older people with food, and this they do cheerfully and ungrudgingly. In this way and in accordance with the needs and conditions of the community, these savages have long ago settled the question of an old-age pension, or rather they have rendered any such thing quite unnecessary."

The remarkable marriage-systems of the Arunta and Urabunna are repeated with varying gradations right through the central tribes. As to the "group-marriage" of the Urabunna, the authors now state explicitly that the supernumerary husbands and wives are called *Piraungaru*, as amongst the Dieri. The present writer once compared the facts with Mr. Howitt's evidence as to the Dieri custom. The authors repeat with insistence that "individual marriage does not exist either in name or in practice amongst the Urabunna tribe." Again, "this state of affairs has nothing whatever to do with polygamy any more than it has with polyandry," a statement which I confess

FIG. 2.—Visit to tree grave at sunrise, a few days after the death of a man, to try and discover some clue to the supposed murderer. Warramunga tribe. The men in the tree are examining the body.

I do not understand. They add that this group-marriage is not abnormal, because a gradation to individual marriage can be traced among the other tribes; but what we suggest is that group-marriage is abnormal for humanity as a whole. As to the connection of totemism with the bisectional marriage-system, their conclusion for these tribes is important:—"the two systems have become associated together in various ways in different tribes, but are perfectly distinct from one another in origin and significance." The account of relationships is fuller than before. New facts as to the custom of exchanging wives are given, and in particular the account of the elaborate Fire Ceremony of the Warramunga, a typical Saturnalia, proves that one object at least of these primitive "bursts," in which everything is topsy-turvy and goes by opposites, is, as the present writer had suggested, to promote harmony and union, "to make every one good-tempered and kindly disposed."

Two remarkable beliefs, which were among the new facts brought to light by the previous work, are found to prevail right through the tribes. These are the belief that each individual is the reincarnation of an ancestor, and the queer notion, difficult to regard as absolute, that the intercourse of the sexes has *nothing to do* with conception. The Urabunna and Warramunga systems necessitate that in each successive reincarnation the spirit-child changes its sex, its totem, and its moiety. There are curious folk-tales, in one of which a man propagates himself by fission, in another by a sort of budding; the hero of another shakes himself, whereupon children emanate from his muscles. We find new "totems," such as darkness, "laughing boy," and "full-grown man," which will give pause to framers of definitions of this very comprehensive term. *Intichiuma* ceremonies are actually performed by the Kaitish to increase the supply of flies and mosquitoes! Further interesting details are given as to those interesting articles, the *Churinga*, or sacred bull-roarers; in one case they are used to effect moral amelioration—to lessen a man's appetite and to make him willing to share his food with others, he is rubbed and prodded violently in the stomach with a heavy stone *churinga*. One incident of the initiation of young men among the Urabunna is a sort of tossing in the blanket—without the blanket; the patient is smacked as he comes down to a chorus of "I will teach you to give me some meat." Everyone here is a worker of magic. Husbands and wives are obtained by its means; the charms of the fair sex are literally "charms." A popular cure for head-ache or stomach-ache is to wear your wife's bonnet or its native equivalent. Among these tribes, as also shown in the earlier work, magic practically takes the place of religion. The Central Australian is a professing atheist; at initiation he learns that "the spirit creature whom up to that time as a boy he has regarded as all powerful is merely a myth, and that such a being does not really exist, and is only an invention of the men to frighten the women and children." In this connection one wonders if the Central Australian really represents a more primitive stage of culture than other savages.

A very full description is given of the tools and implements used by the natives, and of their decorative art. A remarkable application of the latter is to be found in the ground-drawings, showing considerable power of design, which are made for the numerous ceremonies.

If there is any defect in this fine monument of anthropological science, it is perhaps one that is due to its chief merit—the objective character of the study; one desiderates further analysis of the psychology of the blackfellow.

Thanks to investigators like Howitt, Fison, Roth, and Spencer and Gillen, we know the Australian of the east and centre better than any savage in the world, and we may hope that our authors will be able, before it is too late, to crown their work, already invaluable, by a study of the western districts, at present a *terra incognita*.

ERNEST CRAWLEY.

THE WIRELESS TELEGRAPHY BILL.

A MEMORANDUM explanatory of the Wireless Telegraphy Bill which was introduced by Lord Stanley, the Postmaster-General, has been issued as a parliamentary paper. We have already referred to the

proposals made in this Bill in our notes columns, but a brief abstract of the memorandum and of the provisions of the Bill may be of interest to readers of NATURE. The paper opens by pointing out that the rapid development of wireless telegraphy which has been and is still going on makes some form of State control practically essential in the interests of the naval and military requirements of the Empire. The United Kingdom stands, in fact, almost alone in not having any such control; in ordinary circumstances the powers of the Postmaster-General do not extend beyond the three-mile maritime limit; although in times of war or emergency the Government can take over the telegraphic business of incorporated companies, this power does not extend to the installations of private individuals. Obviously a private individual, were he maliciously inclined, could cause a great deal of trouble with a wireless telegraphy installation in the neighbourhood of important strategical signalling stations. A certain very limited power of control exists by an arrangement already made with several foreign Powers by which these Powers undertake not to permit the establishment of systems for communication with the United Kingdom except after consultation with the British Government; this safeguard, such as it is, would naturally fail in the event of war. It is especially in the case of war that control becomes of vital importance, and it is necessary to introduce legislation to meet this event.

The points which have to be particularly considered are:—

(1) That there must be means of preventing information being conveyed to the enemy, and of preserving secrecy as to plans and preparations.

(2) That all possibility of outside interference with Government signalling must be removed.

It is therefore desirable for the Government to have in their power (*a*) the control of the transmission of messages; (*b*) the prevention of the establishment of unauthorised stations; and (*c*) the disposition of stations in the most advantageous way so as to obtain the best results in working, free from interference, accidental or intentional.

In addition to these strategic reasons other considerations make Government control of wireless telegraphy desirable, notably, for example, the advantages to be gained by international agreement on the subject, which at present the British Government could not enter into as it has not the power to enforce any agreement which might be made.

On all these grounds it is proposed in the Bill that the Government shall exercise control by granting licences; these shall be granted by the Postmaster-General, but the consent of the Admiralty and the War Office shall be necessary in order that the strategic considerations may be duly regarded. The Board of Trade is to be added as a third party whose consent is necessary; this is done because the progress of wireless telegraphy affects so closely the trade and commerce of the country. The Bill provides penalties for the unlawful establishment or working of a wireless telegraph station. It is also provided that special licences may be granted by the Postmaster-General for experimental purposes. It is understood that the Government proposes to push the Bill through this session if possible, the reason for its wishing to do so being partly that it may have power to act at the next international wireless telegraph conference, which is to be held early in October, probably at Berlin.

M. S.

NOTES.

A STANDING Committee on machinery designs has been appointed by the Admiralty. Prof. A. B. W. Kennedy, F.R.S., is to act as president of the committee; the other members will be Engineer Rear-Admiral J. A. Smith and Mr. J. T. Milton, chief engineer-surveyor to Lloyd's Register.

A REUTER telegram from Vardö, Norway, states that the relief party of the Ziegler North Polar Expedition arrived at that place on August 3 on board the steamer *Frithiof*. In consequence of fog and ice the *Frithiof* had been unable to establish communication with the expedition on board the *America*. A later telegram states that the *Frithiof* left Vardö on Friday last for Franz Josef Land.

A REUTER telegram from Wellington, New Zealand, reports that the heaviest earthquake for many years was experienced at that place at 10.22 on the morning of August 9. Several public buildings were seriously damaged, and many private firms and householders sustained heavy losses. No loss of life is reported. The shock was felt in both islands. A slight earthquake shock was also felt at Lisbon and its vicinity at 11 o'clock on the night of August 8, but no damage was done.

THE death is announced, at the age of fifty-nine years, of Dr. Carl Weigert, director of the Pathological and Anatomical Institute of Senckenberg.

NEWS of the sudden death, on the Continent, of Sir William Mitchell Banks has been received. Sir William Banks was born in 1842. He was educated at Edinburgh Academy and University, became M.D., and took the university thesis medal in 1864, and in 1899 was made honorary LL.D. He acted for a time as demonstrator of anatomy in the University of Glasgow, and settled in Liverpool in 1868 as a consulting and operating surgeon, being particularly distinguished in cancer research. Dr. Banks, who was knighted in 1899, rendered valuable service as one of the founders of the new Royal Infirmary, Liverpool, in the establishment of University College, and in the movement which resulted in the formation of Liverpool University.

MAJOR RONALD ROSS, C.B., F.R.S., and Dr. Weir Mitchell have been elected foreign corresponding members of the Paris Academy of Medicine.

THE Vienna correspondent of the *British Medical Journal* states that a meeting was recently attended by the Senate of the Vienna University to celebrate Prof. v. Vogl's seventieth birthday, and to bid him farewell on his retirement from the position he has so long held in the university. Prof. v. Vogl's successor has not yet been appointed, but he will, it is thought, probably be one of the retiring professor's former assistants.

