THURSDAY, OCTOBER 7, 1909.

TWO BIRD BOOKS.

(1) *Birds of the World: a Popular Account.* By Dr. Frank H. Knowlton. With a chapter on the Anatomy of Birds, by Frederic A. Lucas; The whole edited by Robert Ridgway. Pp. xiii+873. (New York: Henry Holt and Company; London: Constable and Co., Ltd., 1909.) Price 30*s.* net.

(2) *Birds Useful and Birds Harmful.* By Otto Herman and J. A. Owen. Pp. viii+387. (Manchester: The University Press, 1909.) Price 6*s.* net.

(1) IT would seem that there is no satisfying the demand for books on birds. Every year places before, not the scientific ornithologist only, but the general reader, in this country, scores of volumes on this group of animals, which must indicate a ready sale for them. The taste for natural-history works has unquestionably been growing in England at a rapid rate during the last decade among all classes of the community, instigated and encouraged largely by the non-technical manner in which so many treatises of the highest scientific authority are being published for the general reader, the majority of them lavishly illustrated, as well as by the issue of so many local faunas, which give an impulse to the study of the species to be found in their own neighbourhood by those into whose hands the books fall.

Imitation is the sincerest flattery, we know. The "Birds of the World," the first of the two volumes on our list, is one of the American Nature series, projected by Holt and Company, of New York, to which the leading scientific men of America are to contribute. This volume, however, compares disadvantageously in one respect with those of the English Nature series, in handiness and comfort in reading or consulting. It is an octavo measuring 10½ inches long by 7½ inches wide, and nearly 3 inches thick. It contains 873 thick pages, and turns the balance at more than 4lb.; it might be termed a bi-manual, or perhaps more appropriately a table-edition. In respect to its contents, the book stands on a high pedestal of excellence.

The demand for books on birds seems to be developing in America as rapidly as it is doing in England, for the Nature series of the United States is due, as the preface assures us,

"to the great awakening of popular interest . . . in recent years in relation to our birds, an interest that has been fostered not only by the admirable work of the Audubon societies and the widespread nature teaching in the schools, but by the deeper, broader sentiment which is leading back to, and nearer to, nature. The increasing number of people yearly turning back to the country, either for recreation or permanent residence, has naturally stimulated a desire to know more intimately their surroundings—the trees, the flowers, the birds."

The three names which appear, as authors or editor, on the title-page are a sufficient guarantee that the desire of the migrant to the country to know more, not only about the birds of the United States, but of those of the globe generally, will be gratified amply, accurately, and in a manner likely to foster personal observation of those species within the reader's reach.

After an introductory chapter dealing with definitions, and such questions as pterylosis and feather structure, nests and eggs, we are presented with clearly, concisely written chapters on the anatomy of birds, their geographical distribution, migration and classification. The various subclasses and orders of birds are then dealt with in twenty-one further chapters. Dr. Knowlton recognises two subclasses—Archæornithes, with unique representation in the Archæopteryx, and Neornithes, containing all other birds, which he divides into twenty-one orders. Had space permitted, we should feel tempted to demur at the position assigned in the avian "tree" to the Hesperornithiformes and Ichthyornithiformes, and to the Palamedeæ and Opisthocomi. Taking the author's brigading as it stands, we find each of the orders discussed in a very interesting manner. The habits and life-history of all the more important species in each are described concisely, as space demanded much condensation; yet nothing essential or really important is omitted to enable the reader to obtain an excellent grasp of each group. The illustrations are very numerous, and, with a few exceptions, excellent. There are 233 black-and-white blocks, many of them full-page; of the latter, some of the best are reproductions of those beautiful life-like groups with scenic backgrounds which form one of the most attractive features of the American Museum in New York. The representation of the young hoatzins is specially instructive. Where the blocks, however, have been made from coloured plates in such works as Schlegel's "Diergaarden" or the Zoological Society of London's publications, the results have proved less satisfactory, inasmuch as the yellows and reds of the originals have come out too dark. The smaller text-figures also leave something to be desired, occasionally, in the clear definition of markings on the plumage. Of the sixteen full-page plates reproduced in the three-colour process, with which the volume is further embellished, specially noteworthy are those of the mandarin-duck, the racket-tailed kingfisher, and the lesser bird of paradise. The figure of the kiwi on p. 29 is taken, we presume, from a drawing of the type which was mounted for Lord Stanley's collection at Knowsley, before the correct attitude and habits of the apteryx were sufficiently known either to scientific men or to taxidermists. Buller's "Birds of New Zealand" would have supplied a better model.

The information contained in the "Birds of the World" is, as already remarked, nearly everywhere up to date, and very accurate; but the omission of any reference to the Phororachidæ is surprising. In regard to the moa, the bird is described as being absolutely wingless. Evidence, however, was obtained from a turbary deposit near Omaru proving that certainly one species of Dinornis possessed a humerus that functioned in its glenoid cavity on the scapulo-coracoid; and, if the writer be not mistaken, a small bone is in existence in New Zealand very similar in form to that described as belonging to the humerus of Œpyornis. The moa had probably, therefore, a diminutive wing like

that of the kiwi. With regard to the question whether the Maoris ever saw the moa, it is stated on p. 81 that

"it appears that the Maoris have only been in their present location for about ten generations, or some 250 or 300 years, and the moa could hardly have lived within that period, and it is held as probable that their extinction was several centuries earlier than this."

Definite evidence of the contemporaneity of the Maori and the moa was adduced some eighteen years ago, during the exploration of the Sumner Cave, near Christchurch. The mouth of this rock-shelter had been closed by a landslide before the arrival of the Europeans in the South Island, the result, probably, of an earthquake, while a meal was in progress. The occupants succeeded in escaping, but round the fire-place about which they had been sitting were found moa bones and portions of the eggs, with the shell-membrane intact, on which they had been feasting. On the floor near by lay a boat-bailer and other objects with the carving truly characteristic of the Maori upon them.

Of the three specimens of the now extinct *Dromaeus ater* discovered, and brought to Europe by the French expedition under Baudin, all have now been located, as stated in the work before us—two in Paris (a skeleton and mounted specimen), and one (a skeleton) in Florence. A fourth specimen, it might have been mentioned, is now in the Lord Derby Museum, Liverpool, and was exhibited at the International Ornithological Congress in London by the Hon. Walter Rothschild on behalf of the director of that institution. As to the black swan of Australia, it seems extremely probable that it was indigenous to New Zealand as well as to the island-continent. The bones of a species, described under the name of *Chenopis sumnerensis*, hardly differing from those of *Chenopis atrata*, were found among the débris of the disturbed meal referred to above in the Sumner Cave, as well as in an ancient kitchen-midden in the Chatham islands.

A very full index completes this very excellent, succinct, and trustworthy account of the "Birds of the World," and we hope it will, despite is bulkiness and weight, meet in the United States, and in England also, with the appreciation it fully deserves.

(2) The second volume in the list given above is of a very different character, and the reason for its publication in this country is not very apparent.

The book is a translation of portions of the valuable work prepared by the director of the Royal Hungarian Ornithological Bureau to enable landowners, farmers, fruit-growers, and gardeners in that country to discriminate their avian friends and foes, together with a somewhat well-worn account, padded with poetical quotations, by Mr. J. A. Owen, of a selection of our most common English birds, including always the statement whether the species is harmful or useful in England, which seems to be apparently the only excuse for Herr Herman's book (in part) appearing in an English garb. The English co-author believes that amongst the innumerable books on bird-life which have been published of late years "there has been a lack which this little volume may supply." From a careful reading of the work we can really discover very little not to be found in nearly every book on British birds. It includes also a few species, common in Hungary, which rarely visit England, or are only winter visitors which can trouble the English agriculturist but little. It lacks, moreover, the details "arranged on a regular scientific basis" and "the investigations with regard to the food of birds carried on by a fully qualified entomologist" upon which Herr Herman has proved the various species of Hungary to be useful or harmful, and which would have impressed the corresponding classes of readers in England as those for whom the volume was prepared in Hungary. A more thorough work on the economic value of birds in the English language is to be found in the Bulletins of the U.S. Department of Agriculture, which contain the life-history and the detailed results of the examination of hundreds of individuals of each species, including nearly as many English ones as are given in the volume under review. "Birds Useful and Harmful" may, nevertheless, assist in spreading the knowledge of those birds, persistently persecuted, that deserve protection. F.

A GROUP OF "FLORAS."

(1) *A Tourist's Flora of the West of Ireland.* By R. L. Praeger. Pp. xii+243; with 5 coloured maps, 27 plates, and 17 figures. (Dublin: Hodges, Figgis and Co., Ltd., 1909.) Price 3*s.* 6*d.* net.

(2) *Illustrated Guide to the Trees and Flowers of England and Wales.* By H. G. Jameson. Pp. xi+136. (London: Simpkin, Marshall and Co., Ltd., 1909.) Price 2*s.* 6*d.* net.

(3) *Flora Koreana. Pars Prima.* By T. Makai. (Journal of the College of Science, Imperial University of Tokyo, Japan, vol. xxvi., article i., 1909.)

(4) *The Botany of Worcestershire. An Account of the Flowering Plants, Ferns, Mosses, Hepatics, Lichens, Fungi, and Fresh-water Algae, which grow or have grown spontaneously in the County of Worcester.* By J. Amphlett and Carleton Rea. Pp. xxxiii+654. (Birmingham: Cornish Bros., Ltd., 1909.) Price 25*s.* net.

(1) MR. R. L. PRAEGER'S book is a solid contribution to the subject of phytogeography, and is increased in value by the many beautiful, mostly full-page, photographs of striking species of plants, some of which appear for the first time, as here illustrated. Coloured and uncoloured maps of the districts described or of the distribution of species add to the usefulness of the book, which is well indexed and singularly free from typographical errors. The introduction contains a short account of the physical features of the west of Ireland, of its, mainly edaphic, plant formations, and of the more remarkable features of its flora. The topographical section which follows contains valuable information on the character of the flora of the numerous regions selected for description. This section will appeal to the touring botanist, more especially as the information given is not purely botanical. The author might have expanded this section, with advan-

tage to the inquiring tourist to whom the west is unknown.

The systematic section forms half the book, and follows mainly the classification and nomenclature of the London catalogue. *Pilularia globulifera* is wrongly placed in the Selaginellaceæ. The distribution of each species is recorded, and in many cases it is due to the work of the author that the distribution is now known to be so extensive. First records are duly credited to the discoverers, and many interesting observations are embodied in the text. The Saxifrages and the heaths, *e.g.*, are adequately treated. The book can be well recommended for the sake of its illustrations, and would be worth purchase if it had none. It does justice to the delightful botanical and other attractive features of the west, and is a credit to author and publisher.

(2) The avowed object of the writer of this book is to enable readers, knowing little of botany, by its use to give names to the plants they find, the name being, the writer insists, the first essential. This idea is not at all in keeping with recent views on nature-study. Still, every student of botany should learn to name a plant by the help of a "flora." Teachers know how students, even with the keys in our best floras, fail from time to time to name a plant. In the book under review all flowering plants are divided into ten sections. One section—flowers in heads or umbels—includes the Papilionaceæ. In another section—flower parts in threes or sixes—Rumex occurs between Triglochin and Luzula. The section devoted to aquatic plants will prove useful. Monocotyledons and Dicotyledons are not differentiated. Ruscus is said to have "phyllodes" as leaves. This is one of the few cases in which botanical terms are introduced.

The second part of the book is devoted to a selected number of natural orders, and more especially to the means of identification of the species of different genera, arranged alphabetically. This is the most useful part of the book. The illustrations, though small, are generally good. Misprints are few. There is, however, no index. The book is cheap, and will prove serviceable to the reader who already knows his natural orders fairly well.

(3) Mr. Makai's work is indicative of the line followed by Japan on the absorption of a new province into its empire. Korea was quite recently annexed, and so early as 1906 Makai began his study of its flora. The systematist of Japan is to-day doing as the British systematists did at the time England first acquired and explored her colonies.

This first part of the "Flora Koreana" deals with the Polypetalæ and certain Gamopetalæ, and is well illustrated by fifteen plates (one or two of which are rather crowded) of plants mostly new to science. Though printer's errors are numerous and generally indicated in a list of *errata*, the volume is produced in a form in keeping with the high standard of the other publications of the College of Science of Tokyo. The keys to the genera, and, under each genus, to its species, are useful. Under each species its bibliography, habitat, distribution, and Japanese name are given. New species and varieties are described in Latin, and usually illustrated. The index is inadequate. It is necessary to search the body of the work for the novelties, and there is no general index to the contents of the plates. It is impossible to discuss the contents of the volume in detail. One illustration must suffice for comparison with our flora. The beautiful genus Acer is represented by fifteen species or varieties. Trifolium by one species only.

(4) This work deals in a comprehensive manner with the flowering and flowerless plants of the county of Worcester. In an introduction of twenty pages justice is done to earlier publications, Lees and Mathews being specially noted. The authors follow the London Catalogue in the names of the species, adding useful synonyms. First records are duly credited, and valuable specific distinctions are occasionally added. Some of the notes, now and then amusing, are often loosely worded, and might sometimes have been omitted with advantage. The mosses and liverworts are listed by J. E. Bagnall, and the fungi by C. Rea, both authorities on their groups. It is a little disconcerting to find *Protonema muscicola*, Ag., recorded as a fresh-water alga (crowding about the bases of moss-stems)! Throughout the book derivatives of the Latin names are given. A map showing the botanical areas of the county is an excellent feature. The book is a distinct advance on previous publications on Worcestershire botany, and should stimulate interest in field botany in the county. The price is high for a county flora, but local patriotism will probably rise to the occasion. T. J.

GEOLOGY OF NEW YORK CITY.

Geology of the City of New York. By L. P. Gratacap. Pp. x+232; with 65 figures and 4 maps. Third edition, enlarged. (New York: Henry Holt and Co., 1909.)

THIS general treatise on the underlying structure of the city of New York and its immediate surroundings appears to be the amplification of a shorter work on the same subject, printed privately for the author. Its outlook is local, and, as the interpolated "Class Directions" indicate, it is intended primarily for use in the instruction of the inhabitants of the great city. It is compiled from various sources, which are duly acknowledged, and contains, besides, some original observations, but these are not sufficiently important or numerous to appeal to the wider circle of geologists who have no particular interest in the locality. In many passages it emphasises the transformation wrought by man on the original aspect of the country, in deference, no doubt, to the naïve astonishment with which the average town-dweller receives such information.

New York is one of the few great cities founded upon crystalline schists. Some of the problems of the schists and their entangled igneous intrusions are touched upon by the author, but his grasp is hardly adequate for their unravelling. As in almost every similar region, diverse views are held respecting the age of the different members of the schistose series.

They are supposed by the official geologists of the U.S. Survey and others to include large masses of altered Palæozoic sediments, while the author supports the alternative opinion that most of these rocks are Pre-Cambrian. The Triassic rocks of the western side of the Hudson River, with their intrusive diabase which forms the picturesque Palisades, and the sparingly exposed Cretaceous strata of Staten Island are the only other "solid" formations known in the neighbourhood of New York.

The drift deposits and their associated phenomena, everywhere conspicuous, afford the subject for the final chapter of the book, which the author presents in a strain calculated to impress the uninitiated.