THE sixty-first annual congress of the British Archæological Association was opened at Bath on Monday last, and will remain in session until Saturday next.

THE arrangements for the annual meeting of the Society of Chemical Industry, which is to take place in New York from September 7 to 12 next, have now been completed. The president, Sir William Ramsay, K.C.B., F.R.S., is to give an address in the gymnasium of the University of Columbia on September 8, and in the evening of that day the annual dinner of the society will be held at the Waldorf-Astoria. A tour has been arranged, to last from Monday, September 12, until Thursday, September 29, with the object

of affording members and guests an opportunity of attending the international congresses in St. Louis during the week beginning Monday, September 19. Among the cities to be visited in the course of the tour are Philadelphia, Washington, Pittsburg, St. Louis, Chicago, Detroit, Buffalo (Niagara Falls), and Boston, the last named to be reached on Thursday, September 29. Ninety-four persons, in addition to those resident in America, have already signified their intention of attending the meetings. Further particulars may be obtained from the general secretary of the society, whose address is Palace Chambers, 9 Bridge Street, Westminster.

ACCORDING to the *Pioneer Mail*, Allahabad, an irrigation conference lasting four days will assemble at Simla on September 5. Some thirty papers on subjects covering a large range of irrigation practice have been promised, and it has been suggested that if time permits the following subjects shall also be discussed:—(1) The most suitable value of "N" in Kutter's formula, for use in designing channels. (2) American practice and the two or three notions described in Mr. Kennedy's recent report, paragraphs 15–18, circulated as technical paper No. 157. (3) Distribution of water by measurement. As a basis for discussion, the remarks of the Irrigation Commission in vol. i., paragraphs 275–290, and Mr. Kennedy's memorandum, published on pp. 59–63 of the appendix, vol. iv. of that report, may be studied. (4) Loss by absorption from channels.

AN International Exposition of Hygiene is about to be held in Paris. The following congresses will take place in connection with it, viz.:—life-saving, from August 25 to 31; public health, from September 10 to 20; fisheries, from October 1 to 10; social economy, from October 11 to 20; hygiene, from October 21 to 31; and tuberculosis at a later date.

A CONGRESS of climatotherapy and urban hygiene has been arranged for at Arcachon, France. It will be held from April 24 to 29, 1905, under the presidency of Prof. Renaud, of Lyons. The general secretary is Dr. Lalesque, of Arcachon. Communications relative to the congress should be addressed to Dr. Festal, Villa David, Arcachon.

ON the initiation of the Austrian Minister of Public Instruction, an International Congress of Botany is to be held in Vienna from June 10 to 18, 1905.

THE *Novoe Vremya* states that the Medical Department of the Caucasus has decided to disinfect all letters and parcels coming from Persia to guard against the spread of cholera from Persia to Russia, and that to assist the work three sanitary bacteriological sections (each consisting of a medical man, a medical woman, assistants and sanitary officers) have been fitted out with bacteriological laboratories, disinfectants and drugs, at the expense of the Discount and Loan Bank of Persia, which is a branch of the Russian Imperial Bank. The work of organising these bodies was carried out by the Institute of Experimental Medicine.

INDIAN papers report that a provincial museum is to be erected at Rangoon, and the proposal has been made that the collections at present in the Phayre Museum shall be handed over to the Government to be deposited in the new museum. It is also proposed that the proceeds of the sale of old materials shall be applied either in adding to the collection or towards the building of a portion of the provincial museum, and that the collection shall either be kept together and be called the Phayre collection, or that the name of Sir Arthur Phayre shall be connected with some part of the new building.

THE sum of 300*l.* recently voted by the New York State Legislature for cooperative hydrographic work with the U.S. Geological Survey will, it is stated in *Science*, be used in maintaining records of the rise and fall, the ordinary outflow, floods and droughts of many streams in the State. The work has gradually grown until there is hardly a section of the State in which some river is not systematically measured, and at the present time the condition of streams in more than fifty places in the State is regularly reported.

IT is stated in the American papers that an aquarium, costing from 600,000*l.* to 800,000*l.*, is to be established in San Francisco by Dr. H. Tevis in memory of his late father, Mr. Lloyd Tevis, and that plans for the building are being prepared.

THE County Council of Aberdeen has voted for another year a grant of 200*l.* to enable the Agricultural Research Association of Aberdeen to prosecute its inquiry further into a function of latent plant food in soil.

ANOTHER line of steamers—the Allan—is to have an ocean newspaper published on board its vessels. The company has, it is stated, arranged with the Marconi Company to have the most important news transmitted to its boats crossing the Atlantic, both homeward and outward bound, as soon as they come within effective distance.

THE railway department of the Grand Duchy of Baden has, says *Engineering*, presented to the Museum of Masterpieces of Natural Science and Technics at Munich an interesting collection of drawings and plans from the early days of railways. The collection includes diagrams of the first passenger and goods cars of Baden from the years 1839 to 1841, of carriages of the Nürnberg-Fürth Railway of 1837, of the Taunus Railway of 1841, of the London and Birmingham line, and further detailed diagrams of the cars of the Elberfeld experimental railway of the year 1832.

IN the latter part of 1902 arrangements were made for the establishment of a mineralogical survey in Ceylon, to last for a period of three years, the objects in view being an examination of the occurrence of economic minerals in the island with the view of their further development, and the preparation of a report descriptive of the mineral resources, as well as the arrangement of the geological collections in the museum and the accumulation of further specimens, a duplicate series being reserved for exhibition at the Imperial Institute. The report of the director of the survey for 1903 has just reached us, and tells of much work done during the period under consideration. In 1903 the area examined amounted to 512 square miles, but, as is pointed out, the work of the survey can only partially be judged by area, as in the event of the examination of important economic minerals being necessary a prolonged stay in one area may be required. At the conclusion of his report the director asks for a special grant of 1000 rupees to enable him to procure a collection of gems for the museum, the present collection being poor.

THE nature and importance of the work accomplished by the director of the Royal Botanic Gardens, Ceylon, and his staff may be judged from the report issued for last year, from which it is evident that the scientific staff is kept continuously busy in dealing with numerous inquiries and with the investigation of various horticultural problems. At the principal experiment station, Peradeniya, the treat-

ment of cacao canker has occupied considerable attention, also the value of different manures for tea plantations, and of green manures generally. The branch garden at Nuwara Eliya has been utilised for the purpose of experimenting with grasses and fruit trees upon the patana soil, and a new area of 150 acres has been reserved in the dry zone at Mahailuppalana, where cotton has already been planted, and later the cultivation of rubber and cacao under irrigation will be tried. The Government chemist, Mr. Kelway Bamber, has made an important discovery of a trustworthy test which will determine the amount of adulteration in citronella oil.

IT is instructive to have the opinion of a zoologist on the results obtained by Prof. de Vries in his experiments on the production of new plant species. Prof. A. W. Hubrecht has contributed a critical review to the *Popular Science Monthly* for July which is interesting not only because it discusses the essential points of de Vries's theory, but also because the writer takes considerable trouble to show that the mutation theory modifies, but is not opposed to, the views expressed in the "Origin of Species."

IN an article contributed to the *Journal of Botany* (July) Mrs. Gepp contrasts the sporangia of *Halimeda gracilis* with those of *Halimeda Tuna*, and describes the methods of communication between the central filaments in the thallus which serve as a basis for a systematic arrangement of the genus. In the same number Canon Lett describes a new hepatic, *Adelanthus dugortiensis*, from Ireland which appears to represent an ancient flora, since it has affinities with a group of hepatics found in hot climates.

AN elaborately illustrated "Catalogue of Exhibits of Insect Enemies of Forests and Forest Products" at the Louisiana Exposition has just been issued by the U.S. Department of Agriculture (division of entomology), and will well repay perusal by economic entomologists and all who have to do with forestry operations. The catalogue has two indices, one of scientific and the other of common names.

THE issue of the *Proceedings* of the Philadelphia Academy for the latter part of April and May contains several papers of interest. Among them is one by Mr. J. P. Moore on polychætous annelids from California, and a second, by Dr. H. C. Chapman, on the anatomy of the hyrax, in the course of which he raises the question whether the so-called "coney" of the Bible is really the Syrian representative of that group. Of more importance is the article by Mr. A. E. Brown on post-Glacial Nearctic centres of dispersal for reptiles, the title of which has been previously quoted in our columns. The absence in post-Glacial times of a circumpolar reptile fauna renders the retention of a Nearctic and a Palæarctic region convenient when discussing the distribution of this class, although this is no bar to the merging of the two into a Holarctic region for general purposes. Their present distribution points to two post-Glacial centres of dispersal for Nearctic reptiles, one in the south-eastern Austro-riparian, and the other in the Sonoran province, and temperature and humidity have been important factors in regulating such dispersals.

VOL. xl., No. 2, of the *Proceedings* of the American Academy contains an elaborate essay by Mr. G. M. Allen on the heredity of the colour of the coat in domesticated breeds of the common mouse, as illustrative of Mendelian principles. The language now used in studies of this description is so excessively technical that it is almost impossible to give a summary of the author's conclusions which would be intelligible to the ordinary reader. It has been found, however, that complete albinism is a character "recessive" towards pigmentation. The grey of the common mouse (composed of black, chocolate, and yellow) is predominant over the colours of the "fancy" breeds, so that when the latter are crossed with wild mice grey offspring result. Black mice breed true, and the "golden-agutis" also generally do the same, but may give rise to chocolate forms. The predominant grey may be produced synthetically by crossing blacks with golden-agutis, the three pigments of the former being thus brought together. Finally, black, chocolate, and the golden-aguti strains may be produced by a resolution of the original compound grey.

ANOTHER short communication to hand this week, from Reichenow's *Ornithol. Monatsberichte* for July and August, contains a continuation of Dr. J. Thienemann's observations on the birds of Rositten, dealing in this instance with the members of the crow family. The author takes the opportunity of thanking all who have assisted him in his investigations, and begs for the continuance of their kind help.

MR. L. W. LAMBE has sent us a short extract from the *Ottawa Naturalist* for 1904 in which he discusses the nature of the squamoso-parietal crest in two species of horned dinosaurs from the Alberta Cretaceous.

WE have received a copy of a paper by Mr. G. H. Carpenter on injurious insects and other animals observed in Ireland during 1903, forming No. 12, part v., of the first volume of *Economic Proceedings* of the Royal Dublin Society. As was observed during the preceding year, the grubs of crane-flies (Tipulæ) are the most serious insect enemies against which the Irish farmer has to contend, although the potato-flea-beetle (*Psylliodes affinis*) did some amount of harm.

THE contents of the *Entomologist* for June include descriptions of new South American beetles of the genus Chlamys by M. Jacoby, a paper on new African butterflies of the family Lycænidæ by Miss Sharpe, a supplementary list of Lepidoptera from Capri by Mr. C. S. Browne, and the continuation of a paper by Mr. P. Cameron on various new forms of Hymenoptera.

PROF. SIMON NEWCOMB has applied mathematical analysis to an inquiry into the probability of the causes of the production of sex in human offspring. In the entire Semitic race, over the whole of Europe and America, there is a small and uniform preponderance of male over female births. There is thus on the whole a unisexual tendency in the male direction among parents of the Semitic race. In isolated families the unisexual tendency becomes more marked and may be in either direction; in some families the offspring may be either mainly male or mainly female. Among the negro race the preponderance of male over female births is either quite small or non-existent. Prof. Newcomb, analysing the data by the method of probabilities, concludes that the sex is not determined at any one moment or by any one act, but is the product of a series of accidental causes, that the functions of the father have probably little influence, the sex being determined wholly by the mother, and that it seems in the highest degree unlikely that there is any way by which a parent can influence the sex of his or her offspring. The first-born child of any mother is more likely to be a male in the proportion of about 8 to 7, and there is probably a smaller preponderance in the case of

the second child, but there is no conclusive evidence that after a mother has had two children there is any change in her tendencies.

IN the *Monthly Review* for August Mr. J. E. S. Moore discusses "the cancer problem to-day," in which he details recent investigations into the cytology of malignant growths; and in the *Fortnightly Review* Dr. Alfred Mumford writes on the alleged physical degeneration of the race. The general trend of this article is that the deterioration in the vigour and health of the British race as a whole has been exaggerated, and that all the combined effort of the past for the permanent improvement of the race cannot have been without result.

AT a special meeting of the Academia dei Lincei held on June 5, the results of the competition, which closed on December 31, 1902, for the royal prizes of the academy were made known. In the section of philology, a royal prize is awarded to Prof. A. Trombetti for a work on the genealogical connection between the languages of the ancient world. The prize for astronomy is divided between Prof. E. Millosevitch and Vincenzo Reina, and that for philosophical science between Prof. Sante Ferrari and Prof. Covotti. To celebrate the tercentenary of the academy, which is the oldest institution of its kind in the world, it is announced that Prof. Pirotta is preparing for publication the botanical works of Prince Federico Cesi, who, with Galileo Galilei, founded the Lincei in 1603.

IN the *Physikalische Zeitschrift* (No. 15) H. Mache concludes that the emanation from the Gastein thermal spring, which is so strongly radio-active, is identical with that of radium, as the activity of both emanations decays according to the same law. Moreover, the activity induced in other bodies by the emanation from the water is of the same character as that caused under similar conditions by radium. In the same number E. F. Burton shows that the diminution in the conductivity of air enclosed in a metal vessel which is produced by surrounding the vessel with water is proportional to the thickness of the aqueous layer. The view that the radiations causing the discharge come from an external source is thus confirmed. It is also shown that, on diminishing the pressure of air in the vessel surrounded by water, the conductivity falls off continuously with the change of pressure.

IN the *Physical Review* for June, E. L. Nichols and Ernest Merritt give an experimental confirmation of Lommel's contradiction of Stokes's law that, in fluorescence, the fluorescent light is always of greater wave-length than the exciting light. The variation in the intensity of the light throughout the fluorescence spectra of such substances as fluorescein, eosin, and naphthalene-red was measured by means of a spectrophotometer, and it is shown that, whatever be the wave-length of the exciting light, the curve connecting intensity of light with wave-length in the fluorescence spectrum is always of the same character. The maximum of intensity in the excited spectrum may have a wave-length much smaller than that of the exciting source. Thus in the case of eosin, with an exciting light of wave-length λ 585–605, the maximum in the fluorescence spectrum is at λ 580, the whole spectrum extending from λ 535 to λ 640.

PART ii. of the *Bulletin* of the French Physical Society for 1904 contains a description by A. Turpain of a new apparatus for cleaning large quantities of mercury. The cleaning agent is a solution of mercurous nitrate, and the mercury, after being cleaned, is dried by means of concentrated sulphuric acid, any free acid in the mercury being subsequently removed by potash. The apparatus works automatically during long periods, and needs little attention.

IN the July number of the *American Journal of Science* Mr. H. A. Bumstead describes experiments on atmospheric radio-activity, which indicate that the activity acquired by a negatively charged wire exposed in the open air at New Haven, is of a two-fold character. From the rate of decay it is concluded that thorium as well as radium excited activity is present. With a three-hour exposure of the wire, 3 to 5 per cent. of the initial effect is due to the thorium activity, and with a twelve-hour exposure the thorium activity is sometimes 15 per cent. of the whole. Messrs. Trowbridge and Rollins communicate that the electrical resistance of an aluminium wire is not altered to a measurable extent when subjected to the action of radium.

THE *Geographical Journal* for August contains a very clear map showing the work of the National Antarctic Expedition. The map is the work of Lieut. Mulock, R.N., who joined the *Discovery* from the *Morning* in February, 1903. The positions fixed by observations, magnetic variations, soundings, heights, and the tracks of the sledge travellers are clearly shown, as well as the track of the ship to her furthest point along the coast of King Edward VII. Land. An inset map shows the position of the discoveries with reference to the circumpolar area. The same number also contains the paper on "The German Antarctic Expedition" which was read before the Royal Geographical Society in April last by Dr. E. von Drygalski. It is illustrated by some remarkable reproductions of photographs of icebergs, &c.

THE current *Century Magazine* contains two contributions which should be of interest to all students of nature, one, by that careful American observer, John Burroughs, on "What do Animals Know?" in the course of which a good deal of out-of-the-way knowledge is given in a charming manner, the other, illustrated by some striking engravings (one in colour), on "The Colossal Bridges of Utah," which deals with the wonderful arches or natural bridges that are to be found near the head of White Cañon, in San Juan County, Utah. One of these bridges, named by the discoverers the Caroline, measures two hundred and eight feet six inches from buttress to buttress across the bottom of the cañon. Its height is one hundred and ninety-seven feet from the surface of the water, while its thickness at its highest point is one hundred and twenty-five feet. The floor of the bridge is one hundred and twenty-seven feet wide, so that, as is pointed out, an army could march over it in columns of companies, and still leave room at the side for a continuous stream of artillery and baggage waggons. Two other magnificent bridges, named respectively the Augusta Bridge and the Little Bridge, are described and figured in the article, which is well worth perusal.

OUR ASTRONOMICAL COLUMN.

EPHEMERIS FOR ENCKE'S COMET.—A set of elements for Encke's comet, corrected only for the Jupiter perturbations of the first order between 1901 and 1904, is published by MM. Kaminsky and Ocoulitsch in No. 3962 of the *Astronomische Nachrichten*. These elements are given below, together with an extract from a daily ephemeris for the period August 1 to October 16:—

Epoch and Osculation 1904 *November* 9·0 (*M.T. Berlin*).

$$\left.\begin{array}{rl} M = & 341\ 3\ 39 \\ \pi = & 159\ 2\ 39 \\ \Omega = & 334\ 27\ 8 \\ i = & 12\ 35\ 37 \end{array}\right\} 1904{\cdot}0$$

$$\varphi = 57\ 54\ 20$$

$$\mu = 1075''{\cdot}666$$

$$\log a = 0{\cdot}34555$$

T = 1905 Jan. 11d. 8·8h. M.T. Berlin.

Ephemeris oh. (*M.T. Berlin*).