The arrangement of the book is somewhat confusing to the outsider, being based on the municipal divisions of the city. The style of writing is often turgid, over-ornamented, and not particularly accurate. A region is described as of "pene-Saharal loneliness"; there have been "loculicidal slippings" in the gneiss (the botanical adjective looking quite aggressive here); the drifts "tell the singular story which the long, tireless and infinite retinue of glacialists has been engaged in translating these long years"; and so on. Misprints are numerous, even in the preface "carefully" appearing as "carfully"; the so-called "bibliographies" contain few proper references; and there is no index to the volume.

In some appended notes on the archæology of Manhattan Island, some relics of the British army engaged in the Revolution are mentioned; and, considering the recency of the period, it seems curious to read that "the habits and life of the soldiery have been traced by the remains of their food, utensils, pikes, cutlery." G. W. L.

THE LAWS OF INHERITANCE.

Elemente der exakten Erblichkeitslehre. Deutsche wesentlich Erweiterte Ausgabe in Fünfundzwanzig Vorlesungen. By W. Johannsen. Pp. vi+516. (Jena: Gustav Fischer, 1909.) Price 9 marks.

WITHIN the last few years the output of exact experimental work upon phenomena of heredity has been very large, and the progress made, as compared with that of the previous forty years, has been astounding. In England it has chiefly been produced by investigators who have strictly segregated themselves either to the Mendelian or the biometrical schools, and who as a rule seem unable to realise the merits of the work of their rivals. One may pause in astonishment on reading, in a recent work issued by the head of the Mendelian school, that

"Of the so-called investigations of heredity pursued by extensions of Galton's non-analytical method and promoted by Prof. Pearson and the English biometrical school it is now scarcely necessary to speak. That such work may ultimately contribute to the development of statistical theory cannot be denied, but as applied to the problems of heredity the effort has resulted only in the concealment of that order which it was ostensibly undertaken to reveal. . . . With the discovery of segregation, it became obvious that methods dispensing with individual analysis of the material are useless."

Most biologists, with no axes to grind, are able to appreciate the importance of the work of both schools, though at present it is scarcely possible for them to judge whether the work of the one is destined to be of more permanent value than that of the other. The mutually destructive criticism of the two, though not without value in stimulating healthy competition, has the unfortunate result that the biologist who is wedded to neither school finds it difficult to lay his hands upon an adequate but impartial description of their methods and results. To such we can cordially recommend the work on inheritance, by Prof. Johannsen, now before us. The Danish edition of this book was published in 1905, but the present edition is double the size of the original, and is practically a new work. It consists of twenty-five lectures, in the first eight of which the facts of variation and its statistical study are discussed. The author then describes at some length his own very interesting experiments upon a "pure line" of self-fertilised beans (Phaseolus), which he bred for six generations. He found that selection within such a pure line did not lead to departure from the type, *i.e.* beans grown from a small bean were exactly the same size as those grown from a large bean of the same plant. He designates these non-heritable variations in size as "fluctuations." These results have coloured the author's outlook upon problems of segregation, mutation, and selection, and before accepting his interpretation the criticism of his experimental results by Prof. Pearson and the late Prof. Weldon should be studied ("Biometrika," ii., p. 499).

In subsequent lectures the author discusses discontinuous variation, correlation, regression, and the effects of conditions of life, and then passes on to describe Mendel's law and de Vries's theory of mutation. Darwin's principle of natural selection acting continuously upon small, indefinite variations finds but small favour in his eyes, and he attributes the origin of species to the appearance of mutations and the production of new races by crossing, the new characters being propagated unchanged in accordance with Mendel's law. Selection produces nothing, but extirpates unfavourable mutations, and so leaves room for new and favourable ones. However, the author makes no attempt to explain how mutations, in spite of their extreme rarity, have been able to effect so much. Hence, as is only to be expected, these views on heredity, though worthy of full consideration, must be studied in a critical spirit. H. M. VERNON.

OUR BOOK SHELF.

A Sketch of the Geography and Geology of the Himalaya Mountains and Tibet. By Col. S. G. Burrard, R.E., F.R.S., and H. H. Hayden. Part iv. The Geology of the Himalaya. (Calcutta: Government Printing Office, 1908.) Price 2 rupees.

THE fourth part of the sketch of the geography and geology of the Himalayas is entirely the work of Mr. H. H. Hayden, and is devoted to a review of the present state of our knowledge of the Himalayas. This knowledge is fragmentary; of the Himalayas east of Sikkim only a few small patches, and these close to the southern margin, have been visited, then

comes the independent State of Nepal, of which nothing at all is known, and it is only in the British territory and the native States under British control at the north-western extremity of the range that the geology is known, even approximately There is, consequently, a tendency to extend the knowledge of this region to the rest of the range, and to draw conclusions which are only doubtfully applicable.

This tendency has not altogether been avoided, and the lengthy discussion of the age of the unfossiliferous sedimentary rocks of the Simla region seems to give this subject an importance which it does not possess, especially as, in the end, it is left in a state of little less uncertainty than before. The only clue to the age of these rocks is the fact that they contain a series of beds, the Blaini, which is generally acknowledged to present unmistakable signs of glacial origin. At one time this series was regarded as of Permian age, but this explanation is rejected, and the Blaini series is correlated with the pre-Cambrian glaciation which has been studied and described in Africa, China, Australia, and, we may add, in Norway. Mr. Hayden argues with great plausibility that the complete absence of any trace of fossils in a great thickness of rocks, which might well be expected to contain them, and their abundance in the great series of deposits on the other side of the snowy range, is more reasonably explained by a difference in age than in conditions of deposition. This reasoning we may accept, and acknowledge that the Blaini tillites are more probably pre-Cambrian than Permian in age, but the possibility that the rocks of the Simla area are a flysch facies of the fossiliferous sediments of Spiti must be borne in mind, and, until less equivocal evidence is adduced, the problem must remain unsolved.

With this exception the work is a well-balanced summary of the geology of the Himalayas, useful to those who wish to have the leading facts put briefly and clearly, and also, by the copious references to original authorities, invaluable as a guide to more detailed study.

Elementary Physiology for Teachers and Others. By W. B. Drummond. Pp. viii+198; illustrated. (London: Edward Arnold, 1909.) Price 2*s.* 6*d.*

THIS is a useful little book of its kind, elementary, as its title implies, and correct in its details, an element so often lacking in similar works. Like other books of its class, it necessarily contains a good deal of what is anatomy rather than physiology, and it chiefly differs from its competitors in pointing out the applications of physiology in the health, well-being, and training of children. This is by no means an unimportant point, seeing that the work is written for school teachers. W. D. H.

Evolution: A General Sketch from Nebula to Man. By Joseph McCabe. Pp. vii+128. (London: Milner and Company, Ltd., n.d.) Price 1*s.* net.

THE author of this little book defines his aim as being "chiefly to present a panoramic view of the development of the world—especially the world that lies close about us—by a conscientious use of the results of many sciences, and aided by a personal acquaintance during many years with both telescope and microscope." The style is interesting, and the slight sketch provided may send a few general readers to first-hand authorities for further information. The language is not always precise; for instance, we find "refractory liquid fire," "a lowering of climate," and so on; but on the whole the volume may serve a useful purpose by introducing non-scientific readers to some problems of inorganic and organic evolution.

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.*]

Magnetic Storms and Solar Eruptions.

REFERRING back to the *Electrician* of nine years ago (December 7, 1900), I find that, following up a suggestion of G. F. FitzGerald made in 1893, I promulgated a view of major magnetic storms which events have confirmed. See, for instance, Mr. Maunder's paper in Mon. Not. R.A.S. for 1904, vol. lxv., p. 33.

What I have to point out is that a stream or beam of electrons ejected from the sun and passing near or over the earth would cause magnetic perturbations of the kind required—positive as it approached, zero as it passed over, negative as it receded; with many minor disturbances superposed due to variations of density, as well as others due to the effect of particles caught by the atmosphere.

Such a beam or stream of electrified particles is essentially a magnetic cyclone, and the changes in magnetic force as it travels past any locality bear a fairly close analogy with the changes in wind-velocity during the passage of an atmospheric cyclone.

The relative speed of such a solar beam, as it overtakes the earth, follows from the sun's angular velocity, and is 210 miles a second.

Earth currents would, in the main, be induced as it approached and checked as it receded.

The rotation of the earth in the magnetic field of such a stream is too slow to be effective: though locally in the neighbourhood of six o'clock an intense ray of the main beam might generate east and west currents.

Now magnetic disturbances recorded during the recent storm, and quoted by Dr. Chree in the *Times* and elsewhere, indicate a declination deflection of 1½ degrees, followed by a reversed deflection of the same amount—all within a quarter of an hour.

This means—on the above theory—that the main beam took this time to traverse the place, so that the breadth of the beam was comparable to twenty times the earth's diameter. No doubt it is diffused, at this distance from the sun, by internal repulsion of the particles.

The intensity of field which would give the above deflection is approximately one-fortieth of that of the earth's horizontal intensity, or, say, 0·004 C.G.S., as the order of magnitude.

Taking these data, together with the known charge and velocity of electrons in kathode rays—say $e=10^{-20}$ electromagnetic C.G.S. units, $u=10^9$ centimetres per second—let us reckon the closeness of the crowd of particles in the beam necessary to account for the observed force.

The magnetic intensity at any place, distant r from the axis of a linear stream of sectional radius a and current density γ, is given by the following expressions:—

$$H=\frac{2C}{r}$$

$$C=\pi a^2\gamma$$

$$\gamma=n_1eu,$$

where n_1 is the number of particles per cubic centimetre of the stream.

This gives

$$n_1=\frac{rH}{2\pi a^2eu},$$

so taking a place just grazed by the beam, so that $r=a=20\times2/\pi\times10^9$, and putting in the other data just cited, we get

$$n_1=\frac{0\cdot004}{80\times10^9\times10^{-11}}$$

$$=0\cdot005 \text{ per c.c.},$$

or, say, five electrons per litre, on the average, all through the beam. I regard this as a modest and not unlikely estimate of crowdedness. The amount of matter ejected from the sun in this beam is insignificant, being less than a couple of tons per week.

The total current equivalent of such a beam is six

hundred thousand amperes—which again is rather surprisingly moderate, and leaves plenty of margin for underestimate of disturbance and for local perturbations too great for the instruments.

I send this little calculation because some doubt has been expressed as to whether the magnetic effect of a solar stream would be adequate to explain observed facts. It appears to me in general outline to be ample, both in amount and kind. OLIVER LODGE.

University of Birmingham, October 4.

The Magnetic Storm.

SOME details of the magnetic variations during a period including the great magnetic storm of September 25 may be of interest to the readers of NATURE.

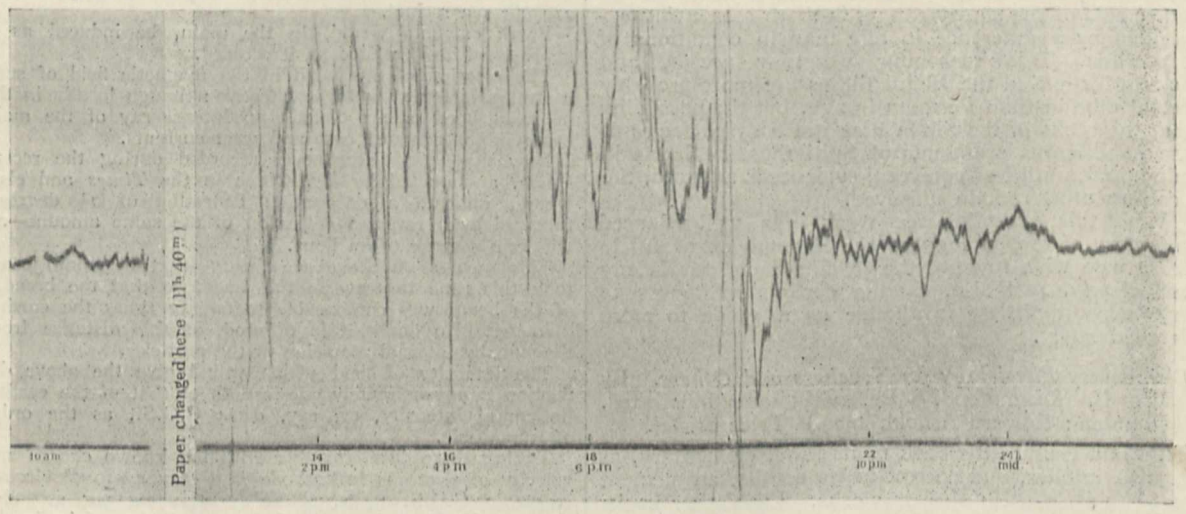
From the beginning of the month the magnets were comparatively quiet, disturbed from a state of calm only by small oscillations, increasing somewhat on September 7, 8, and 15 until September 21, when a greater disturbance was recorded between noon and midnight. This was followed by an approximate calm until 8.30 a.m. of September 25, when the coming storm was foreshadowed by a sudden small dip in the curves of the declination and horizontal-force magnets, and a slower fall of vertical-force curve, indicating an eastward movement in declination and a diminution of the two components of force. The preliminary oscillations thus started remained small, averaging about 10′ of arc on both the declination and horizontal-force curves until some time between 11.40 a.m. and noon, whilst the films were being changed. It is, therefore, not clear on which side of the film the spot of light was carried away by the first great deflection; but in declination it remained off the paper until 11.40 a.m., when it was found returning from the east, while the horizontal force had already recovered, and, together with the vertical force, was showing a rapidly increasing intensity.

The general deflection in declination was westward throughout the storm, with many rapid moves off the film, and only two violent throws to the east, one at the commencement and the other at the end of the storm, the latter being a swing across the film from the extreme west edge over the east edge in less than two minutes of time, covering more than 2¾ degrees. An equally great and rapid movement on the horizontal-force curve took place at the same time near the close of the storm, with increase of the component force, and the vertical-force balance finally heeled over through loss of force.

The storm seems to have been at its height between 3.30 and 5.30 p.m., when the light spots of all three instruments were, for the most part, off the papers, and ended at 8.30 p.m. It was followed by smaller rapid oscillations of the declination and horizontal-force needles until midnight, when the small after-tremors commenced, and continued until about 6 p.m. of September 27.

The seismologist cannot fail to see in these three phases of oscillation an imitation of the pendular swings produced by a distant earthquake, and the preliminary movements are undoubtedly of the first interest to the student of terrestrial magnetism. The suggestion is very pointed that, whatever be the cause of the magnetic storm, it must be something arriving in our neighbourhood, whether directly from the sun or circulating round it, of which a part travels quicker and has less effect than the slower moving particles which produce the great oscillations; but we are in no position to meet the difficulties which beset any definite supposition as to the nature of these particles, and defend it against the apparent contradictions which assail it. WALTER SIDGREAVES.

September 28.



Declination Magnetogram, Stonyhurst College Observatory, September 25, 1909.

THE MEETING OF THE INTERNATIONAL GEODETIC ASSOCIATION IN LONDON AND CAMBRIDGE.

THE meeting which began in London on Tuesday, September 21, and ended in Cambridge on September 30, has been notable in several respects. Great Britain joined the International Geodetic Association only twelve years ago. The triennial meeting has been held this year for the first time in England, and for the first time Greater Britain has been represented by special delegates from the Governments of India, Australia, and Canada; Chili has become a member of the association and sent a representative; and the Egyptian Government has been represented by one of the British officers of the Survey Department. The London meeting marks, then, a broadening of the interests of the association on the political and administrative side; on the scientific side it has been remarkable for the extremely interesting reports upon the special problems of the internal constitution of the earth and the lunar earth-tides.