1904	α (app.)	δ (app.)	log *r*	log Δ
	h. m. s.	°		
Aug. 13 ...	1 51 3	+21 10·2	0·3685	0·2634
,, 17 ...	1 52 13	+21 45·0	0·3615	0·2421
,, 21 ...	1 52 57	+22 19·8	0·3542	0·2201
,, 25 ...	1 53 14	+22 55·1	0·3467	0·1970
,, 29 ...	1 52 59	+23 30·4	0·3390	0·1732
Sept. 2 ...	1 52 9	+24 5·7	0·3309	0·1485
,, 4 ...	1 51 28	+24 23·4	0·3268	0·1358
,, 6 ...	1 50 36	+24 41·2	0·3226	0·1229

THE REVISION OF THE CAPE PHOTOGRAPHIC DURCHMUSTERUNG.—In the third volume of the Cape Durchmusterung Sir David Gill referred to several lists of stars which Prof. Kapteyn had prepared in order that the objects might be re-observed and the origins of the discrepancies between the Cape and other catalogues discovered. The work of revision was commenced by Mr. Finlay, but has been continued, since 1896, by Mr. Innes. Parts i., ii., and iii. of vol. ix. of the Cape Observatory *Annals* contain the results of this revision, giving the observer's full notes and copious remarks concerning each object observed. Mr. Innes believes that not a single uncoloured star of the ninth magnitude or brighter, and south of declination −19°, is now missing from the catalogue.

Many of the questionable objects have been found to be variables or highly coloured, whilst others are fainter than the ninth magnitude. Part ii. is especially devoted to full particulars of each variable star observed at the Cape between 1896 and 1902, the elements, the curve, the region-charts, and all the available information—or references to the same—being given for each of the seventy-three objects observed.

A summary of the number of stars in the C.P.D. exhibits several interesting points. For example, whereas M. Stratonoff found that the B.D. (dec. +90° to −20°) gave a mean of 4·895 stars brighter than the ninth magnitude for every square degree, the corresponding value in the C.P.D. (dec. −19° to −90°) is 5·85. Part of this difference, at least, may, however, be due to a difference of magnitude standards. The total number of stars now contained in the C.P.D. is 91,358, and the richest region is near to η Argus, for in the −59° zone, between 10h. and 11h., there are 256 stars, or 32·7 per square degree, brighter than the ninth magnitude.

Part iii. tabulates, and comments on, the errors found by Prof. Kapteyn—and others discovered since—in other southern star catalogues for the regions south of dec. −19°, and concludes with a table of reference to all the published errata.

DETERMINATION OF LATITUDE AND ITS VARIATIONS.—In No. 3962 of the *Astronomische Nachrichten* M. E. Bijl, of the Royal Belgian Observatory at Uccle, gives the results of 685 determinations of latitude made by him during the period 1898·4–1899·5. The table given shows the time of each observation and the corresponding latitudes as deduced from the star positions given in the Berliner Jahrbuch and Newcomb's catalogue respectively. There is a constantly positive value for the difference Newcomb-B.J. of something of the order of +0″·6. The resulting latitudes show a range of about 0″·7 with a maximum at 1888·6, a minimum at 1889·0, and a lower maximum at 1889·3–1889·4.

THE STANDARDISATION OF ROWLAND'S WAVE-LENGTHS.—In an article appearing in No. 1, vol. xx., of the *Astrophysical Journal*, Prof. Hartmann answers the criticisms which have been passed on the proposals of his previous article, wherein he strongly urged the standardisation of Rowland's wave-lengths to a uniform *relative* scale. It has been urged that Michelson's absolute values should be used for the construction of an *absolute* scale, but Prof. Hartmann points out that the adoption of this idea would necessitate a wholesale revision each time a new estimate of the absolute wave-lengths was made.

In lieu of this he again suggests that the wave-length of the red line in the cadmium spark spectrum in air at +20° C. and 760 mm. pressure be adopted as λ=6438·6911 for all time, and that a coordination of a system of *relative* wave-lengths should be made with this as the standard.

The most urgent need before such a system can be completed is that an observer having the control of a large grating spectrograph shall continue Kayser's work in establishing a system of standard iron lines in the region as yet untouched by that observer. This need supplied, the values obtained by Michelson, Hamy, Fabry and Perot for a number of metals would furnish the connecting links for the completion of the proposed system.

SATURN'S NINTH SATELLITE.—From a note by Prof. E. C. Pickering in No. 3962 of the *Astronomische Nachrichten*, it appears that the position angles and distances of the satellite Phœbe, which were recently published in a Kiel *Circular*, were obtained from an ephemeris corrected to agree with the positions determined from eleven photographs obtained by Prof. Frost at Arequipa. These allowed the path of the satellite to be followed from April 16 to June 9.

DISTRIBUTION OF SUCCESSES AND OF NATURAL ABILITY AMONG THE KINSFOLK OF FELLOWS OF THE ROYAL SOCIETY.

THE result of this inquiry is to prove the existence of a small number of more or less isolated hereditary centres, round which a large part of the total ability of the nation is clustered, with a closeness that rapidly diminishes as the distance of kinship from its centre increases.

The materials are derived from the replies to a circular which I sent with a blank schedule, to all fellows of the Royal Society, asking for the names and achievements of their "noteworthy" kinsfolk in each degree of near kinship as specified in the schedule. Noteworthiness was defined as including any success that was, in the opinion of the sender, at least equal in its way to that in which the honour of a fellowship of the Royal Society is held by scientific men.

Returns are still dropping in, and now exceed two hundred. They continue to be very acceptable, but I judged it best to content myself with the number received up to a date when I could conveniently work at them, and to publish preliminary results without longer delay. The total number of returns received up to the date in question, that contained one or more noteworthy kinsfolk, was 110.

Subjoined are classified lists of the qualifications that were considered by one or other of the 110 correspondents as warrants of noteworthiness. I attached to each of these more or less noteworthy kinsmen (for my own private use in this inquiry) a ∗, a +, a −, or a o, signifying respectively 3, 2, 1, or no marks. In doing this, account was taken of honours, of biographical notices, and of the context of the communication, which often helped in deciding cases. Only one of these symbols was allotted to each individual.

A List.—Mostly recipients either of a ∗ or a +.

Ministers of State, Heads of Departments, Permanent Secretaries, and other high posts in public offices. Member of Parliament, but subject to reservation.
Foreign Ambassador or Minister, Consul General, Secretary of Legation.
Governor of a Colony, Colonial Secretary, high Colonial Office.
Admiral or General in important command, high Staff appointments.
Clerical dignitaries, eminent ministers, philanthropists.
Legal dignitaries at home and in the colonies.
Medical men of distinction.
Professors in great universities, heads of the more important colleges and schools. University scholarships, first or second place in class lists of universities or in competitive examinations for Woolwich, Indian Civil, or principal home services.
Distinction in any form of Art—as poet, musician, singer; architect sculptor; painter, engraver, caricaturist; actor.
President or secretary of great institutions connected with science, literature, art, or purposes of public utility.
Authorship of a standard work, editorship of an important journal, authorship of valuable memoirs.
Inventor in any branch, scientific traveller.
Founder of a great business, management of great commercial undertakings, pioneer of a new industry.

B List.—Useful to corroborate and to check.

Honours:—From the Crown—as knighthood and all superior orders. From public bodies—as honorary university degrees, Fellowship of Royal Society (all F.R.S. were granted a *), of Royal Academy, and other selected associations.

Biographical notices—as in Dictionary of National Biography and in other standard collections. Obituary and other notices in the journals of literary and scientific societies. Special memoirs. Men of the time; Who's Who?

C List.—Personal estimates taken into account.

Prominent county man. Active in public affairs, successful in business. Forward in civic matters. Good professional position. Of high repute as a scholar, &c.

D List.—Referring wholly to women.

A social leader. Great force of character. Reputed very clever. Artistic (in any way) to an exceptional degree. Successful work in educational, civic and philanthropic matters was also taken into account. Brilliant prize winnings at school or college. The following are examples of the more suggestive returns (but slightly modified). "I have no hesitation in judging her to be 'noteworthy.'" "Acquisitive mind of a high order." "Learned both Greek and Hebrew unassisted." "Had a great and recognised influence in forming the character of her (distinguished) sons." "Helped her husband greatly in his (standard) work."

E List.—Referring to youths only, and reaching at most the qualification of –

Good place in examinations, though lower than the very high ones mentioned above. School scholarships and exhibitions of fair importance.

Much less difficulty was experienced in assigning marks than had been anticipated. The totals of the number given were 183 of *, 188 of +, 83 of –.

The 183 * included 23 fellows of the Royal Society. Brothers were only counted once.

Abbreviations used in the schedule are employed here also, to distinguish different kinds of kinship that bear the same popular names, as uncles and first cousins. They are convenient, and seem to have been easily understood. They were first suggested by me in NATURE of January 28 of this year:—*bro*=brother; *da*=daughter; *fa*=father; *Hu*=husband; *me*=mother; *si*=sister; *so* or *son*=son; *Wi*=wife. *fa bro son* means "MY father's brother's son IS"; *me da* means "MY mother's daughter IS"; *so Wi bro* means "MY son's wife's brother IS," &c.

The total amount of marks that were thus assigned to each grade of kinship are given in Table I. For example, out of the 110 *fa fa fa* of the 110 senders, 3 were allotted a *, 1 a +, and none a –. Out of the 110 *fa* the corresponding numbers were 27, 25, 5.

TABLE I.—*Distribution of Symbols and of Indices of Success among the Kinsfolk of the* 110 *Senders.*

Kinship	Symbols * (2) + (1) –	Indices of success	Kinship	Symbols * (3) + (2) – (1)	Indices of success
fa fa fa	3 1 —	11	*me fa fa*	2 1 —	5
fa fa bro	8 1 —	26	*me fa bro*	3 1 —	11
fa me bro	1 — —	3	*me me bro*	1 1 —	5
fa fa	16 8 3	67	*me fa*	13 8 3	58
fa bro	11 15 3	66	*me bro*	11 14 3	64
fa si	1 4 1	12	*me si*	— 4 1	9
fa me	— 1 3	5	*me me*	1 3 1	10
fa	27 25 5	136	*me*	4 4 4	24
bro	37 21 17	170	*si*	3 6 5	26
Half brothers: *fa son*	3 3 —	15	Half sisters: *fa da*	— — —	—
me son	— — —	—	*me da*	— — —	—
bro son	4 11 2	36	*si son*	1 4 1	12
bro da	— 2 —	4	*si da*	1 1 1	6
fa bro son	10 7 1	45	*me bro son*	9 9 1	46
fa bro da	— — 1	1	*me bro da*	1 1 —	5
fa si son	5 3 4	25	*me si son*	6 5 3	31
fa si da	— 2 1	5	*me si da*	— — —	—
son	1 16 14	49	*da*	— 6 5	17

Total 183 of *, 188 of +, 83 of –.

Examples:—the index for *fa fa fa* is equal to 3 multiplied into 3, *plus* 2 multiplied into 1, =9+2, =11; that for *si son* is equal to (1×3, +4×2, +1×1)=3+8+1=12.

Tables II. and III. are based on Table I.

TABLE II.—*Successes of Kinsmen of Fellows of the Royal Society.*

A.—Through Male lines. Kinship	Index of successes	B.—Through Female lines. Kinship	Index of successes
fa fa bro	26	*me me bro*	5
fa bro son	45	*me si son*	31
fa fa	67	*me fa*	58
fa bro	66	*me bro*	64
	204		158

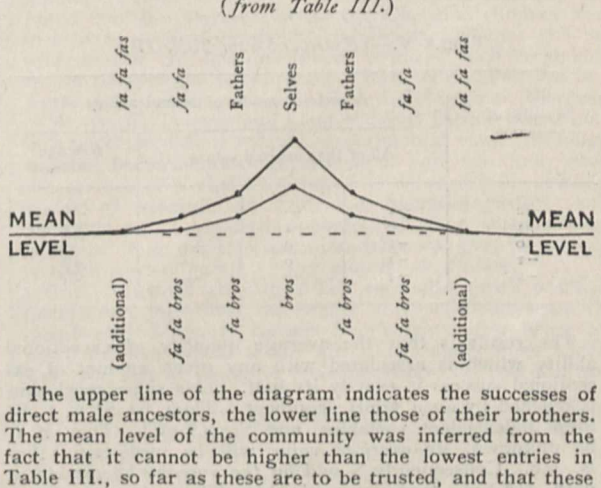
A popular notion that ability is mainly transmitted through female lines is more than contradicted by these figures.

The families of the fellows of the Royal Society must be fertile, because the number of brothers, whether of selves or of fathers, came out closely as 2·43. I will not now pursue the analysis, as the other kinds of kinship are hardly numerous enough in the present collection to justify conclusions.

TABLE III.—*Indices of Success among near Kinsmen in Ascending Generations of the* 110 *Contributors.*

110 persons in each class: Generation	Kinship	Observed indices	Accepted indices	Brothers of 110 persons in each class: Kinship	Observed indices	Accepted indices
I.	Selves	330	330	Brothers	170	170
II.	fathers	136	136	*fa bros*	66	65
				me bros	64	
III.	*fa fa*	67	62	*fa fa bros*	26	16
	me fa	58		*me me bros*	5	
Additional	*fa fa fa*	11		*fa me bros*	3	
				me me bros	5	

Distribution of Success in the Families of Successful Men (from Table III.)



The upper line of the diagram indicates the successes of direct male ancestors, the lower line those of their brothers. The mean level of the community was inferred from the fact that it cannot be higher than the lowest entries in Table III., so far as these are to be trusted, and that these would be of barely perceptible magnitude in the small diagram.

Relation of Success to Natural Ability.—The success of

a man is wholly due to the combined effect of Natural Gifts and of Circumstances. More, however, being included under the title of natural gifts than can influence success, this part may be disregarded. The remainder comprises intellectual power, appropriate tastes, a persevering disposition, and much else, forming a large group which will be briefly termed "Natural Ability." The Circumstances, so far as they affect success, include healthy rearing, family and social influences, education, money, leisure, and surroundings that encourage work or idleness.

Men whose histories are known can be sorted with rough fairness, and with little difficulty, into three grades of natural ability, one-third of the whole number being classed as "above mediocrity" and marked +1, another third being classed as "mediocre" and marked 0, the remaining third being classed as "below mediocrity" and marked −1. After this has been done and the results recorded, the same men may be sorted afresh and independently into three grades, according to their Circumstances, one-third of them consisting of those whose circumstances conduced to success and are marked +1, the other thirds being respectively marked 0 and −1 on the principle already explained. Assuming for the moment (the question will be discussed later on), first, that Natural Ability and Circumstance are independent, and, secondly, that the mark for Success will always be equal to the sum of those for Ability and Circumstance, then the relation of Success to Ability is easily found. A square table (Table IV.) is made with three columns and three horizontal bands; it consequently contains nine compartments. The "arguments" at the head of the several columns will be +1, 0, −1; so will be those that precede the several bands. Then an entry is made in each compartment equal to the sum of its two arguments. The next step is to sort the successes in order of their values, annexing to each the various grades of ability that have been associated with it, and to enter the averages of them at the side as in Table V.

TABLE IV.—*Distribution of Successes, under the assumption that each differs little from that of the sum of its two variable constituents, and that these vary independently.*

Circumstance	Natural ability		
	+1	0	−1
+1	+2	+1	0
0	+1	0	−1
−1	0	−1	−2

The entries in the body of the table represent the Successes. Each is the sum of its two arguments, which refer respectively to Natural Ability and to Circumstance.

TABLE V.—(*Extracted from Table IV.*)

Grades of success	Associated grades of natural ability			
	All of the observed values			Average values
+2	+1	—	—	+1
+1	0	+1	—	+½
0	−1	0	+1	0
−1	−1	0	—	−½
−2	−1	—	—	−1

The result is that the average quantity of exceptional ability which is associated with any given amount of exceptional success is exactly its half. This same conclusion is reached by an *a priori* argument. Thus, let S, A, C be three independent variables, and $S=\frac{1}{2}(A+C)$. Then if C be unknown, its *average value* will be mediocrity, that is, =0. Consequently S will *on the average* be associated with $\frac{1}{2}(A+0)$, that is, with $\frac{1}{2}A$. There is a uniform rate of regression towards mediocrity. The same will take place if the cases are sorted in such proportions that the mediocrities shall be twice as numerous as either of the extreme groups. The table will then have four columns and four bands, with the arguments +1, 0, 0, −1, and it will have sixteen compartments. The result will still be the same if the mediocrities should be thrice as numerous as either of the extreme groups, and so on.

The two assumptions that have been made with the purpose of giving a rough idea of what would really occur must now be justified so far as may be. The first assumption was that natural ability and circumstance may be treated as *independent* variables. This position would be indefensible if we were making a precise analysis, because the two are certainly correlated to some extent. Thus a bright attractive boy receives more favour, and thereby has more opportunities of getting on in life, than a dull and unpleasing one, but these advantages are not unmixed with drawbacks; attractiveness leads to social distractions, such as have ruined many promising careers. The amusing couplet of Henry Taylor is worth quoting:—"Me, God's mercy spared, from social snares with ease Saved by the gracious gift, ineptitude to please." Another instance of correlation is that the disposition to intellectual effort being heritable, a naturally studious boy is frequently brought up in a family whose influence and opportunities develop his natural bent; similarly as to natural scapegraces. But my returns here and elsewhere show that home influences are much less potent than might be supposed. Many correspondents speak of themselves as the only members of their family who had tastes like their own, and kinsfolk win distinction in many different directions. Moreover, a reaction against the monotony of home influences is often shown by those strong characters whose tastes are not in complete harmony with them. The correlation between natural aptitude and the circumstances favourable to success is consequently less strict than appears at first sight, and to the best of my judgment is not worth regarding in a rough inquiry.