About fifty delegates, from twenty nations, were appointed to represent their respective Governments, and came to the congress, which held its London meetings in the handsome apartments of the Institution of Civil Engineers, kindly placed at the disposal of the British representative. A large part of the business of the association consists in the reception and adoption of general reports of a highly condensed and technical character, impossible to summarise.

We believe that we shall do better to give an account of the principal discussions only, rather than to attempt to mention the name of every report and its author.

On Tuesday morning, September 21, the chair was taken by Mr. Haldane, Secretary of State for War, who warmly welcomed the association to England on behalf of the British Government. Sir George Darwin, vice-president, welcomed the delegates in the name of the Royal Society, in the absence of Sir Archibald Geikie, prevented by an accident from being present. General Bassot (president of the association) then took the chair and delivered his address; the permanent secretary (Prof. H. G. van de Sande Bakhuyzen) presented his report, and much business of a formal character was taken.

On the Wednesday morning the first business of importance was Prof. Hecker's account of his determination of the lunar earth-tides. Nearly thirty years ago Sir George Darwin and Mr. Horace Darwin tried to observe the lunar earth-tide in the Cavendish Laboratory at Cambridge, but the effect was masked by much larger deviations due to temperature. Prof. Hecker states that the effect of the solar heat was diminished 85 per cent. when his apparatus was transferred from the cellars of the Geodetic Institute to a chamber in a well shaft 25 metres below the surface. Here, in 1902 December, he installed his horizontal pendulums, and observed, with two small interruptions, until 1909 May. Analysis of the resulting curves shows an undoubted periodicity in half a lunar day, and a comparison of the observed with the easily calculated theoretical curve gives the following results:—The yielding is a little larger than would occur if the earth were a ball of steel, and about half the theoretical amount for a perfect fluid; there is little lag, so that the internal friction caused by deformation of the earth must be insignificant; the ratio between the major and minor axes of the elliptical curve does not agree with theory; this is probably not caused by local irregularity, but is, perhaps, due to the position of Potsdam near the western edge of the European-Asiatic continent; an investigation, whether the shape of the surface of the earth is changed by change of barometric pressure, gave inconclusive results. Prof. Hecker concluded that the outstanding questions could be settled only by observations at a number of stations, and he asked the association to stand godfather to these investigations.

In discussion, Sir George Darwin said that the association had in the past devoted much of its funds to the study of the variation of latitude; we may feel quite sure that Newcomb was right in regarding the prolongation of Euler's nutation period as due to the elastic yielding of the earth's mass; and he regarded Hecker's work, therefore, as a second chapter in the variation of latitude investigations. He accepted as worthy of consideration Prof. Hecker's explanation of the remarkable absence of symmetry in the path of the vertical, but suggested an alternative possibility. The curve was much compressed in the N.–S. direction, showing that the earth has much greater rigidity E.–W. than N.–S. It is possible to explain this to some extent by the earth's rotation. Lord Kelvin introduced the idea of gyroscopic rigidity, that is, of greater rigidity E.–W. due to rotation. Whether this is a sufficient explanation cannot be said, because no one has succeeded in solving completely the gravitational problem of a rotating elastic globe. Prof. Hecker's examination of the barometric effect had proved abortive; but he had been pleased to receive lately a letter from Mr. Napier Denison, of the Canadian Meteorological Service, who has succeeded in showing that on the Pacific coast, when the high-pressure system moves towards Alaska, the mean position of the vertical shifts in the same direction.

Dr. Backlund (Russia) suggested that in this matter the International Seismological Association might cooperate with the Geodetic Association in providing funds.

A commission to report on the subject was appointed as follows:—Dr. Backlund (Russia); Sir George Darwin (Great Britain); Baron Eötvös (Hungary); Profs. Haid, Hecker, and Helmert (Germany); M. Poincaré (France); and Prof. Weiss (Austria).

On the Thursday morning Sir David Gill presented his report on the progress of the great African arc of meridian. The British portion has been carried nearly to Tanganyika from the south, and a small section has just recently been measured on the Uganda-Congo frontier. The intervening section belongs to Germany. He understood that Prof. Helmert had already taken active steps to ask for money, and was sorry that for the moment the German Treasury had not responded with its usual alacrity. He could only hope that the little piece just completed to the north will act as a hook to which they will duly rise and be caught in the net of triangulation. We must now think of carrying the arc forward to Egypt, and from Egypt to join Struve's great arc which terminates on the Danube. Captain Lyons had travelled over most of the line in Africa, and Sir David Gill had his authority to say that the completion was only a question of money. There are no real geographical difficulties. Much has been made of the sudd, but this occupies only the valleys, and there are hills on each side. He believed, also, that it is possible to find, away from the river, a line more practicable and closer to the 30th meridian. To complete the whole from Uganda to the Danube would cost about 100,000*l*. He wished the association to adopt a resolution expressive of the importance of the work, and hoped that in time the Governments concerned, helped by private munificence, might be able to provide the money.

Colonel Close (General Staff) said that when it became necessary to send a party to survey the disputed territory on the Congo-Uganda boundary, the Colonial Survey Committee gladly took advantage of the occasion to measure a section of the arc of meridian. The British Government asked the Government of the Congo to approve and cooperate, and the latter appointed a commissioner, who observed all the latitudes. The Royal Society, the Royal Astronomical and Geographical Societies, and the British Association had contributed part of the funds. The whole was an admirable example of cooperation between governments and learned societies.

On the Saturday morning, Prof. Baron Eötvös presented a very encouraging report on the results of his three years' work with his torsion balance. In 1906 he had described the plan of this remarkable apparatus, which gives a rapid means of determining abnormalities in the direction and intensity of gravity. In response to a recommendation of the association, the Hungarian Government placed an annual sum of 60,000 crowns at the disposal of Baron Eötvös, who has been enabled thereby to make many improvements in his apparatus, and to complete a gravity survey over 400 square kilometres in the great plain of Hungary. Simultaneous observations with the torsion balance and with half-second pendulums of the standard Potsdam type, combined with determinations of the deviation of the vertical from astronomical and geodetic latitudes, resulted in a complete accordance, and established the accuracy as well as the extreme handiness of the torsion balance. Baron Eötvös'

words give a graphic picture of the operations :—" M. Ch. Oltay followed the traces of the torsion balance and determined by means of his pendulums the differences in gravity between five stations. This voyage into the unknown, far from mountains and from all other irregularity in the distribution of [surface] masses, had a peculiar charm. As we marched over a quite uniform plain, our instruments continually revealed to us something that was hidden below, and we could always direct our steps so as to follow or to cross a series of masses, and in this fashion know them better and better." A bye-product of this work illustrates its remarkable delicacy. Newton had shown that the gravitational attraction upon units of mass of different substances is the same within one part in a thousand; Bessel reduced the limits of possible difference to one in sixty thousand. Baron Eötvös, with his torsion balance, has reduced them to one in a hundred million, and thus set at rest the disturbing doubt whether geodesists might not have to consider more than one geoid.

We have left little space for the other topics that came before the congress. Colonel Bourgeois' report on base measurements revealed a mistrust of invar wires which was not generally shared; the resulting discussion, however, revealed some difference of opinion as to the necessity of standardising these wires in the field, and as to the respective merits of wires and tapes; it was decided to publish an interim report on the subject as soon as possible. Mr. King, Dominion Astronomer, made the gratifying announcement that his Government had authorised the establishment of primary triangulation in Canada upon a strictly geodetic basis. Colonel Burrard, representing India, described the measures which had been taken to discover whether geologists are right in supposing that the Himalayas and Tibet are moving southward and crumpling up the Siwalik range from the alluvial plain. Mr. Keeling described the geodetic operations in Egypt, resumed two years ago by the Government of H.H. the Khedive, " after a regrettable interruption of twenty centuries." Dr. Backlund and Dr. Carlheim-Gyllensköld gave a further account of the geodetic operations in Spitsbergen. Colonel Bourgeois described the re-measurement by the French Academy of the historical " arc of Peru." Prof. Hecker reported on his determinations of gravity over the Black Sea, on a vessel put at his disposal by the Russian Government. There is a somewhat remarkable circumstance connected with these investigations. On his earlier voyages he omitted to take account of the alteration in gravity produced by the E.-W. motion of the ship. Baron Eötvös pointed out the omission, and Prof. Helmert showed from Hecker's observations that the correction appeared to make otherwise concordant observations discordant; hence, he said, the theory appears to be incomplete. Prof. Hecker finds, however, from his Black Sea observations that the correction in question is certainly required. It remains to be explained why the former observations were accordant without it. Prof. Helmert has undertaken that the whole shall be re-reduced.

The somewhat severe and technical labours of the congress were relieved by pleasant social functions, which were, however, kept strictly within bounds, and not allowed to become the burden which the festive side of a congress is too apt to be. On September 22, Sir George Darwin, representing the British Government, gave an official dinner to the principal delegates. On September 23, the president of the Royal Geographical Society took the whole party to Greenwich by water for a visit to the Royal Observatory and the Royal Naval College. On September 24, the Treasurer of the Royal Astronomical Society and Mrs. Hills were " At Home " at 32 Prince's Gardens. On September 25, the delegates and their ladies visited Windsor, on the gracious invitation of the King. On September 26 many of them visited the National Physical Laboratory.

On Monday, September 27, the congress moved to Cambridge, where those unaccompanied by ladies enjoyed the hospitality of Trinity, St. John's, and Caius Colleges, and many others received private hospitality. On September 28, Sir Robert and Lady Ball were " At Home " at the Observatory in the afternoon, and Sir George and Lady Darwin gave an evening party in St. John's College. The final meeting was held on Wednesday, September 29, and in the evening the visitors entertained their Cambridge hosts to dinner. Thus ended an exceedingly valuable, successful, and pleasant meeting.

THE ADMINISTRATION OF AGRICULTURAL EDUCATION.

A MEMORANDUM has just been issued setting out the arrangements which have been made between the Board of Agriculture and the Board of Education in regard to agricultural education. It has been known for some time that a certain amount of controversy existed between the two departments on account of the anomaly arising from the fact that the Board of Agriculture inspected and gave grants to the various agricultural colleges and other institutions for higher agricultural education, whereas agricultural instruction in secondary and primary schools, like all other forms of education, was controlled by the Board of Education. On the one hand it was felt that agricultural education could not thus be dissociated from the general system of the country; on the other hand, there was the danger that so special, and in many respects so weakly supported, a subject would never receive the attention it deserved without the fostering care of its own special department. The situation became more critical as it appeared that the Board of Agriculture, however anxious to retain its connection with the colleges, was unable to obtain the funds either to make adequate grants to existing institutions or to promote the creation of fresh colleges where they were needed. The two Boards appear now to have arrived at a compromise which still leaves the higher educational institutions under the charge of the Board of Agriculture, but also secures an interchange of views by the creation of an inter-departmental committee. The Board of Agriculture is to take charge of advanced schools of agriculture serving, as a rule, more than one local education authority's area, and taking students of an age of seventeen and upwards; under its charge also will be such special institutions as deal only with one branch of agricultural instruction, as dairying, forestry, &c. As before, the Board of Education will be in charge of the agricultural instruction that is provided by the county councils and other local educational authorities, but it is not clear by which board, or in what way, pressure can be brought to bear upon the backward counties that are now doing nothing for organised agricultural education. For example, the East Sussex County Council uses part of its " whisky money " to maintain an agricultural college, which is further assisted by grants from the Board of Agriculture; the West Sussex County Council next door puts the whisky money to the relief of rates, and does nothing for agricultural education. The defect in the Board of Agriculture's administration has been the fact that it has been powerless in such cases; it could neither compel nor bribe such counties to do their duty, and what the public interested in such matters is anxious to know is how the new arrangement will be worked

to ensure a provision of higher agricultural education for farmers in all parts of the country, a national system that is not dependent on the caprice or the poverty of any county council.

The novel feature in the memorandum besides the Inter-Departmental Committee is a proposal to create a Rural Education Conference, consisting of representatives of the County Councils' Association, the Agricultural Education Association, and other agricultural organisations, with certain officers of the two Boards. Such a consultative committee seems to smack of the Board of Agriculture's favourite attitude of asking the farmers what it can do for them, but perhaps the influence of the Board of Education, which takes a less humble view of its own expert qualifications and powers to give a lead, will supply the stiffening and find a means of translating the suggestions of the conference into practice.

SCIENCE TEACHING IN GERMAN SCHOOLS.

THE habit of self-depreciation, or at any rate the latest manifestation of it, which is now so prominent a feature of our national life, can be traced to its beginning in a general dissatisfaction with our system of education. At a time when there was no misgiving as to the superiority of our navy, when our commercial supremacy was still unchallenged, and when no foreigner dared to be our rival in the world of sport, it was nevertheless felt that in the science of education we had much to learn from abroad. If our secondary schools, especially the great "public schools," were allowed to have been successful in the formation of character, yet the intellectual equipment of those who passed through them was, and still is, held by many to be miserably inadequate. Germany, on the other hand, is regarded as the land, *par excellence*, where not only the schoolmaster knows and does his business, but where a parental Government has elaborated an almost ideal system of mental training. It is interesting, therefore, to hear that in one important province of school work—the teaching of natural science—there is another side to the picture.

Dr. Erich Leick[1] finds it necessary to bring before the minds of the German public certain points that with us for some years have been received as axiomatic, and are no longer discussed. In England we believe and act on the doctrine that no scheme of education, even for the children of well-to-do classes, should omit all reference to the living world of nature. It is, moreover, generally agreed that courses of practical lessons where common objects are studied by each pupil form the best means whereby the power of observation, clearness of expression, and the inductive methods of science can best be acquired, let alone a general interest and love for living things. Yet in Germany up till now, so we learn from Dr. Leick, natural-history lessons, if given at all in the secondary schools, have been of the old didactic kind, in which the teacher lectures almost entirely for one, or at most two, school hours in the week, and practical work is conspicuous for its absence. This seems to hold good for other branches of science, especially in the classical gymnasia, where, as Dr. Hoppe[2] tells us, practical work in physics is not insisted on, and is done only by "Freiwillige." His pamphlet, in fact, is written to show that some boys will do laboratory work out of school if allowed, and he gives hints as to the best exercises for such volunteers.

It need scarcely be said that thoughtful teachers in Germany are dissatisfied with this state of things, and it is gratifying to read in Dr. Leick's account that the example of England is gradually affecting German science teaching. In fact, anyone who has read Mr. O. H. Latter's article on the teaching of science in secondary schools, recently published as an educational pamphlet by the Board of Education (see NATURE, August 12, p. 192), may well rub his eyes with astonishment at the antiquated systems still prevailing in many of the German Gymnasien and Realgymnasien compared to those of our own schools. Is it too much to hope that our improved methods of teaching may bring forth fruit in the next generation, and do much to remove the reproach we are constantly hurling at ourselves that we are an unscientific nation?