The other assumption was that success is equal to the simple sum of natural ability and favouring circumstance. On the contrary, it must be some highly complex and discontinuous function of it. Still, the fact remains that a gifted child is more likely to succeed under conditions that are on the whole favourable to success than otherwise. The obvious objection that circumstances favourable to the development of one class of mind may be prejudicial to that of another is met by supposing a preliminary grouping of the men according to their dominant tendencies, scientific, scholastic, artistic, devotional, militant, and so forth, and treating these groups separately, each with its appropriate classification of circumstance. Little more is asked for than that natural ability and circumstance, as reasonably interpreted, shall be considered *cumulative*, in a broad and general sense, in their power of leading to success. It follows from this that any "exceptionality" of natural ability will, on the average, be roughly proportional but inferior to the exceptionality of the accompanying success. Also that the two will agree in direction, good ability going with high success, poor ability with the reverse. Rare exceptions do not invalidate general conclusions, any more than the fact of one boy in a class of schoolmates dying very early or very late invalidates the expectation of life at school ages as calculated by actuaries.

Exceptionally Gifted Families.—The diagram would assure us, even if we had no other grounds for assurance, that exceptionally gifted families must exist, whose race is a valuable asset to the nation. A few of these have been indicated by the present returns; they well deserve, and will probably receive, a full description hereafter. It must suffice for the present to mention the existence of at least nine gifted families connected with fellows of the Royal Society, two or three of whom are exceptionally gifted. I will conclude with the remark that the experience gained through this inquiry has strongly confirmed an opinion expressed in my lecture on Eugenics before the Sociological Society, of which an abstract appeared in these columns (vol. lxx. p. 82), namely, that it would be both feasible and advantageous to make a register of gifted families. I have now better hope of being able to carry some such design into effect.

FRANCIS GALTON.

THE HEALTH CONGRESS AT GLASGOW.

AT the congress of the Sanitary Institute recently held at Glasgow, a large number of sanitary officials, delegates from sanitary authorities, and others interested in public health matters assembled, and a busy four days of discussions were relieved by a generous programme of local entertainments. Glasgow is an excellent centre for such a meeting. The hospitality of the city is proverbial, and the enlightened enterprise of the corporation and its officials in dealing with the sanitary needs of "The Second City in the Empire" is generally recognised. The city abounds in interest to those who appreciate what a far-sighted and energetic civic management of affairs has achieved in the direction of solving the many public health problems which present themselves in every large industrial community. An enlightened municipality has provided an excellent system of electric trams, and acquired its own water supply and lighting; four public abattoirs have been established, and private slaughter-houses abolished; and hospital accommodation amounting to 1½ beds to every 1000 of the population has been provided for the infectious sick. But the energy and wisdom which have characterised the civic management of affairs is in no respect better evidenced than by the circumstance that in comparatively recent years no fewer than fifteen parks or open spaces, together amounting to more than 1000 acres in area, have been procured as lungs for the city. There is, indeed, no form of municipal enterprise in the interest of public health, however recent or advanced, which has not been adopted and put to the test in Glasgow; and hence the attractiveness of the city to the hygienist and to the earnest municipal representative. Model lodgings for the poor and labourers' dwellings now replace some of the insanitary property which has been demolished; the corporation owns a municipal infants' milk depot, reception houses for the temporary detention of those who have been in close contact with certain of the infectious diseases, municipal chemical and bacteriological laboratories, public baths and wash-houses, and it has recently had the courage to demand the closing of the public houses at 10 p.m. Drunkenness is very prevalent in Glasgow, and the more drunkenness can be reduced the easier does the solution become of most public health problems.

Despite all this good work, the conditions under which so many of the poor are still housed in Glasgow continue to demand the exercise of much energy and enterprise on the part of the local authority. A tremendous amount of "spade-work" still remains to be done, and it is not easy to contemplate the state of things which would now exist if the corporation had shown less wisdom and vigour in dealing with the poorer section of the community in the past, for few, if any, cities of Great Britain have stood more in need of enlightened administration. Glasgow is essentially a manufacturing and trading community. A city cannot be this and beautiful at the same time. It has an atmosphere in which poverty, dirt, and intemperance naturally take root and thrive. But the corporation has proved itself to be quite wide awake to the wants of Glasgow, and it is administering to those wants with no niggard hand. Would that it could deal effectively with those pernicious individuals who fatten on the poorest section of the community by the system of "farming" tenements, and would that it could succeed in abolishing that almost essentially Scotch custom of placing beds in air-stagnant recesses in the walls of living rooms, for it is not easy to exaggerate the harmful effect the custom must have upon the public health.

It is, of course, impossible within the limits of a short article to deal adequately with the extensive programme of work performed at the congress. Figuring most prominently among the more important subjects which came under discussion were those of the milk supply, the disposal of sewage, the housing of the poor, infant feeding, school hygiene, the hospital isolation of infectious disease, and disinfection.

Dissatisfaction was generally expressed at the lack of suitable precautions to guard our milk supply from contamination, and there was a general conviction that this circumstance was responsible for much preventable infantile mortality. The same unanimity was not accorded to the subject of the value of hospital isolation of scarlet fever patients, and this was responsible for a lengthy discussion at the conference of medical officers of health. There is a considerable body of expert opinion opposed to the present wholesale and indiscriminate hospital isolation of this disease, which now generally assumes so mild a type. Hospital isolation seems incapable of materially reducing the attack rate among the community, and so few children escape attack altogether that the good obtained is disproportionate to the enormous expense entailed, and therefore the restriction of the number of cases admitted to hospital to those who cannot possibly be nursed at home without great risks, is advocated by many. This restriction, strictly enforced, would reduce the number of admissions by some 50 per cent. in many large towns, and the money thus saved could be spent with far greater effect upon other public health measures.

Many of the papers contributed to the congress dealt with controversial subjects, and contained nothing of scientific value; these contributions, however, serve a most useful purpose at such meetings, for the adoption or otherwise of administrative measures of public health importance is largely determined by the trend of the general discussions which they evoke.

Reference may be made to one or two of the more practical papers which were of general interest.

In a paper read by Dr. R. H. Crowley upon the spread of diphtheria in schools, it was pointed out with reference to a school outbreak of this disease in Bradford that whereas the throats of ninety-three scholars gave no clinical evidence of diphtheria, in forty-two instances diphtheria bacilli were present; and the importance of such an examination and the necessity of isolating scholars who, though apparently healthy, contain the germ on their throats during such outbreaks were emphasised.

Dr. Louis Cobbett, in another paper, concludes from the result of his experience in the Chelmsford and Cambridge outbreaks of the disease that diphtheria bacilli in healthy persons are only to be found among such as have come into contact with cases of diphtheria, and possibly also in those who have come into contact with healthy people who harbour the bacilli, and he advocates that all sanitary authorities should have at their disposal the services of a skilled bacteriologist.

Dr. A. Greenwood brought before the notice of the congress the results of his examination of the air of certain school class-rooms in Blackburn. He found that the average amount of carbon dioxide (CO_2) present in the air of Blackburn was 4·37 per 10,000, whereas that of the air of Blackburn schools was 9·69. This amount of vitiation of the air in the class-rooms of schools is doubtless very general, and improved means of ventilation are demanded in the interest of scholars.

Dr. H. Wright Thompson gave the results of his examination of the eyes of 750 Glasgow school children. He found that 34·2 per cent. of the 600 Christian children were in need of medical ophthalmic treatment, and that 47·6 per cent. of the 150 Jewish children required such treatment. So far as eyesight is concerned, Glasgow children are in a worse condition than those in either Edinburgh or Aberdeen.

Mr. W. C. Tyndale and Lieut.-Colonel Davies, R.A.M.C., in a paper recording valuable experimental work (including suitable bacteriological experiments), conclude that when the surface of a chalk formation is deluged with sewage, traces of sewage, as evidenced bacteriologically, may penetrate to a considerable depth, but that when sewage is applied in an ordinary and reasonable way over the surface no such contamination of the subsoil takes place.

Prof. Kenwood and Dr. Allan, in dealing with practical disinfection, furnished the results of experiments upon the disinfecting action of certain disinfectants after being exposed for four weeks to the air. The results show a considerable loss of power in most instances, even in the case of carbolic acid.

A rather sensational paper was read by the chief sanitary inspector for Glasgow, Mr. Peter Fyfe, upon the result of the examination of certain flock material taken from mattresses. This material is sometimes made from rags and cast-off clothing sorted from ash-pits, &c., and the bacteriological examination of the flock taken from some recently purchased mattresses disclosed an amount of un-

cleanliness in the form of live potential dirt that is unpleasant to contemplate, and is not without its dangers. The results of the examination revealed a state of affairs which calls for remedial action.

The usual exhibition of sanitary apparatus and appliances was held in association with the congress, and a new feature, which certainly met with an encouraging amount of success, was the delivery, each evening, of free popular lectures upon different items of general hygiene.

INDIAN IRRIGATION AND ITS RELATION TO FAMINES.