The limits of this notice forbid a discussion of either of these interesting pamphlets. Suffice it to say that Dr. Leick, after a review of the gradual introduction of inductive methods into the study of natural science, describes the ups and downs that biological teaching has met with in Germany, and acknowledges the part played by the authorities of Hamburg and Bremen in insisting on natural history being taught in their schools. He shows clearly enough the kind of mental training that biology alone can give, although he is no revolutionary who would sweep away humane letters out of the field. Especially noteworthy is his tactful reference to the problem of sex, how it can best be dealt with by natural-history lessons in the hands of a sympathetic teacher. Doubtless the details of his scheme invite criticism, especially the use of the compound microscope by young pupils, but they offer food for thought to all who have to teach his subjects.

Dr. Hoppe's little work may be well offered to those classical masters in our public schools, if such there be, who still believe, like Darwin's headmaster, that natural science is a waste of time, and have forgotten in their zeal for grammar the true spirit of inquiry of the ancient Greeks. Teachers of practical physics may gain some useful hints from his list of exercises.

But, as has already been suggested, the chief interest to British teachers in these pamphlets lies in the fact that they give us glimpses of what we should not have suspected in so scientific a country as Germany. They confirm the present writer's impression after hearing a science lesson in a German Realschule, that the boys were standing aside and watching rather than taking off their coats and joining in the work themselves.

M. D. H

ANTON DOHRN.

THE whole biological world will feel a pang of grief at the news of the death of Anton Dohrn, the founder and director of the Zoological Station of Naples. It is true that he had accomplished the great work which he set himself forty years ago, and had seen the projects and dreams of his youth fully realised—and more than realised. I met Dohrn first in 1870 at Liverpool, when Huxley was president of the British Association, and in May and June of the next year went, after a winter spent in Leipzig, to join him at Jena, where he was a "privat-docent" in zoology. He was then thirty years of age, and had done some excellent embryological work on the Crustacea, in furtherance of which he had passed some months at Naples and Messina. His father, with whom I later spent some weeks at Naples, was a very remarkable man, one of the iron-willed, somewhat grim type of North Germans, a handsome old gentleman, known throughout Europe as a great collector of Coleoptera,

[1] "Die biologischen Schülerübungen." By Erich Leick. (Leipzig: Quelle and Meyer, 1909.)

[2] "Freiwillige Schülerübungen in Physik in humanistischen Gymnasien." By Prof. Dr. Edmund Hoppe. (Leipzig: Quelle and Meyer, 1909.)

a hobby which brought him into close personal friendship with similar enthusiasts in Italy, Spain, England, and France, whom he visited from time to time. He enjoyed an ample income from a sugar-refining business in Stettin, where he resided, and was anxious that Anton should accept the post of director of the Hamburg Zoological Garden, marry, and settle down there. But when I knew him at Jena, Anton had already made up his mind to do something really large and important for the progress of zoological science. Like others who had visited the Mediterranean in order to study its rich marine life, he had felt the difficulty of carrying on such work in lodgings, without apparatus, without library, and at the mercy of the fishermen whom it was necessary to employ and to conciliate. The French naturalist Coste had, when employed by the Government of the Second Empire to study economic questions connected with the national fisheries, established a laboratory, with aquaria, tanks, and fishing-boats, at Concarneau, on the Brittany coast. Henri de Lacaze-Duthiers had also arranged a permanent marine biological laboratory for himself and his pupils. The plan took shape in Anton Dohrn's mind of establishing a larger and more completely equipped laboratory than these on the Mediterranean coast, and, but for the war between France and Germany, he would probably have carried out his first intention and placed his laboratory on the coast near Marseilles. When I knew him he had already thought out the scheme which he realised, and had determined to try to secure a site at Naples in the Villa Reale, which stretches along the shore. He had succeeded with no little difficulty in securing a certain sum of money from his father—his heritage, in fact—and he intended deliberately to risk this in his enterprise. His plan was to secure the cooperation of all European universities in building and maintaining the Naples laboratory, or "station," as he proposed to call it. This meant, in all cases but that of England, the cooperation of the State Governments. But in order to obtain this support and cooperation he realised that it was necessary, at whatever effort and risk, to make a plunge—to start the "stazione," to erect a fine and imposing building, to demonstrate the convenience and excellence of its organisation, and thus to secure approval and unhesitating financial assistance. His plan was to sink his own fortune in that first step, and he did so. He obtained help from friends both at home and in this country as the building grew, and by tactful appeal and untiring effort—involving years of work given up to persuading statesmen, politicians, associations, professors, millionaires, and emperors of the value and importance of the great Naples "Stazione Zoologica"—he achieved for it a splendid and permanent position.

During the two months which I passed in 1871 at Jena, Dohrn, Kleinenberg, Abbé, and I used to dine in Dohrn's study, our meal being sent in from the Black Bear Hotel. We were usually joined by Willie Preyer, the professor of physiology, in our after-dinner walk in the "Paradise," which resembled Christ Church meadow on a smaller scale. I attended Gegenbaur's lectures, and was kindly given a place by Haeckel in his laboratory, where I was one day visited by the Grand Duke of Saxe-Weimar, who told me that he was a cousin of my Queen, and kissed Haeckel on both cheeks, much to my astonishment. I was working at the embryology of Mollusca, and especially at that of Pisidium, a minute bivalve, the haunt of which Kleinenberg showed to me. He himself was preparing his celebrated work on Hydra. Abbé was experimenting and applying mathematical knowledge in the optical workshop of Zeiss, which led later to the splendid result which all the world knows. Those delightful men, with the exception of the veteran Haeckel, are all dead now. Haeckel remains not only alive and active, but faithful to Jena. In those days Jena was a singularly beautiful place. The nearest railway station was at a distance of seven miles. It was a very small town. I had a room overlooking the "Prinzessen-garten," and was kept awake by the nightingales. Dohrn and I took long walks in the wooded hills of the Thuringer Wald, and I learnt and discussed fully with Dohrn his plans for the Naples "station." He adopted the name "station" because he hoped that, in the course of time, other thoroughly equipped marine zoological laboratories would be set up elsewhere on the same sort of international cooperative basis as that which he intended to adopt at Naples. Port Jackson was one point which we selected for a future station, and some favoured spot on the Japanese coast another. Already, before we left Jena, and before he had opened any negotiations with the Neapolitan municipality, Dohrn had planned the series of monographs of the fauna and flora of the Gulf of Naples which has been so splendidly realised. Dohrn was a profound student of Goethe, and had a saying of the great teacher for every occasion. He was what appeared to me, with my English upbringing, singularly introspective, and he puzzled, even occasionally alarmed, me by his self-conscious and systematic cultivation of his will-power. I have no doubt that he was fully endowed with this power, as his remarkable accomplishment of what he set out to do proves, and I do not suppose his anxiety to keep it at a high pitch of activity was really of any effect in the end. When we were at Jena he did not smoke and drank very little. It was not, I think, until he was past forty that he took to tobacco. I left him at the end of June, 1871, promising to join him at Naples in October. He arranged to take an unfurnished flat in the Palazzo Torlonia, where we were to have ample space, and to take down with him plans for the projected laboratory, and an architect. Whilst he negotiated with the municipality and the Italian Government, I was to set up a temporary laboratory in our flat and pursue embryological work. This plan was carried out. Dohrn had succeeded in obtaining the definite and effective support of the new German Imperial Government, and his path with the Naples municipality was smoothed. But there was a good deal of haggling and putting forward of the palm of the hand (which Dohrn ignored) before the site to be occupied by the "Stazione" in the Villa Reale (or Nazionale, as it is now called) was made over, with many queer and strenuous conditions, to Dohrn, and so to the building contractor. When I left Naples in May, 1872, after an attack of typhoid fever, the walls of the laboratory were a couple of feet above ground. An example of the innumerable difficulties which Dohrn had to surmount is the challenge to a duel brought to him by the representative of the Neapolitan architect whom he had agreed (in order to conciliate the Neapolitans) to employ for the design of the elevation. This gentleman considered himself insulted because Dohrn refused to promise him a ten per cent. commission instead of the five per cent. which is usual in northern Europe. I had to act as Dohrn's second, and conferred with the Neapolitan architect's friend. On my insisting that Dohrn was a soldier of the German Emperor, and a very deadly man with the sabre—and determined not to yield to any nonsense—the challenge was withdrawn, and the insulted architect completed his task very satisfactorily. On another occasion, in my presence, Dohrn was deliberately threatened with assassination by a Neapolitan who could not get his own way. "You forget," the Neapolitan said, "that the night is dark and that for a few francs I can get a couple of men to deal with you." Another very

awkward thing was that the young German architect who had come to Naples with Dohrn, and was living with us in the Palazzo Torlonia, suddenly went quite mad, and had to be sent home under escort. Happily he completely recovered. A great feature in our life at the Palazzo Torlonia was the occupation of one of the chief "flats" (ours was high up in a building against the Posilippo cliff) by the Baranowski family. Dohrn had made their friendship in Sicily a year before, and we spent nearly every evening with them. Baranowski had been governor of the Russian province of Orenburg, and was now employed by the Russian Government on important missions in China. His wife, a Polish lady, her sister, two daughters, and a son, took up their residence in the chief "suite" of our Palazzo, and in the late winter were joined by Baranowski himself, whose official business did not allow him to remain for long. All those dear friends of the Palazzo Torlonia are now dead and gone, with the exception of the elder of the two sisters, who three or four years later married Anton Dohrn, and is the mother of his four now grown-up sons. She nursed him in his last illness during the past six months at Munich. In 1874, when the Naples laboratory was built and its machinery at work, its rooms filled with professors and investigators from all parts of Europe, including the wonderfully gifted and beloved Frank Balfour and his friend Dew-Smith, I again spent three months at Naples. Dohrn was suffering from the labours he had gone through in securing the position of the laboratory, and also from the climate of Naples. He was engaged, but his marriage was delayed and his future wife's family were no longer at Naples. A very remarkable Englishman, Grant by name, who had been lecturer in English literature and a close friend of Dohrn's at Jena, was with him, and remained for some years in Naples. His delightful book, "Stories of Naples and the Camorra," is the memorial of the work Grant did there. He died some years ago. Later I made two short visits to Naples, and saw my friend with his family growing up around him. In the 'nineties he visited Oxford and received an honorary degree. For some years the University, following the example of Cambridge, had rented a table at the Naples station, and provided the travelling expenses of a graduate selected to pursue investigation there.

During the thirty-six years of its existence, the Naples station has increased vastly in size and the perfection of its organisation. Its biological library is one of the best in the world, its staff of servants, assistants, and skilled workers of all kinds unrivalled. Having secured capable assistants in all departments and the funds for carrying on the now large and celebrated institution, Dohrn was able to pursue some of the problems of vertebrate morphology which had occupied his mind already in Jena days. I think that the most important of the general ideas which he had arrived at in those early times was, first, that degeneration or simplification of organic structure is a result of evolution as well as increase of complexity, and that the relatively simple or less complicated members of a group are not necessarily more primitive or archaic than the more elaborately structured members. Also of great value was his determination to take a free and unprejudiced view as to the lines of the animal pedigree, and he particularly objected to being tied in any way to the conclusions of Haeckel on this subject. He successfully resisted the notion that either Amphioxus or the Ascidians represent in any definite or complete way the lower phases of vertebrate ancestry. He held that they were specialised, and, in the sense of being simplified, degenerate. He sought himself to connect the vertebrate stock with that of the chætopod worms, but though this hypothesis led him into many interesting discoveries of detail—which are published in a series of papers in the *Mittheilungen* of the Zoological Station of Naples—it cannot be said to have been placed on a secure footing, and we are still speculating, with very little assurance, as to the nature and structure of the pre-vertebrate ancestors of Vertebrata.

Dohrn was a great lover of classical music, like his father, and I think that music and philosophy were his chief relaxations from the severe labour of business correspondence and scientific discussion. He was very fortunate in having the opportunity, some fourteen years ago, of receiving the German Emperor at the Naples laboratory. He was able thoroughly to interest that able man in the work of the institution, who recognised that it was a real honour and glory to the German name, and accordingly gave to it his warm friendship and support. From that time forward large assistance has been given to the Naples laboratory from Berlin, and I believe that some definite responsibility in regard to the institution—involving possibly its ownership—now passes to certain authorities in Berlin.

It is a great and satisfactory thing which I have had to record here—the success of a noble effort. Dohrn's example in founding a "station" for marine zoology has been followed in a modest way elsewhere. The Marine Biological Laboratory at Plymouth, which I joined with others in founding some twenty-five years ago, was, confessedly, an attempt to provide on our English coast an institution similar to, if less spacious than, that established by Anton Dohrn at Naples. The Plymouth laboratory has done good service to science and to fishery interests, but London is not Berlin, nor are the ways of British departments of Government in regard to science in any way similar to those of the German Imperial Government. The former are ignorant, envious, and destructive; the latter are intelligent, friendly, and helpful.

E. RAY LANKESTER.

NOTES.

IN reply to a question asked in the House of Commons on Thursday last, the Postmaster-General stated that arrangements have been completed with the Marconi Company for the transfer to the Post Office of all their coast stations for communication with ships, including all plant, machinery, buildings, land, and leases, &c., and for the surrender of the rights which they enjoy under their agreement with the Post Office of August, 1904, for licences or facilities in respect of coast stations intended for such communication. In addition, the Post Office secures the right of using, free of royalty, the existing Marconi patents and any future patents or improvements, for a term of fourteen years, for the following purposes:—communication for all purposes between stations in the United Kingdom and ships, and between stations on the mainland of Great Britain and Ireland on the one hand and outlying islands on the other, or between any two outlying islands; and (except for the transmission of public telegrams) between any two stations on the mainland; and on board Post Office cable ships. All the stations will, under the International Radio-telegraphic Convention, be open for communication equally to all ships, whatever system of wireless telegraphy they may carry, and the Post Office will be free to use or to experiment with any system of wireless telegraphy at its discretion. All inland communication of messages by wireless telegraphy will be entirely under the control of the Post Office. Arrangements have also been made with Lloyd's for the transfer

to the Post Office of their wireless stations for communication with ships, and for the surrender of all claims to licences for such communication.

AN Italian National League against malaria has recently been formed, and the first meeting is now taking place at Milan. The inaugural address is being delivered by Prof. Baccelli, and the following communications have been promised:—the present state of knowledge in regard to malaria, by Prof. Bordoni-Uffreduzzi; prophylaxis against malaria, by Prof. Castellino; the pathology of malaria, by Prof. Golgi; some questions relating to the pathology and treatment of malaria, by Prof. Grassi; little known abortive forms of malaria, by Prof. Queirolo.

THE programme of the second International Congress for the Repression of Adulteration in Food, Chemical Products, Drugs, Essential Oils, Aromatic Substances, Mineral Waters, &c. (to be held in Paris on October 17–24), has now been issued. The discussion of the various subjects will be classified in the following sections:—(1) wines, alcohols, syrups, liqueurs, beer, cider; (2) farinaceous foods, baking, pastries, meat and other pastes, spiced confectionery; (3) cocoa, chocolate, confectionery, honey, sugar, and sugar candy; (4) vinegar, mustard, pepper, spices, tea, coffee, chicory; (5) butter, milk, cheese, eggs; (6) lard and edible fats, margarine, provisions preserved in oil, bacon, sausages and pork products, salted provisions, and canned and bottled goods; (7) drugs, chemical products, essential oils, &c.; (8) mineral water (medicinal), aërated waters, ice.

IN opening the *Nimrod* Antarctic Expedition last week, the Lord Mayor of London stated that he intended to call a meeting at the Mansion House to initiate a fund towards the expenses of the forthcoming expedition under Captain Scott to the south polar regions.

IT is stated in the *Times* that a telegram has been received from Dr. T. G. Longstaff to the effect that he has arrived at Leh, in Ladak, after having connected the Tarim river with the Saichar glacier, making it about fifty miles long. This would appear to mean that the Tarim or Yarkand Darya river, which flows north from the Himalayas towards the Taklamakan desert, and had hitherto been supposed to rise near the Karakoram Pass, originates much further to the west in the Saichar glacier. On existing maps, what was supposed to be a branch of the river is shown to originate in the Saichar glacier, and it is that branch, apparently, which Dr. Longstaff makes out to be the main river.

THE Ottawa correspondent of the *Times* states that a telegram has been received by the Canadian Marine Department from Captain Bernier, of the Canadian Government steamer *Arctic*, which left Quebec fourteen months ago to cruise in the Arctic region, announcing his arrival at Point Amour, Labrador. Captain Bernier says that he has accomplished his mission, which was to report upon the ice conditions in Hudson's Straits in 1908 and then to proceed north and take possession of Banks Land and other Arctic lands for Canada; he also states that he discovered the record left at Winter Bay in 1819–20 by Lieut. (afterwards Sir E.) Parry.

PROF. J. V. HEPPERGER has been appointed director, and Dr. J. Palisa vice-director, of the Imperial University Observatory, Vienna.

MR. PHILLIP FOX, formerly of the Yerkes Observatory, has now assumed the directorship of the Dearborn Observatory, Evanston, Illinois, in succession to the late Prof. G. W. Hough.

WE learn with regret that M. J. A. Fraissinet, secretary of the Paris Observatory, died, in his sixty-third year, on August 29.

THE Denny gold medal has been awarded by the Institute of Marine Engineers to Mr. W. P. Durtnall, for his paper on the generation and electrical transmission of power for main marine propulsion and speed regulation, which was read at the Franco-British Exhibition in July, 1908.

AS was announced in NATURE of July 15, a model engineering exhibition will be held at the Royal Horticultural Hall, Westminster, on October 15–23. We learn from the promoters that the exhibition will contain a number of exhibits of exceptional interest, *e.g.* model aëroplanes, working model steam and electric railways, electric clocks, light machine tools, model motor-boats, a model engineer's workshop in operation, and a working demonstration of wireless telegraphy by the latest Marconi apparatus.

SIR WILLIAM MACGREGOR, who is shortly to take up his duties as Governor of Queensland, was entertained at luncheon last week at Liverpool, and, speaking in reply to the toast of his health, said he had known the Liverpool School of Tropical Medicine from its inception. He had spent thirty-one years in the service of the country in the tropics, and he thought that few people had had a better opportunity than he had of seeing how much an institution of this kind was wanted in the world. Few men could better appreciate the amount of good it had been able to do. He had had the opportunity of renewing his studies at the school, and what he had been able to learn had been of considerable use to him and would be of great value to others. It was a great school, not on account of its size, but because it was the nucleus which was going to scatter broadcast tropical schools all over the Empire. The beginning of the Liverpool School of Tropical Medicine they owed from a scientific point of view to Major Ross, but to Sir Alfred Jones they were almost equally indebted. He looked upon the school as being the pioneer of all other schools of this kind that were to follow.

A COURSE of twelve free lectures under the Swiney trust will be begun in the lecture theatre of the Victoria and Albert Museum, South Kensington, on Saturday, November 6, by Dr. T. J. Jehu, who will take as his subject "The history of north-west Europe during Tertiary times."

THE new session of the Royal Geographical Society will open on November 8, when a paper entitled "Two Journeys in Bhutan" will be read by Mr. J. Claude White. The other papers expected to be delivered at meetings before Christmas are:—journey into northern Arabia, by Mr. Douglas Carruthers; explorations in the Hispar region, by Dr. Hunter Workman and Mrs. Bullock Workman; and a naturalist's travels on the Congo-Zambezi watershed, by Mr. S. A. Neave. The papers expected after Christmas are:—an expedition to the North Pole, by Commander Peary; explorations in and around Lake Chad, by Captain J. Tilho; explorations in Fernando Po and the Cameroons, by Lieut. Boyd Alexander; explorations in southern Nigeria, by Mr. P. A. Talbot; explorations in and around Magellan Straits, by Dr. K. Skottsberg; a journey from Uganda by Lake Rudolf to Abyssinia, by Captain C. H. Stigand; explorations in the Aldabras, by Mr. J. C. F. Fryer; climbing and exploring in Central Asia, by Dr. T. G. Longstaff; boundary-making and ex-

ploration in Bolivia and Brazil, by Major P. H. Fawcett; exploration in the Kasai region of the Congo, by Mr. E. Torday; a journey in South-west Africa, by Prof. Pearson; geographical conditions affecting the development of Australia, by Prof. J. W. Gregory, F.R.S.; and geographical conditions affecting the development of Canada, by Mr. W. L. Grant.

ARRANGEMENTS have been completed whereby a standard clock at the Hamburg Observatory, Bergedorf, is connected to the trunk telephone system. A sounder automatically emits a siren-like note from the fifty-fifth to the sixtieth second of each minute—mid-European time—and this goes automatically to all the receivers connected, at that time, with the special exchange number which has been allotted to the time signal. Thus Hamburg and neighbourhood and other towns of east Germany are supplied with a ready means of ascertaining the standard time.

THE past summer was characterised by cool and unsettled weather, and, with the exception of about a fortnight at the commencement of August, there was a peculiar absence of warm days. For the six months April to September the observations at Greenwich show that there were in all only fifty-three days with a temperature of 70° or above; of these, twenty occurred in August and eighteen in July, whilst there was only one instance in September. During the last quarter of a century the only years with as few warm days are 1888, 1894, and 1903. On the average of the last fifty years, there are seventy-four such warm days. There were nine days with a temperature of 80° or above, and in the last five years the number varies from two in 1907 to twenty in 1906. The absolutely highest temperature during the summer was 86°, on August 12 and 15. The aggregate rainfall at Greenwich for the six months is 14·04 inches, which is 1·75 inches more than the average summer fall of the last fifty years, the mean being 12·29 inches. With the exception of the summer of 1903, when the aggregate rainfall was 22·21 inches, there has been no summer as wet since 1888. There was an excess of rain in all the summer months except May and August, and the wettest month was June, with a total of 3·65 inches, which is 1·65 inches above the average. The early summer months were exceptionally bright, and a record duration of sunshine for any month was established in May, with 326 hours, but most of the subsequent months had a deficiency of bright sunshine.

SOME remarkable experiments on the reproductive apparatus of insects have recently been conducted by Prof. J. Meisenheimer, and are recorded by him in a treatise ("Experimentelle Studien zur Soma- und Geschlechts-Differenzierung") published by Fischer at Jena. The results of this investigation have been summarised by the author in the *Naturwissenschaftliche Wochenschrift* for August 29. The species selected for experiment was the well-known "gipsy moth," *Lymantria dispar*. The reproductive glands were removed from larvæ of both sexes, in some cases immediately after emergence from the egg. The difficulty of operating upon larvæ barely three millimetres long must have been great; it was, however, successfully overcome by aid of the galvanic cautery. In larvæ of a larger growth an actual transplantation was effected of testis into the female and ovary into the male. Details of much interest are given in the original paper; the main result is that, in strong contrast to the conditions obtaining in vertebrates, the removal of the primary sexual organs has no effect upon the development of the remainder of the sexual apparatus, or of the secondary sexual characters whether somatic or psychic. This takes its normal course even in the presence of a successfully transplanted primary organ of the opposite sex.

To the August number of the *National Geographic Magazine* Mr. H. M. Smith, U.S. Deputy Commissioner of Fisheries, communicates a very graphic and interesting account of the herring-fisheries of the world, in which stress is laid on the importance and value of this industry, which has determined the position of cities and influenced the destiny of nations. In America large numbers of the smaller-sized herrings are tinned and sold as sardines. In place of the methods adopted on this side of the Atlantic, weirs of stakes and brushwood play an important part in the American herring-fishery. As the average tidal rise and fall is 20 feet, and in spring nearly 30 feet, the weirs are necessarily large and strongly built structures. These weirs are fished at low water, when the fishermen enter in boats, set a seine and haul its ends together, and proceed to take out the fish in huge dip-nets. Sometimes, however, the herring are left high and dry by the falling tide, when they are collected by hand or with pitchforks.

IN No. 29 of the "North American Fauna," published by the Biological Division of the U.S. Department of Agriculture, Mr. E. W. Nelson gives an exhaustive account of the Leporidæ of North America, of which no fewer than ninety-seven species and races are recognised, against eighteen in 1887. Although in America all the members of the family are commonly termed rabbits, the author suggests that the name rabbit should be restricted to the so-called "cotton-tails," which produce blind and naked young in burrows or other concealed cavities, while the species related to the typical Lepus of the Old World should be designated hares. The fact that the cotton-tails resemble the European rabbit in the matter of habits and the condition of the young at birth goes far to justify their separation as Sylvilagus, although that term might perhaps be preferably employed in a subgeneric rather than in a generic sense. It is pointed out that both "jack-rabbits" and "cotton-tails" are serious pests to the agriculturist and horticulturist in the United States, although the former are considerably the worse of the two. On the other hand, these rodents form a valuable asset to the country as a source of food and of fur.

IN the annual report of the Natural History Section of the Indian Museum for 1908–9 the director states that the Museum Conference at Calcutta has done much to facilitate the interchange of opinions and specimens between the various museums of the country. At that conference it was agreed that the Calcutta establishment was to be the depository for all type-specimens, except such as, for climatic reasons, would be safer in London. Among recent additions attention is directed to a skeleton of the Mishmi takin (*Budorcas taxicolor*), which is alleged to be the only one in existence. If those of the living individuals of the species be excluded, this statement may be literally true, although it might have been added that the British Museum possesses skeletons of the Bhutan race (*B. t. whitei*) and of the Sze-chuen *B. tibetanus*.

IN the September number of the *Zoologist* Mr. G. B. Corbin states that the smooth snake (*Coluber laevis*, or *austriaca*) is still to be found in the New Forest and on the heath-lands on the opposite side of the Avon, where it was first recognised as a British species. Unfortunately, a portion of its habitat is slowly but steadily coming under the hand of the builder.

WE have received three parts (Nos. 1, 4, and 5) of a new Bulletin of Economic Biology, issued by the Depart-

ment of Agriculture of the Federated Malay States. and published at Kuala Lumpur. No. 1, by Mr. H. C. Pratt, the Government entomologist, deals with termites found in rubber-plantations; No. 4, by the same author, is devoted to a zygænid moth (*Brachartona catoxantha*), the larva of which infests cocoanuts; while in No. 5 Mr. W. J. Gallagher discusses the best means of destroying the rats, which do serious damage to rice-fields.

MR. H. M. LEAKE has followed up his first paper on the experimental breeding of Indian cottons by a second, published in the Journal and Proceedings, Asiatic Society of Bengal (vol. v., No. 1). The author's object is to discover characters which behave as units under artificial crossing. In the present paper he records the constancy for Indian cotton plants of the position of the accessory bud on the main stem, *i.e.* certain plants regularly produce the accessory bud to the right, others to the left, of the main bud, but this character does not follow the Mendelian laws. Similarly, the main stem is always a monopodium, but the subsequent branching may be monopodial or sympodial; these are two distinct types, of which the sympodial is dominant. Further, it was observed that early flowering is a feature of the sympodial type, and herein lies the importance attached to a differentiation of Indian cottons according to their mode of branching.

THE thirty-fourth series of contributions to the flora of Africa, published under the direction of Dr. Engler, occupies the bulk of Engler's *Botanische Jahrbücher* (vol. xlii., parts i. and ii.). An important revision of African species of the genus Impatiens is supplied by Dr. E. Gilg, and Dr. Engler contributes descriptions of several new species, notably of the genus Mesembrianthemum. The classification of African species of the polymorphic genus Senecio is discussed by Dr. R. Muschler. Five subgenera, comprising about 500 African species, are demarcated. The subgenus Eusenecio is further divided into many sections, of which twenty are added by the author. The sections *crassuli* and *kleinioidei* are succulents, similar in this respect to the subgenus Kleinia; the section *tuberosi* is based on the production of large tubers; a large group is that of climbing plants, *scandentes*; other sections are the *pinifolii*, *rhizomatosi*, and *arborei*, the latter being represented by *Senecio Johnstonii*, a tree attaining a height of 45 feet.

A SECOND set of studies of tropical American ferns, by Mr. W. R. Maxon, is published in the Contributions from the United States National Herbarium (vol. xiii., part i.). The first paper deals with ferns collected in Guatemala by Baron von Türckheim, principally in the humid mountainous region of Alta Verapaz. The determinations include several new species, notably an interesting Campyloneuron and an epiphytic Lycopodium, also the species *Diplazium ternatum*, formerly recorded from Mexico. The author also supplies a revision of the West Indian species of Polystichum, with a key for determination. Diagnostic characters are sought in the presence or absence of a proliferous bud upon the rachis. Where present, it may arise immediately above the uppermost pinna, as in the species *heterolepis*, or on a whip-like prolongation, as in *P. decoratum*.

THE Cambridge Scientific Instrument Company, Ltd., has recently issued a new catalogue explanatory of its microtomes and accessory apparatus. The ingenious rocking microtome is, of course, universally known; the present-day instrument shows several improvements on the original pattern, notably in the fitting of the rocking arms. A second type of microtome, also a rocker, cuts flat sections, and is suitable for objects up to a diameter of 30 mm., while a larger microtome has been recently designed which will take objects up to 40 mm. diameter, and with which hard substances, such as bone or cartilage, can be manipulated.

THE Bulletin of the Johns Hopkins Hospital for August (xx., No. 221) is devoted to tuberculosis. The subjects dealt with are tuberculin treatment of dispensary patients, report of the work of the Phipps Dispensary for Tuberculosis, Marmorek's serum in the treatment of pulmonary tuberculosis, and the kind of employment suited to arrested cases of the disease. In the last it is concluded that farm-colonies are the best possible means for the after-care of consumptives.

THE July number of the *Journal of Comparative Neurology and Psychology* consists of a monograph, by Mr. M. E. Haggerty, on imitation in monkeys. To the lay mind there will appear no question as to the power of monkeys to learn by imitation. The experimental evidence, on the other hand, has not always been on the side of popular opinion. It is true that Hobhouse obtained experimental evidence of the imitation of human behaviour by monkeys, and that Kinnaman observed two cases in which one monkey, after watching another monkey that had learnt to get food by manipulating a mechanical device, itself repeated the performance; but Thorndike was unable to find any such imitation of one monkey by another, and in neither of the two monkeys studied by Watson was there evidence that the watching animal learnt to get its food by seeing how the other animal got it. Mr. Haggerty bases his observations on no fewer than eleven monkeys. Following previous workers, he places the animals "in the presence of simple mechanical devices, the manipulation of which opened doors, disclosed openings, or dropped food into the experiment cage." The important feature of his paper consists in the extraordinarily detailed record of the movements of the monkeys while under experimental conditions. The seven mechanical devices with which the monkeys were at various times confronted yielded sixteen cases of successful imitation (three of which were immediate), five cases of practically successful imitation, and five failures. Seven of the monkeys imitated in every form of test, two failed absolutely, while two succeeded in some tests but failed in others. The statistical results, however, are of less interest than the valuable description of the facts of behaviour, inasmuch as there is doubt as to what shall be allowed to count as imitation. In the present state of the subject it is observation that is needed, and this Mr. Haggerty's paper supplies in abundance.