IN the summer of 1901 the Governor-General of India in Council decided on the formation of a special commission to report on the irrigation of India as a protection against famine.[1]

The commissioners appointed were Sir T. Higham, M.I.C.E., Inspector-General of Irrigation; the Hon. Denzil C. J. Ibbetson, Chief Commissioner of the Central Provinces; the Hon. J. W. P. Muir Mackenzie, Secretary to the Government of Bombay; Diwan Bahadur Mudaliar, member of the Legislative Council of Madras; with Sir Colin Scott Moncrieff as president, and Mr. W. B. Gordon, M.I.C.E., as secretary. Their first meeting was held at Lahore on October 29, 1901. Two years were spent in inspecting all the principal irrigation works, and their report was presented to Parliament a short time ago in the form of a Blue-book.

About the same time the Department of the Interior United States Geological Survey sent Mr. Herbert M. Wilson, one of their staff, to India to investigate the method of irrigation as carried out there, and to obtain such information as might be of use to the department charged with the irrigation works in the western States and the reclamation service of the American Geological Survey.

His report, entitled "Irrigation in India,"[2] was published in 1903. Largely as the result of the renewed activity in irrigation in America, the first edition of the report was soon exhausted, and a second edition revised up to date has been issued.

India stands preeminent in the gigantic engineering undertakings carried out for irrigation purposes. No other country has so vast and so fertile an expanse of territory with such convenient slopes for the construction of canals, and at the same time such an abundant though varied water supply.

The main factors determining the use and value of irrigation are the rainfall, the character of the soil, and the class of crop best suited to the special conditions prevailing.

In India the zone of heaviest rainfall lies along the western coast of the main peninsula, where the monsoon striking the western Ghats precipitates on their outer slopes an average annual rainfall of 100 to 250 inches. On the outer ranges of the Himalayas the annual rainfall amounts to 461 inches. Over the greater part of India, however, the rainfall is below 40 inches. In the extreme south of the peninsula it is scanty and precarious, and in some of the States of the north-west the average annual fall is as low as 5 inches. Where the annual rainfall is below from 10 to 12 inches cultivation is practically impossible without irrigation. Where it is abundant and exceeds 70 inches the chance of the failure of the crops may be regarded as so remote as to make irrigation unnecessary. Between these two extremes lies a vast tract of nearly a million square miles of which, in the absence of irrigation, no part can be deemed absolutely secure against the uncertainties of the season and the scourge of famine.

On the irrigated lands two crops can be taken in the year, one of which is sown in the early spring and gathered in the autumn, and the other sown in the autumn and gathered in the spring. The summer crop depends little on irrigation for its maturing, as this is growing during the monsoon or rainy season. The autumn crop consists of millet, pulses and rice, and the spring crop of wheat, barley, linseed and grain. The crops mainly dependent on irrigation to ensure a full return are wheat, barley, sugar cane, garden crops, and cotton where it grows on the black soil. The area under wheat covers more than 16 million acres, and that on which cotton is grown 8⅓ million acres. Rice is an extensively cultivated crop, but is principally limited to the delta lands of the Orissa, Godaveri and Bengal; 80 per cent. of the crops raised in such regions are rice. Millet and oil seeds also are important crops. All kinds of vegetables and fruit are produced, these being the chief food of the natives. Jute is very extensively grown, the largest imports to this country coming from India. Indigo is also largely grown by the natives, and poppies for the production of opium. Tobacco and coffee are only grown in small quantities. Tea is extensively grown in Assam, where it is indigenous, and also in Darjeeling.

Irrigation has been practised in India from time immemorial. Many of the large tanks or storage reservoirs date back to the eighth and ninth centuries. The Grand Anicut in Madras is supposed to have been made in the second century. A canal on the banks of the Jumna made by the former rulers was restored in 1814, and the experience gained in this work led to the construction of the great Ganges Canal, a work which in magnitude and boldness has not been surpassed by any irrigation work.

The total length of the Government irrigation canals, including branches, is 36,000 miles, and they can discharge more than 100,000 cubic feet of water a second, and irrigate annually 19 million acres. There are also 7000 miles of minor protection works and storage reservoirs with a capacity of 25,000 million cubic feet.

The total area in India irrigated is estimated at 44 million acres, of which 42 per cent. is supplied with water from State works, 15½ millions being from canals, and 3 millions from reservoirs. Of the private works, covering 25½ million acres, 2·8 per cent. is from canals, 11·8 from tanks, 29·2 from wells, and 14 from other sources.

The capital outlay on the thirty-nine canals and major works up to the end of 1901 was more than 36½ millions of pounds (counting a lakh of rupees as equal to 10,000*l*.). The annual revenue after paying all working expenses was 7·1 per cent. The works in the Punjab yield a net revenue of 10½ per cent.; those in Bombay and Bengal do not earn enough revenue to cover interest charges on capital outlay.

The value of the crops irrigated in a single year is about equal to the whole capital cost of the works, and in time of famine the produce of the irrigated area being largely available for transport to distressed districts becomes an important item in the general food supply of the country. The irrigation works have also been largely instrumental in relieving congested districts. Some of the great canals in the North-West Provinces and the Punjab were undertaken in districts that were sparsely inhabited; within ten years from their construction the country became fully populated.

With regard to the value of irrigation works in mitigating the horrors and cost of famines, in the Sholapur district, where four famines have occurred since 1846, and where the cost to the State of the last two famines in 1896 and 1899 was equal to 1,150,000*l*., the estimated loss is reckoned at 50,000*l*. a year, which, capitalised at 4 per cent., amounts to 1¼ millions of pounds as the limit of unproductive expenditure that might be incurred for the sake of avoiding the future cost of famine relief for this district alone. During the terrible famine of 1876, for which a large relief fund was raised in this country, 5½ million of lives were lost, although the Indian Government expended 11 millions of pounds in relief.

Many of the great works already undertaken have been the direct outcome of famines. The great famine of 1837 in Bengal led to the project of the Ganges Canal, which has now 5500 miles of main canal and branches; the famine which desolated Orissa and the north of India in 1864, when a million of the inhabitants lost their lives by starvation, notwithstanding the expenditure of upwards of 6¼ millions of pounds in combating the famine, and also more than 3 millions in works of irrigation, resulted in the policy since adopted of systematically carrying out extraordinary public works and expending half a million a year in developing

[1] Report of the Indian Irrigation Commission, 1901–3. Part i. General. (Eyre and Spottiswoode). Price 1*s*. 4*d*.

[2] "Irrigation in India." By Herbert M. Wilson. (Washington: Government Printing Office.)

irrigation for the purpose of preventing the recurrence of these terrible disasters.

As the result of its investigation, the commission found that in the several districts it visited a programme of works had been prepared for work in such proportion of the population as is likely to be affected by famine, and that it was claimed that most of these works would be of a useful character; but the commissioners were of opinion that the degree of utility likely to be attained must for the present be regarded as uncertain, many of the works having been hurriedly selected. In addition to irrigation, the works included roads and railways.

The commissioners also recommended a very extensive programme of protective irrigation works to be constructed as rapidly as may be practicable in the tracts that are most likely to suffer from famine. They also endorse the recommendation of the Famine Commission of 1901, that greater reliance should be placed in future on village works as a means of employing relief labour than has been the practice in recent famines. They, however, advise the use of caution, and express the opinion that no relief labour can be more useless than that expended on works which, however useful if eventually completed, will probably remain as a famine folly, incomplete for ever.

They strongly recommend that a central board should be constituted, and invested with the responsibility of regularly watching and reporting progress as to works set out in the programme laid down, and of guarding against material deviations from the working plans of each province being made without the express sanction of the Government.

For the prosecution of their programme of new State irrigation works, it is pointed out that a large and permanent increase will have to be made in the strength of the engineering establishment.

The general conclusion arrived at is that there is a wide but not unlimited field in which the engineers and civil officers can work together for the protection of the country from famine, partly by the construction of new State irrigation works, and partly by encouraging and stimulating the extension of irrigation by means of private works. Both methods will involve heavy expenditure on the part of the State, upon which there may not be anv direct return, although it may be justified by the value of the protection afforded. While the whole of India can never be protected from famine by irrigation alone, yet much can be done to restrict the area and to mitigate the intensity of famine. Any enduring success of works carried out will depend no less on their effect in evolving a spirit of self-help and thrift among the people than in their efficiency in securing crops from drought.

Mr. Wilson's report is of considerable value to engineers engaged in irrigation works, as it contains a great deal of information relating to constructive works, such as weirs, sluices, and dams, and also descriptions, accompanied by illustrations, of many of the principal irrigation works carried out in India.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The following re-appointments for three years have been made:—Dr. A. J. Herbertson, to be lecturer in regional geography and curator of the School of Geography; Dr. G. B. Grundy, to be lecturer on ancient geography; Mr. C. R. Beazley, to be lecturer on the history of geography.

DR. REGINALD BULLER, lecturer on botany in the University of Birmingham, has been appointed professor of botany in the University of Manitoba.

THE Salters' fellowship of the Pharmaceutical Society has again been conferred on Mr. J. Stuart Hills, who since October, 1903, has devoted himself entirely to research work.