THE June number of *Petermann's Mitteilungen* contains a short paper on the climate of Siam, by Dr. W. Gerbing, which deals specially with the observations made by Dr. Hosseus during journeys in 1904 and 1905. Little is known of the meteorology of the mountainous regions of the Laos States, where Dr. Hosseus spent most of his time, and the observations are therefore of considerable value. They consist chiefly of seven months' records kept at the mission station at Djeng Mai by Dr. Harris, and temperature observations made *en route* and during halts in climbing expeditions on the Dai Sutep.

THE Bulletin of the American Geographical Society (vol. xli., No. 8) contains an article on the Stonington Antarctic explorers, by Mr. E. S. Balch. The article is based on letters and papers belonging to Mrs. Richard Fanning Loper, of Stonington, Connecticut, who inherited them from her father, Captain Alexander Smith Palmer. These papers are few in number, as most of the Antarctic

records of the Palmers were destroyed by fire in 1850, but they afford much valuable fresh information about four very fruitful exploring voyages, and throw many new side-lights on the formerly important sealing industry in the South Seas.

THE August and September numbers of the *Bollettino* of the Italian Geographical Society contain a report on the Messina earthquake of December 28, 1908, by Dr. Mario Baratta. The author gives the results of a full examination of the scene of the earthquake and a comparison of its effects with those of the earthquake of 1783. A number of illustrations and detailed maps accompany the report.

A SUPPOSED ancient canoe was recently discovered, embedded in sand below water (not in peat) near Lochmaben. It is formed of a single oaken trunk, and is about 13 feet long and 2 feet broad, with sides which can hardly have been 1 foot in height. The bottom is flat and smooth. On the inside there are two rows of neatly drilled holes, in which were wooden pegs. These holes are at intervals of 18, 21, 24, and 27 inches, and lie in shallow grooves close to the sides of the canoe. The bow has a distinct resemblance to that of a dug-out canoe, and it is of course possible that this may be an ancient boat with ribs to which rough planks were tied, but the evidence for this theory is hardly convincing. It differs greatly from the dug-out canoes found at Lochrutton and Friarscarse, which were probably used by the dwellers in the crannoges which existed in those lochs. We have to thank Mr. Thomas Henderson, of Lockerbie, for the measurements given above, which would seem to show that the people who made the holes used a foot rule divided into 12 inches. It is very likely, however, that a flat-bottomed boat of this kind might have been used in the loch at almost any period from 1200 A.D. to 1600 A.D.

ACCORDING to the *Jewish World*, the French expedition has made further notable discoveries at Susa, the Shushan of the Bible, the ancient Elamite capital. In the Acropolis the explorers found, superimposed one above the other, the remains of three cities dating back to B.C. 4000, and beneath these other settlements of the prehistoric period. The most important discoveries were three black stone pillars, on which was inscribed the law code of King Hammurabi of Babylon. The site appears to have been occupied by the Babylonians earlier than B.C. 2800. Subsequently the Elamites regained their independence, and retained possession of the city until B.C. 649, when it was sacked by Assurbanipal, King of Assyria.

PHYSICAL anthropologists in search of a new test of race to supplement that of the cephalic index, which no longer commands the authority once attributed to it, will welcome the essay, reprinted from the fourth volume of the *Philippine Journal of Science*, by Mr. R. B. Bean, entitled "Filipino Ears, a Classification of Ear Types." The author claims that he established for the first time a seriation of human ears, and that each ear type is associated with a physical variety of man. Most of the Filipino ears, except those of some long-term convicts, agree with the European type, and those varying from this standard are of an older morphological class. The Spanish population of Manila has ears closely agreeing with the European types among the Filipinos. In this, as in other characteristics, Chinese influence is apparent. He concludes that prehistoric Europeans have probably to some extent affected this ear type, and that Chinese ears are longer than those of Europeans, Filipinos, or Indians, because the Chinese population is composed more largely of the long-eared European types (northern, sub-northern, and Cro-Magnon). Ear type he believes to be to some extent independent of pigmentation, because the same type of ear is found in blonde and brunette Europeans, in dark- and light-skinned Filipinos, in dark-skinned Indians and light-skinned Chinese. It is improbable that his views of the permanence of ear type as a test of race will be accepted without criticism, but, at any rate, this monograph, with its large selection of photographs, raises a new and interesting problem.

AN interesting article on the climatic features of Wyoming and their relation to "dry-farming," by Mr. W. S. Palmer, section director, is published in the *U.S. Monthly Weather Review* of February last. From systematic data collected during the last seventeen years, it appears that the average annual rainfall of the State is 13·7 inches; in some parts the amounts vary from about 5 inches to 20 inches, and crops are now being successfully produced by the dry-farming method in semi-arid regions where a few years ago it was considered that the precipitation was not sufficient for the purpose. Prof. C. Abbe explains that the expression dry-farming may be considered as an abbreviation of dry-land-farming, and that the method consists in giving up the attempt to raise crops every year, and attempting instead so to conserve and utilise the moisture as to secure a crop every two or three years. Success depends essentially upon the annual quantity rather than upon the seasonal distribution of precipitation and evaporation.

IN the valuable meteorological charts of the Atlantic and Indian Oceans issued by the Meteorological Office for October, 1909, it is pointed out that the Southern Ocean has been remarkably free from icebergs and drift-ice throughout the first seven months of this year. Icebergs were frequently passed in 1908, and during the first five months of 1909 some were seen between latitude 52° and 59° S. and longitude 90° and 130° W., the loftiest being 300 feet high; but not a single berg has been sighted in the vicinity of Cape Horn. During the past quarter of a century many icebergs having an altitude of not less than 1000 feet have been met with in the Southern Ocean.

THE use of light filters in spectroscopic work whenever it is necessary to shut out all but a particular portion of the spectrum is so simple an expedient that we venture to direct attention to a list of Wratten light filters which has recently been issued. They consist of thin films of gelatin coloured with organic dyes, and the list gives the spectrum of the light transmitted in each case. One of the most useful for spectroscopic work appears to be the mercury green line filter, which is transparent for the mercury green line, but opaque for all the other mercury lines.

A DETAILED study of the lengths of the waves emitted by many of the ordinary forms of generators of short electric waves has been carried out by Messrs. H. W. Webb and L. E. Woodman at Columbia University, and the results are given in the August number of the *Physical Review*. The object of the authors was to establish such definite relations between the dimensions and electrical properties of the generators and receivers of the waves as to enable future workers to calculate the wave-length with certainty from the dimensions of the apparatus used. The method employed was Boltzmann's, the beam sent out by the generator being reflected at two mirrors, and the two half-beams brought together to produce interference. Rod, cylinder, Righi, and other generators were tested, and the wave-length measured in each case, a non-selective receiver being used. For apparatus of the same type, but of different size, the wave-length is proportional to the linear dimensions of the apparatus.

An interesting paper on sparks as indicators of the different kinds of steel was contributed by Mr. Max Bermann, Budapest, at the meetings of the International Association for Testing Materials, held in Copenhagen early in September. An abstract appears in *Engineering* for September 17, from which we learn that the author stated that the influence of the emery-wheel on the nature of the sparks was far outweighed by that of the quality of the steel. It seems from the author's experiments that the spark ray gives a precise indication of the quality of the metal, and may be so applied in practice. Pointed branching lines denote carbon steel (Siemens-Martin); leafy ends of the branching lines indicate Siemens-Martin steel containing a high percentage of carbon; spark pictures, with a blossom-branch-like appearance, are obtained from ordinary tool steel, and so forth. The author states that the spark test is so sensitive that it gives clear indication of a difference of 0·01 per cent. of carbon, and could be resorted to in the course of the Siemens-Martin process for testing the bath and also for the inspection of the finished material.

Among other interesting articles in the August number of *The Central*, the organ of the Old Students' Association of the Central Technical College, City and Guilds, is one on pipes for use underground, by Mr. H. A. Humphrey. In this article the writer emphasises the great value of a proper covering for steel pipes. Thin bituminous coatings, obtained by dipping in hot mixtures, is liable to be destroyed in places by the subsequent handling of the pipe. What is wanted is a coating which has elasticity and offers greater mechanical protection. The South Staffordshire Mond Gas Company followed the recommendation of the author for its mains, extending over an area of 120 square miles, a great portion of which lay in the "Black Country," thus rendering the mains liable to subsidences and to attacks from sulphur and acid compounds. The steel pipes were coated once with asphaltum, then wrapped round with Hessian or canvas, and afterwards again coated with asphaltum, the result giving a thick, tenacious coating of sufficient elasticity and strength. Five years' experience is now available, and has proved that even under the worst conditions such a coating, when properly applied, is an absolute preservative against corrosion.

OUR ASTRONOMICAL COLUMN.

Observations of Mars.—Further results of his observations of Mars are published by M. Jarry-Desloges in No. 4358 of the *Astronomische Nachrichten* (p. 224, September 24).

Changes are becoming more numerous, and the canals more visible. The observations made at the Massegros Observatory (Causse de Sauveterre) showed a new canal on Libya, but the Hellespontus was no longer visible. The Indus was seen to be intercepted at the estuary of the Oxus, and Syrtis Major and the Baie du Méridien were intersected. Since September 3, both at the Revard and the Massegros stations, a clear band traversing the Auroræ Sinus was recorded. The Revard plateau observing station is being dismantled before it becomes snow-bound, and the instruments are to be remounted on the plains of the Beauce.

Having occasion to examine some of Prof. Lowell's 1907 photographs of Mars, M. Antoniadi was struck by the absence of the dark band which, according to visual observations, is circumjacent to the polar snows. Whilst recognising the possibility that this may be due to the photographic encroachment of the neighbouring bright area, M. Antoniadi does not think that this is the probable explanation; he would rather believe that in the visual observations the phenomenon is a subjective one, the appearance of a dark band being produced by contrast with the bright cap.

Some interesting letters, describing the observed phenomena, and drawings, communicated by MM. Jarry-Desloges and Antoniadi to Signor Schiaparelli, are published by the latter in No. 9, vol. iii., of the *Rivista di Astronomia* (Turin).

The Recent Magnetic Storm and Aurora.—From Mr. Basil T. Rowswell we have received an account of an auroral display observed by him, at St. Martin's, Guernsey, on the night of September 25, the date of the magnetic storm described in Nature for September 30 (p. 395). On going into the garden at 8 p.m. (G.M.T.) Mr. Rowswell was struck by the appearance of a rosy glow, at an altitude of about 60°, in the E.N.E. sky. This glow brightened and then faded away, or was obscured by misty clouds and, possibly, moonlight, until at 8.10 p.m. no trace of it was to be seen; nor could it be discerned at 9 p.m. when the sky was partially clear. That it was a true auroral display which he observed Mr. Rowswell has no doubt, and he suggests that, had the sky been clear, a good, if brief, display might have been seen at Guernsey.

Elements and Ephemeris for Halley's Comet (1909c).—A set of elements, computed by the Russian Astronomical Society, for Halley's comet is published in No. 4358 of the *Astronomische Nachrichten*. The perturbations for the period November 15·9, 1835, to December 13, 1909, were computed by the method of mechanical quadratures, and the time of perihelion passage is given as 1910 April 23. An ephemeris which accompanies the elements gives positions for every tenth day from September 4 to December 23, and agrees fairly well with the position determined, for September 11, from Prof. Wolf's photograph.

Double-star Observations.—In No. 4350 of the *Astronomische Nachrichten* Prof. Doberck compares the observations of a number of double stars, made by various observers, with the data deduced from the published orbits. For twenty-three objects he gives the places where the orbits were published, the years in which observations were made, and the differences, for each observer, in angle and distance. The names of the observers are given in abbreviated form in accordance with a comprehensive list published by Prof. Doberck in No. 4346 of the same journal.

A Newly discovered Nebula Cluster in Cetus.—In No. 4352 of the *Astronomische Nachrichten* Prof. Wolf announces the discovery of a small cluster of nebulæ in the constellation Cetus. The position of the cluster is $\alpha = 2\text{h. } 50\text{m.}$, $\delta = +5{\cdot}4°$ (1855·0), in a region which is generally very barren in these objects. The new object is very faint, with a central condensation, and has a filamentous appearance.

Observations of Variable Stars.—No. 4352 of the *Astronomische Nachrichten* is devoted to the discussion of twenty stars of which the variability is doubtful or small. The observations were made, photometrically, at Potsdam, by Herr W. Münch, during the period September, 1908, to March, 1909, and are discussed at some length.

Terrestrial Refraction in Egypt.—No. 33, vol. iii., of the *Cairo Scientific Journal* contains an interesting discussion of some observations of vertical refraction made by Mr. Xydis at Alexandria. The observer found a well-marked diurnal variation which, in November, 1908, gave for k, the coefficient of refraction, values ranging from 0·0497 (at 9h.) to 0·1186 (at 17h.); frequently the value, which is usually positive, was found to be negative. The observations are also discussed by Messrs. Craig and Keeling, the latter pointing out the difficulties inherent to observations of vertical refraction, especially when settings are made on a sea horizon. Observations made at Helwan Observatory in November, 1908, showed the refraction to vary between 0·781 and 0·101, and, when compared with others made in June, showed that k is much smaller in summer than in winter, the values ranging, in June, from 0·368 to 0·076. It also appears that the refraction in Egypt varies much more than in European countries.

THE IRON AND STEEL INSTITUTE.

THE autumn session of the Iron and Steel Institute commenced on Tuesday, September 28. Meetings for the reading and discussion of papers were held on Tuesday, Wednesday, and Thursday at the Institution of Civil Engineers, and were attended by a large number of members. In the absence of the president, the chair was taken by Lord Airedale, supported by the Duke of Devonshire, who presented the Carnegie gold medal to M. A. Portevin, in recognition of his researches on steel alloys.

A short paper on the production of iron and steel by the electric smelting process, by E. J. Ljungberg, gives information regarding some experiments made in Sweden at the works at Domnarfvet. The latest form of furnace employed resembles a common blast-furnace having three carbon electrodes fed by three-phase alternating current at about 40 volts, 60 cycles, and 9500 amperes. These electrodes take the place of tuyeres. The furnace has been running for 1903 hours, and has produced 280 tons of iron containing from 0·95 per cent. to 3·09 per cent. of carbon. In producing this quantity there was used 442 tons of ore, 24 tons of lime, 41 tons of coke, 58 tons of charcoal, 6·5 tons of electrodes, and 891,623 kilowatt-hours of current. No air whatever is used in the process. The manufacture of iron and steel direct from ore by electrical means is of importance in a country like Sweden, possessing practically no coal mines, but having numerous waterfalls available for the generation of electricity. A commercial start has been made by the installation of three large furnaces in Canada at Sault Ste. Marie.

The difficulties encountered in tests for determining the economy of steam engines used in driving reversing rolling-mill engines are explained in a paper by Mr. C. A. Ablett. Such tests are usually carried out by indicating the engine, and so estimating the steam consumption per indicated horse-power, or by measuring the feed water or coal consumption in cases where the boilers supplying the engine can be isolated. In the latter case the result can be expressed in pounds of steam or coal per ton rolled, provided a record is kept of the total weight of steel passed through the mill during the test. The author also describes how the power consumed in electrically driven mills may be obtained by means of an ordinary integrating wattmeter. The results of such tests are expressed easily in kilowatt-hours per ton. Five steelworks have decided to adopt electrical driving since the last autumn session of the institute, making more than twenty firms in all which have come to this decision. The author gives some results of electrically driven rolling mills, from which we quote the highest and the lowest. In rolling flange rails, 100 lb. per yard, from 2-ton ingots, output 30 tons per hour, 48·0 kilowatt-hours per ton were required. In producing 32-inch by 9-inch slabs from 6-ton ingots measuring 36 inches by 19½ inches, output 40 tons per hour, 4·3 kilowatt-hours were required.

An interesting paper on the growth of cast irons after repeated heatings was contributed by Profs. H. F. Rugan, of Louisiana, and H. C. H. Carpenter, of Victoria University, Manchester. The fact that certain types of cast iron grow after repeated heatings has long been familiar to engineers. Cast iron annealing ovens 8 feet in length, 3 feet in diameter, and 1½ inches in thickness, kept red hot for prolonged periods, sometimes grow to 9 feet in length in the course of use. The conditions under which the maximum growth occurs were first investigated, and, as a result, a period of four hours at 900° C. was chosen for the experiments. For growth to take place, repeated heating and cooling are required. In the tests, three commercial cast irons were examined, the test bars being heated in a cast-iron muffle protected by another muffle of fire-clay. The bars grew at different rates and to different extents, constant volume being reached after ninety-four heats. The growth in volume varied from 35·21 per cent. to 37·50 per cent. An increase in weight of from 7·82 per cent. to 8·60 per cent. was observed. The connection of growth and chemical composition was investigated on a series of iron-carbon alloys containing no graphite. An alloy was found the volume of which remains constant even after repeated heatings at about 900° C. This alloy is a white cast iron having about 3 per cent. of carbon and only small quantities of other constituents, of which silicon is the most important, and this should not exceed 0·2 per cent. to 0·3 per cent. The influence of silicon was examined in a series of iron-carbon-silicon alloys. The growth was found to be roughly proportional to the silicon present. In grey irons there are alloys the growth of which in air on heating is due entirely to oxidising gases penetrating their interior; in others, originally dissolved gases contribute to some extent to the growth.

Some experiments carried out at the Clarence Ironworks, Middlesbrough, are described in a paper by Mr. Greville Jones. These experiments had for their object the determination of whether the principal saving in fuel in blast-furnaces using dry air blast was due to the uniformity of the blast or to its dryness. Two furnaces were used, both of the same size and carrying the same load. For comparison, one of these was run with dry blast, and the other was supplied with blast in which the moisture was gradually increased up to 4 grains per cubic foot during the first of the four weeks over which the experiments extended. No appreciable difference was found in the working of the two furnaces.

Mr. R. S. Moore dealt with the fuel economy of dry blast in a subsequent paper. The author was associated with Mr. Jones in the tests at the Clarence Ironworks, and believes that the results of these tests point strongly to the fact that the great heat saving of the Gayley dry blast must be due to its dryness.

In another paper Mr. F. J. R. Carulla considers the development of the process of manufacturing artificial magnetic oxide of iron. Dr. William Gregory, of Edinburgh, first observed that when a solution of protosulphate of iron is divided into two equal parts, one of which is peroxidised, then mixed with the other, and precipitated by ammonia at a boiling heat, a black oxide is obtained which does not attract oxygen in drying, and is highly magnetic. Its composition must be $2FeO+Fe_2O_3$, as the two solutions contain equal quantities of iron, and Gregory suggests that it may occur native as a variety of magnetic iron ore. Dr. Wülffing first worked out its industrial manufacture from waste liquors. Notwithstanding difficulties, the product is difficult to spoil in the making, and the great protective value of the Gregory-Wülffing magnetic oxide of iron paint is acknowledged by all who have had any experience of it.

The serviceable life and cost of renewals of permanent way of British railways were dealt with in a paper by Mr. R. Price-Williams. The total annual cost of the maintenance and renewal of the permanent way and works now amounts to 15 per cent. of the entire working expenses, which for some years past have reached the high figure of 63 per cent. of the entire railway gross receipts. The wear and tear of permanent way during the last ten years amounts to 5039 miles of railway, which have become worn out and have been replaced in most, if not all, cases with stronger and better materials.

Dr. J. Newton Friend, in a paper on the corrosion of iron, points out that the ionisation of water, which forms the base of the electrolytic theory of corrosion, is purely an assumption of which we have no definite proof. Kohlrausch showed that water offers the greater resistance to the passage of an electric current the more carefully it is purified. Not a few chemists maintain that if absolutely pure water could be obtained it would be found to be incapable of conducting an electric current—in other words, that it would not be capable of ionisation. Leduc has directed attention to the extreme difficulty of removing every trace of dissolved gases from water by boiling. The author points out that the results obtained by Kohlrausch and Heydweiller may be simply a measure of the extent to which the dissolved gases remain in solution under the special conditions of the experiments. If such is really the case, the electrolytic theory of corrosion becomes a myth, whereas the acid theory is unaffected by it.

Dr. Friend read another paper on the action of air and steam on pure iron. His experiments show that pure iron combines with ordinary air and with air dried over phosphorus pentoxide with increasing readiness as the temperature rises. Below 150° C. the oxidation proceeds too slowly to be readily detected. Pure iron becomes tarnished

when heated in pure steam at temperatures ranging from 350° C. upwards. The author concludes that the action of steam on iron takes place in two stages, first, the dissociation of the steam, second, the combination of the dissociated oxygen with the iron and the consequent liberation of free hydrogen gas. If this conclusion is correct, the dissociation pressure of the oxide of iron produced at 350° C. is of the order of $1{\cdot}02 \times 10^{-12}$ atmospheres.

A paper on tests of cast iron was read by Mr. E. Adamson. The general results were as follows. The best tensile and transverse tests are obtained from bars which have been machined. Transverse test bars cast on edge and tested with the "fin" in compression give the best results in testing. The transverse test is not so trustworthy or helpful as that of the moment of resistance. The use of high-grade ferro-silicon in the foundry is of no commercial value. Cast iron gives the best results when poured as hot as possible.

Mr. T. Swinden contributed a paper on the constitution of carbon-tungsten steels. This paper is a continuation of the author's earlier researches on the same subject. His hardness tests and exhaustive microscopic examination support in every respect the conclusions previously recorded upon the cooling-curve work, namely, that the "lowering temperature" marks a definite reaction in which the tungsten is involved, and that the rate of cooling from above the lowering temperature is without influence on the low point. It is suggested that the hypothesis of Edwards, that the lowering of the point is due to the formation of a carbide tungsten, is untenable. The theory of a double carbide formation is difficult to account for with the cooling curve and microscopic facts observed. A tentative hypothesis is given, wherein the lowering of the recalescence point is attributed to the solution of a tungsten compound, probably Fe_3W, at the lowering temperature. The tungsten is re-precipitated at the low point, and the Fe_3C immediately separates also.

THE OPENING OF THE LONDON MEDICAL SESSION.

ALTHOUGH under the present five-years' curriculum of medical study it is perhaps preferable for the student to commence his studies in the summer session, by a time-honoured ordinance the medical year in London always dates from October 1 or thereabouts, and is in many of the schools made the occasion for the distribution of prizes and the delivery of addresses of welcome and advice.

At University College Hospital Sir John Tweedy opened the session, and in his address dealt particularly with the importance of the experimental method in medicine. He pointed out that failure to appreciate the difference between the dissemination of knowledge and the advance of knowledge had given rise to much confusion of thought and not a little waste of endeavour. Perhaps the crudest manifestation of this confusion was the belief, real or feigned, by some persons that inquisitorial experiments are performed in hospitals on men, or on animals, or both. Less crude—nay, even creditable in a sense—was the notion that by establishing sanatoria or endowing special hospitals for the treatment of particular classes of general diseases it was possible to solve the problem of the nature and origin of these diseases and to hasten the discovery of the means of prevention and cure. He proceeded to give examples of the value of research in combating disease, instancing the discoveries relating to malaria, Malta and yellow fevers, and the arrest of hæmorrhage by the ligature of arteries, the last-named being the outcome of experiments on horses performed by Dr. J. F. D. Jones at the beginning of the last century.

At St. Mary's Hospital, the principal of the University of London, Dr. Miers, gave an address to the students on the importance of "theories." Dr. Miers said that for all people there was a certain period of life when they were ready and anxious to invent and to produce something original. It was in the period including the close of school life and the beginning of university life, or whatever came after school, that most people had been guilty of attempts to write poetry, or had endeavoured to construct a tale, or had believed themselves to be on the brink of a discovery or invention, or had taken up some new idea or theory of life which was for them, at least, a new thing of their own making and a piece of their own philosophy. It had been too much the fashion to decry youthful efforts, and to endeavour to persuade ourselves that knowledge and experience were required before anything good came out of a man unless he were a heaven-born genius.

After referring to the instances of Pasteur, Darwin, and other great workers in research, the lecturer went on to draw a distinction between the pleasure of merely acquiring knowledge or making observations, and that more intellectual pleasure of scientific discovery. He contended that after school days were over all the preparatory and educational work that they had to do should be taught and learnt in a new spirit, no longer as an exercise or a preparation, but as real active living research guided by the light of theory and inspired with the hope of discovery. He counselled medical students in all their work to adopt a theory and stick to it so long as they were able, and then, if necessary, to invent a new one, to work in the spirit of investigation in the light of their theories, and to regard all their work as belonging to medical science and illustrating the general principles of that science.

At the Middlesex Hospital, after Dr. Goodall, the subdean, had addressed the students on "walking the hospitals," in which he emphasised the importance of the ground-work of chemistry, biology, anatomy, and physiology for the intelligent study of clinical medicine, Lieut. Shackleton distributed the prizes and gave a sketch of some of his experiences in the Antarctic. The temperature of the explorers on the plateau went down to 94° F. or 93° F.—four or five degrees below normal—without ill effect. The members of the expedition did not suffer from colds, though on one occasion when a bale of clothing packed in England was opened they caught cold, but it disappeared when they went out, while those who remained in the hut still suffered.

"St. George's and the Progress of Physic" was the title of Dr. Rolleston's opening address at St. George's Hospital. The lecturer detailed many interesting facts in the lives of Matthew Baillie (physician to the hospital, 1787–1800), who did much for the study of anatomy; Thomas Young (physician, 1811–29), best known as the discoverer of the undulatory theory of light; John Hunter, the great anatomist and physiologist; Sir Benjamin Brodie, the well-known surgeon; and Edward Jenner, the discoverer of vaccination.

At the London School of Medicine for Women, Mrs. Garrett Anderson, M.D., in opening the proceedings, referred to the admission of Miss Woodward to the membership of the Royal College of Physicians.

Mrs. Henry Fawcett, LL.D., gave an address on "pioneering," in which she pointed out the courage and self-sacrifice displayed by the pioneer in every branch of human endeavour. The pioneers cleared away difficulties, made the road for those who followed safe and easy. If they really wished to recognise with gratitude the work which had been done for them by the great pioneers, she would wish nothing better for them than that they might be able to claim, even though they might not receive, the gratitude of those who followed after them in the noble profession to which they were devoting their lives.

FORTHCOMING BOOKS OF SCIENCE.

AGRICULTURE.

Constable and Co., Ltd.—Soils and Manures, J. A. Murray, illustrated.

ANTHROPOLOGY.

Wm. Blackwood and Sons.—The Life and Times of Akhnaton, Pharaoh of Egypt, A. E. P. Weigall, illustrated. *Constable and Co., Ltd.*—The Tomb of Queen Tiyi (Theodore M. Davis's Excavations), illustrated. *Macmillan and Co., Ltd.*—Totemism and Exogamy: a Treatise on Certain Ancient Forms of Superstition and Society, Dr. J. G. Frazer, 3 vols. *Swan Sonnenschein and Co., Ltd.*—Bushman Folk-lore, Miss L. C. Lloyd, edited by Dr. G. M. Theal, illustrated; History

and Ethnography of South Africa, 1505–1795, 3 vols., Dr. G. M. Theal: vol. ii., Formation of the Cape Colony by the Dutch; vol. iii., Account of the Dutch, Portuguese, Hottentots and Bantu.

Biology.