DR. A. W. CROSSLEY, lecturer in chemistry at St. Thomas's Hospital Medical School, has been appointed to succeed Prof. W. P. Wynne, F.R.S., in the chair of chemistry in the School of Pharmacy of the Pharmaceutical Society of Great Britain, and the following demonstrators have also been appointed in the latter school:—Mr. F. G. C. Walker in chemistry, Mr. J. T. Cart in pharmaceutics, and Mr. T. G. Hill in botany.

THE Drapers' Company has discharged the debt of University College, London, to the bankers to the amount of 30,000*l*. The treasurer has received from Messrs. Wernher, Beit and Co. their cheque for 10,000*l*., promised to promote the incorporation of the college in the university. For the completion of the incorporation scheme, there yet remains the sum of 18,000*l*. to be raised. Prof. Oliver has been re-appointed to the Quain chair of botany. Dr. F. J. Poynton has been appointed sub-dean of the faculty of medicine in succession to Prof. G. D. Thane, resigned. The session 1904–5 will begin, in the faculties of arts and laws and of science, on Tuesday, October 4, and in the faculty of medicine on Monday, October 3. The introductory lecture will be given by Prof. J. Norman Collie, F.R.S., on October 3, at 4 o'clock.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 2.—"The Advancing Front of the Train of Waves Emitted by a Theoretical Hertzian Oscillator." By A. E. H. **Love**, F.R.S., Sedleian Professor of Natural Philosophy in the University of Oxford.

The waves emitted by Hertz's oscillator have been identified with those due to a vibrating electric doublet. The field due to a variable doublet is expressed by equations of the form

$$\left.\begin{aligned}(X, Y, Z) &= \left(\frac{\partial^2}{\partial x \partial z}, \frac{\partial^2}{\partial y \partial z}, -\frac{\partial^2}{\partial x^2}-\frac{\partial^2}{\partial y^2}\right)\frac{\psi(Ct-r)}{r}\\ (\alpha, \beta, \gamma) &= \frac{1}{C}\left(\frac{\partial^2}{\partial y \partial t}, -\frac{\partial^2}{\partial x \partial t}, 0\right)\frac{\psi(Ct-r)}{r}\end{aligned}\right\}$$

in which C is the velocity of radiation, and $\psi(Ct)$ is the moment of the doublet at time t. When there is damping ψ has the form

$$\psi = Ae^{-\frac{\nu}{\lambda}(Ct-r)}\sin\frac{2\pi}{\lambda}(Ct-r+\epsilon),$$

where λ is the wave-length, A a constant depending upon the amplitude of the vibrations, ϵ a constant expressing the phase, and ν a constant expressing the damping. According to the experiments of Bjerknes, ν may be taken to be about 0·4 when the wave-length λ is about 10 m. The constant ϵ is determined by the conditions which hold at the front of the waves ($r=Ct$). The field outside

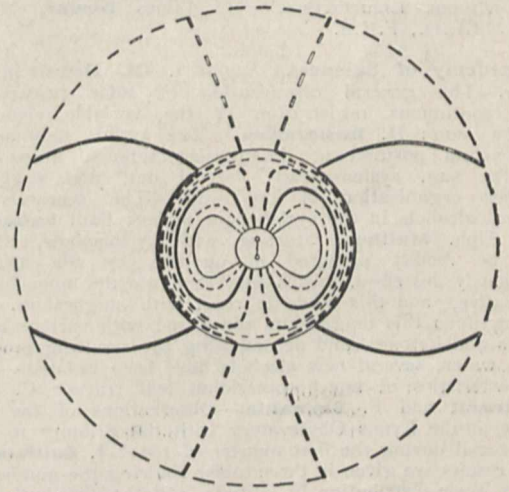


FIG. 1.

this surface is that which is established at the instant when the vibrations begin. At this instant the brass balls of the oscillator are so highly charged that the electric strength of the air between them gives way. The initial field is that due to the charges at this instant, so that it can most appropriately be represented as the electrostatic field of a fixed doublet.

It is shown that the moment of the initial doublet is the maximum moment of the vibrating doublet, and that ϵ is given by $\tan\frac{2\pi\epsilon}{\lambda}=\frac{2\pi}{\nu}$.

The effect of the introduction of the phase-constant ϵ is discussed in detail, and the advance of the waves through the pre-established electrostatic field is illustrated by a number of figures. For example, Fig. 1 here shows the lines of electric force after an interval of (0·51) of a period from the beginning of the vibrations, the fine continuous circle representing the front of the waves. Fig. 2 shows

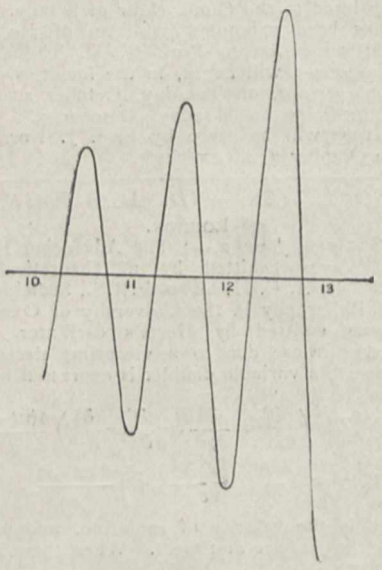


FIG. 2.

the transverse electric force at distances between 10 and 13 wave-lengths from the doublet at the end of 13 periods. Outside the front of the waves, when this front has travelled so far, the electric force is extremely small. Hence the marked discontinuity of the figure at $r = 13\,\lambda$.

June 16.—"The Absorption and Thermal Evolution of Gases Occluded in Charcoal at Low Temperatures." By James **Dewar**, M.A., D.Sc., LL.D., F.R.S.

"The Direct Separation of the most Volatile Gases from Air without Liquefaction." By James **Dewar**, M.A., D.Sc., LL.D., F.R.S.

PARIS.

Academy of Sciences, August 1.—M. Mascart in the chair.—The general organisation of solar researches. The continuous registration of the variable elements of the sun: H. **Deslandres.** The author summarises the actual position at the present time of researches on the sun, systematically carried out, and suggests further organisation of the work.—The synthesis of several alcohols in the cyclohexane series: Paul **Sabatier** and Alph. **Mailhe.** Starting with cyclohexane, which can be readily prepared in quantity by the method previously described, this is converted into the monochloro-derivative, and this made to react with magnesium. By acting upon this magnesium compound with various aldehydes and ketones, and decomposing the resulting product with water, several new alcohols have been isolated.—The characteristics of anachoropteridian leaf traces: C. Eg. **Bertrand** and F. **Cornaille.**—Observations of the sun made at the Lyons Observatory with the Brünner 16 cm. equatorial during the first quarter of 1904: J. **Guillaume.** The results are given in three tables showing the number of spots, their distribution in latitude, and the distribution of the faculæ in latitude.—On the zeros of integral functions: Pierre **Boutroux.**—On the indirect measurement of the real velocity of aërial vessels: Paul **Renard.** The absolute velocity of an airship, U, is the resultant of the velocity of the wind, V, and the real speed, W. A new method of estimating the latter is given.—On the theory of helices capable of supporting a weight: Edgar **Taffoureau.**—On the coefficient of rectilinear diameters: E. **Mathias.**—On the index of refraction of solutions: C. **Chéneveau.** A reply to the criticisms of Edmond Van Aubel on a former paper of the author.—On the mercury thermal ammeter: C. **Camichel.** The method employed consists in heating for one minute, by a continuous current, a mercury resistance placed in the inside of the bulb of a mercury thermometer, the latter radiating to a surrounding vessel maintained at the melting point of ice. The apparatus described gave a displacement of 145·3 divisions with a current of 1·588 amperes. Under these conditions, an increase in the intensity of the current of 0·01 ampere produced a rise of two divisions on the scale.—The action of ammonia upon boron bromide and on phosphorus trichloride: A. **Joannis.** The action of ammonia upon boron bromide depends upon the temperature, an amide being obtained at −78° C., the imide at −10° C. Phosphorus trichloride at −78° C. gives a mixed amido-imide, possibly $NH{=}P{-}NH_2$.—The estimation of bismuth by electrolysis: A. **Hollard** and L. **Bertiaux.** Details are given of a method for separating small quantities of bismuth electrolytically in the presence of considerable quantities of copper or lead. Test experiments show the degree of accuracy obtainable.—On the existence of three kinds of phagocytic cells in normal Amphipoda: L. **Bruntz.**—On the urns of *Sipunculus nudus*: F. **Ladreyt.** These are not phagocytes nor parasites, but are detached from the body of the animal.—On a hemogregarian of *Psammodromus algirus*: H. **Soulié.**—On the structure of the crystalline medium: G. **Friedel.**—On the Callovian layers of the Morocco frontier: Louis **Gentil** and Paul **Lemoine.**—On the eruptive rocks described by the Niger-Bénoué-Tchad mission: Henry **Hubert.**—New observations on the alteration of level of the Mediterranean: Ph. **Negris.** From a study of an ancient bridge at Leucade the author concludes that the level of the Mediterranean is at present about 3 metres higher than it was at the time of the Romans, or about 2000 years ago.—Researches on animal lactase: H. **Bierry** and M. **Gmo-Salazar.**

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Rayleigh