F. Alcan (Paris).—La Critique du Darwinisme social, J. Novicow.—*John Bale, Sons and Danielsson, Ltd.*—Household Pests and Household Remedies, W. R. Boelter; Handbook of Animal Parasites of Men and of Animals, Drs. Braun and M. Luhe, translated; Biological Excursions: being an easily understood Introduction to Biology, Dr. C. Thesing, translated by W. R. Boelter, illustrated. *George Bell and Sons.*—A new edition of Hayward's Botanist's Pocket-book, containing, in a tabulated form, the chief characteristics of British plants, with the botanical names, soil, or situation, colour, growth, and time of flowering of every plant, arranged under its own order, with a copious index, G. C. Druce. *A. and C. Black.*—Egyptian Birds, C. Whymper, illustrated. *Blackie and Son, Ltd.*—Ancient Plants: a Simple Account of the Past Vegetation of the Earth and of Recent important Discoveries in that Realm of Nature-study, Dr. Marie C. Stopes, illustrated. *W. and R. Chambers, Ltd.*—British Flowering Plants, W. F. Kirby, illustrated; Mammals of the World, W. F. Kirby, illustrated; A Book of Birds, W. P. Pycraft, illustrated. *Chapman and Hall, Ltd.*—The Craftsman's Plant-book, or Figures of Plants selected from the Old Herbals, arranged with Notes and Additional Drawings, and an Essay on the Use of Plants in Decorative Design, R. G. Hatton. *Constable and Co., Ltd.*—The Biography of a Silver Fox, E. Thompson Seton, illustrated. *J. M. Dent and Co.*—Physiology, Prof. C. S. Sherrington, F.R.S., illustrated (Scientific Primers); Zoology, Prof. W. A. Herdman, F.R.S., illustrated (Scientific Primers); Nature Photography for Beginners, E. J. Bedford, illustrated; Nature Stalking for Boys through Stereoscope and Camera, W. P. Westell. *Duckworth and Co.*—Diseases of Cultivated Plants and Trees, G. Massee, illustrated. *Gustav Fischer (Jena).*—Handbuch der Anatomie des Menschen, Dritter Band, Vierte Abteilung, Lymphgefässe, Dr. P. Bartels, illustrated; Allgemeine Biologie, Prof. O. Hertwig, new edition, illustrated; Die Säugetierontogenese, Prof. A. A. W. Hubrecht; Vorträge über botanische Stammesgeschichte, Dr. J. P. Lotsy, Zweiter Band, illustrated; Studien über die Bestimmung des weiblichen Geschlechts, Prof. A. Russo, illustrated; Zoologische und Anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika, Prof. L. Schultze, Dritter Band, illustrated; Lehrbuch der Botanik für Hochschulen, Profs. Strasburger and Jost, new edition, illustrated; Technik und Methodik des biologischen Eiweissdifferenzierungsverfahrens mit besonderer Berücksichtigung der forensischen Blut- und Fleischuntersuchung, Prof. Uhlenhuth and Dr. Weidanz, illustrated. *C. Griffin and Co., Ltd.*—The Plant Cell: its Vital Processes and Modifications. H. A. Haig, illustrated. *Harper and Brothers.*—Ant Communities, Dr. H. C. McCook. *T. C. and E. C. Jack.*—The British Bird Book, edited by F. B. Kirkman, in twelve sections, illustrated. *John Lane.*—The Book of Fern Culture, A. Hemsley; The Book of the Cottage Garden; The Book of the Sweet Pea, D. B. Crewe. *Longmans and Co.*—Beasts and Men, C. Hagenbeck, translated by H. Elliot and A. G. Thacker, with introduction by Dr. P. Chalmers Mitchell, F.R.S., illustrated; The Natural History of British Game Birds, J. G. Millais, illustrated; Field and Woodland Plants, W. S. Furneaux, illustrated; Spring Flowers at Belvoir Castle, with Directions for Cultivation and Notes on Gardening, W. H. Divers, illustrated. *Macmillan and Co., Ltd.*—Improvement of Wheat and other Cereals, Prof. R. H. Biffen. *A. Melrose.*—Darwin and Modern Science, Prof. J. A. Thomson; A First Book of Wild Flowers, M. M. Rankin, illustrated. *Methuen and Co.*—Bird Life, W. P. Pycraft, illustrated; Fungi and how to Know Them, E. W. Swanton, illustrated. *The Methodist Publishing House.*—Nature through the Microscope: Rambles and Studies of a Microscopist, Rev. W. Spiers, illustrated. *John Murray.*—Ornamental Bulbous and Tuberous Plants for the Open Air, Greenhouse and Hothouse, with Details as to Descriptions, Culture, and Propagation, J. Weathers.—*The Oxford University Press.*—History of Botany, Prof. J. Reynolds Green, F.R.S.; The Face of the Earth, Prof. E. Suess, translated by Hertha B. C. Sollas, edited by Prof. W. J. Sollas, F.R.S., vol. iv.; Knuth's Handbook of Floral Pollination, translated by Prof. J. R. Ainsworth Davies, vol. iii. *Sir Isaac Pitman and Son, Ltd.*—The Teacher's Course of Elementary Science, part ii., The Plant and its Life, F. Belton. *Smith, Elder and Co.*—The Book of Flowers, Mrs. Hinkson and Miss F. Maitland; The Small Garden Useful, A. C. Curtis, illustrated; The Small Garden Beautiful: and How to Make it so, A. C. Curtis; Common Weeds of the Farm and Garden: including the Weeds of Chief Importance both of Arable and Grass Land, and Weed Seeds, H. C. Long and J. Percival, illustrated. *The S.P.C.K.*—British Wild Flowers in their Natural Colours and Form, Prof. Henslow, illustrated. *Swan Sonnenschein and Co., Ltd.*—Plant Life: a Manual of Botany for Schools, Prof. E. Warming, translated by M. Rehling and E. M. Thomas, illustrated. *The University Tutorial Press, Ltd.*—The Senior Botany, Prof. F. Cavers. *T. Fisher Unwin.*—Leisure Hours with Nature, E. P. Larken, illustrated. *Witherby and Co.*—History of the Birds of Kent, N. F. Ticehurst, illustrated; The Vertebrate Fauna of Cheshire and Liverpool Bay, edited by T. A. Coward, 2 vols., illustrated (Mammals, Birds, Reptiles, Batrachians, T. A. Coward and C. Oldham; Fishes of Cheshire and Liverpool Bay, J. Johnstone, with a chapter on The Dee as a Wildfowl Resort, J. A. Dockray); A Monograph of the Petrels, Dr. F. Du Cane Godman, F.R.S., the fifth and concluding part, illustrated; The Adventures of Tommy, Sir Digby Pigott, C.B.; a nature-story book for boys and girls, describing further adventures of the hero of "The Changeling."

Chemistry.

D. Appleton and Co.—The Story of Sugar, G. T. Surface. *Baillière, Tindall and Cox.*—The Poisons and Pharmacy Act, 1908, with Notes, H. W. Gadd; and new editions of Aids to the Analysis of Food and Drugs, C. G. Moor and W. Partridge; Chemical Notes and Equations, G. H. Gemmell. *The Cambridge University Press.*—Outlines of Chemistry, with Practical Work, Dr. H. J. H. Fenton, F.R.S., first part. *J. and A. Churchill.*—A Course of Practical Chemistry, A. B. Ryley. *Constable and Co., Ltd.*—Van Nostrand's Chemical Annual, 1909, edited by Prof. J. C. Olsen. *Henry Frowde and Hodder and Stoughton.*—Practical Chemistry, Dr. A. M. Kellas. *C. Griffin and Co., Ltd.*—Physico-chemical Tables, J. Castell-Evans, vol. ii., Chemical Physics, Pure and Analytical Chemistry; Technical Mycology: the Utilisation of Micro-organisms in the Arts and Manufactures, Dr. F. Lafar, translated by C. T. C. Salter, vol. ii., Eumycetic Fermentation. *Macmillan and Co., Ltd.*—Chemical Constitution and Crystalline Structure, Dr. A. E. H. Tutton, F.R.S. *Williams and Norgate.*—A History of Hindu Chemistry: from the Earliest Times to the Middle of the Sixteenth Century A.D., with Sanskrit Texts, Variants, Translation and Illustrations, Prof. Praphulla Chandra Ray, vol. ii.; Introduction to the Preparation of Organic Compounds, Prof. Emil Fischer, translated by R. V. Stanford.

Engineering.

Edward Arnold.—The Theory of Structures, R. J. Woods, illustrated; Steel Roof and Bridge Design, W. H. Kerr; and a new edition of A Text-book of Electrical Engineering, Dr. A. Thomälen, translated by G. W. O. Howe, illustrated. *Blackie and Son, Ltd.*—Elementary Principles of Alternating Current Dynamo Design, A. G. Ellis. *Constable and Co., Ltd.*—A new volume of the Deinhardt-Schlomann Technical Dictionaries: Railway Construction and Operation, including Electric Traction, A. Boshart, illustrated; The Encyclopædia of Municipal and Sanitary Engineering, edited by W. H. Maxwell and J. T. Brown; Tables and Diagrams for obtaining the Resisting Moments of Eccentric Riveted Connections, E. A. Rexford, illustrated; Waterproofing: an Engineering Problem, M. H. Lewis, illustrated; Concrete Steel Construction, E. Mörsch, translated by E. P. Goodrich, illustrated; and a new edition of Bridge and Structural Design,

W. C. Thomson. *C. Griffin and Co., Ltd.*—Experimental Investigations on the Power Required to Drive Rolling Mills, translated from the German of J. Puppé; Transformers, Prof. H. Bohle, edited by D. Robertson, illustrated; Stresses in Masonry, Prof. H. Chatley, illustrated; The Design and Construction of Ships, Prof. J. H. Biles, vol. ii., illustrated; Sea-water Distillation, F. Normandy, illustrated; and new editions of Principles and Practice of Dock Engineering, Brysson Cunningham, illustrated; The Theory of the Steam Turbine: a Treatise on the Principles of Construction of the Steam Turbine, with Historical Notes on its Development. A. Jude, illustrated; A Pocket-book of Marine Engineering Rules and Tables, for the Use of Marine Engineers, Naval Architects, Designers, Draughtsmen, Superintendents and Others, A. E. Seaton and H. M. Rounthwaite. *Longmans and Co.*—Tables and Diagrams of the Thermal Properties of Saturated and Superheated Steam, L. S. Marks and Dr. H. N. Davis; Domestic Sanitary Engineering and Plumbing: dealing with Domestic Water Supplies, Pump and Hydraulic Ram Work, Hydraulics, Sanitary Work, Heating by Low Pressure, Hot Water, and External Plumbing Work, F. W. Raynes, illustrated. *E. and F. N. Spon, Ltd.*—Electric Cables: their Construction and Cost, D. Coyle and F. J. O. Howe.

Geography and Travel.

Edward Arnold.—Sikhim and Bhutan: Experiences of Twenty Years on the North-eastern Frontier of India, J. C. White, illustrated; With a Prehistoric People: the A-ki-ku-yu of British East Africa, W. S. and K. Routledge, illustrated. *A. and C. Black.*—Kashmir, Sir Francis E. Younghusband, K.C.I.E., illustrated; National Geography of Africa and Australasia, J. B. Reynolds, illustrated; Geographical Diagrams and Land Forms: Senior, H. J. Snape, three books; Descriptive Geography of the British Isles, F. D. Herbertson, illustrated; Geographical Pictures: Land Forms and how They are Made, in packets of six cards. *The Cambridge University Press.*—Cambridge County Geographies, illustrated: Dorset, A. L. Salmon; Gloucestershire, H. A. Evans. *Constable and Co., Ltd.*—Peaks and Glaciers of Nun Kun: a Record of Pioneer Exploration and Mountaineering in the Punjab Himalaya, Fanny Bullock Workman and W. H. Workman, illustrated. *W. Heinemann.*—The Heart of the Antarctic: the Story of the British Antarctic Expedition, 1907–9, E. H. Shackleton, C.V.O., 2 vols., illustrated; With a Camera in East Africa, A. R. Dugmore, illustrated. *John Lane.*—Lake Victoria to Khartoum with Rifle and Camera, Captain F. A. Dickinson, illustrated. *Longmans and Co.*—Mighty Hunters: being an Account of Some of the Adventures of Richard and Helen Cuthbertson in the Forests and on the Plains of Chiapas in Mexico, A. Russan, illustrated. *Macmillan and Co., Ltd.*—Trans-Himalaya: Discoveries and Adventures in Tibet, Dr. Sven Hedin, 2 vols., illustrated; In the Grip of the Nyika: further Adventures in British East Africa, Lieut.-Colonel J. H. Patterson, D.S.O., illustrated; The Gates of India, Colonel Sir Thomas H. Holdich, K.C.M.G., K.C.I.E., C.B., with maps and plans. *John Murray.*—Zambezia: a General Description of the Valley of the Zambezi River, from its Delta to the River Aroangwa, with its History, Agriculture, Flora, Fauna, and Ethnography, R. C. F. Maugham, illustrated; The Great Wall of China, Dr. W. E. Geil, illustrated. *Sir Isaac Pitman and Son, Ltd.*—Notes of Lessons on Geography, L. Marsh, vol. ii. *Alston Rivers, Ltd.*—Labrador: its Discovery, Exploration and Development, W. G. Gosling, illustrated. *Witherby and Co.*—Across Papua, Colonel the Hon. J. A. K. Mackay, C.B., illustrated; Savage Home-life in Southern Seas, H. W. Walker; and a new edition of Three Voyages of a Naturalist, M. J. Nicoll.

Geology.

F. Alcan (Paris).—La Géologie générale, Prof. S. Meunier, new edition. *Edward Arnold.*—The Geology of Building Materials, J. Allen Howe, illustrated. *J. M. Dent and Co.*—Geology, Prof. J. W. Gregory, F.R.S., illustrated (Scientific Primers). *C. Griffin and Co., Ltd.*—A new edition of Ore and Stone Mining, Sir C. Le Neve Foster, revised by Prof. S. H. Cox, illustrated. *Longmans and Co.*—A new edition of An Introduction to the Geology of Cape Colony, Dr. A. W. Rogers and A. L. Du Toit, with a chapter on the Fossil Reptiles of the Karroo Formation by Dr. R. Broom, illustrated. *Macmillan and Co., Ltd.*—The Origin of Ore Deposits and the Extent of Future Supplies, Prof. J. W. Gregory, F.R.S. *Milner and Co., Ltd.*—Geology, G. Hickling, illustrated.

Mathematical and Physical Science.

Edward Arnold.—An Introduction to the Theory of Optics, Prof. A. Schuster, F.R.S., illustrated. *A. and C. Black.*—Primer of Statistics, W. Palin Elderton and Ethel M. Elderton, with a preface by Sir Francis Galton, F.R.S. *The Cambridge University Press.*—Elements of the Differential and Integral Calculus, Prof. A. E. H. Love, F.R.S. *Cassell and Co., Ltd.*—New editions of The Earth's Beginning, Sir R. Ball, F.R.S., illustrated; The Story of the Heavens, Sir R. Ball, F.R.S., illustrated. *W. and R. Chambers, Ltd.*—Light, E. J. Houston; Magnetism, E. J. Houston. *Chatto and Windus.*—Astronomical Curiosities: Facts and Fallacies, J. Ellard Gore, illustrated. *Constable and Co., Ltd.*—History of the Slide Rule, Prof. F. Cajori, illustrated; Electricity, H. M. Hobart, illustrated. *J. M. Dent and Co.*—Astronomy, Prof. F. W. Dyson, F.R.S., illustrated (Scientific Primers). *Gauthier-Villars (Paris).*—Leçons élémentaires sur la Théorie des Fonctions analytiques, Ier Partie, Tome ii.: Les Fonctions algébraiques, les Séries simples et multiples, Foüet, new edition; Savants du Jour: Henri Poincaré, Biographie et Bibliographie analytique des Écrits, E. Lebon; Nouvelles Méthodes de Prévision du Temps, Guilbert; Leçons sur la Théorie de la Croissance, Borel; Principes de la Théorie des Fonctions entières d'Ordre infini, Blumenthal; Précis de Mécanique, Appell and Dantheville; Des Notations mathématiques, Enumeration, Choix et Usage, André. *C. Griffin and Co., Ltd.*—Electrical Theory and the Problem of the Universe, G. W. de Tunzelmann; Hydrographic Surveying: for the Use of Beginners, Amateurs, and Port and Harbour Masters, Commander S. Messum, illustrated; An Elementary Text-book of Physics, Dr. R. Wallace Stewart, vol. i., Matter, vol. iv., Heat, illustrated; Applied Mechanics and Mechanical Engineering, Prof. A. Jamieson, vol. v., Theory of Machines. *Harper and Brothers.*—Curiosities of the Sky, G. P. Serviss. *W. Heinemann.*—The Conquest of the Air, A. Berget, illustrated. *T. Werner Laurie.*—Chats on Electricity, F. Broadbent, illustrated; Chats on Astronomy, H. P. Hollis, illustrated. *Crosby Lockwood and Son.*—Wireless Telephony, Dr. J. E. Murray; Electric Power Conductors, W. A. Del Mar, illustrated; and a new edition of Alternating Current Machines: being the second volume of Dynamo Electric Machinery: its Construction, Design, and Operation, Dr. S. Sheldon, H. Mason, and E. Hausmann, illustrated. *Longmans and Co.*—Physical, Chemical, and Mathematical Tables, Dr. G. W. C. Kaye and Prof. T. H. Laby; The Apprentices' Course of Experimental Physics and Mechanics for Preliminary Technical Students and Secondary School Pupils, J. L. Maxim. *Macmillan and Co., Ltd.*—The Life of William Thomson, Baron Kelvin of Largs, Prof. Silvanus P. Thompson, F.R.S., 2 vols., illustrated; Lord Kelvin's Early Home: being the Recollections of his Sister, the late Mrs. Elizabeth King, illustrated; Aviation, Prof. G. H. Bryan, F.R.S.; Ancient Eclipses, and the Lengths of the Day, Month, and Year, P. H. Cowell, F.R.S.; Solar Researches, Dr. G. E. Hale, For.Mem.R.S.; Researches in Magneto-optics, Prof. P. Zeeman; The Shape of the Earth, Prof. A. E. H. Love, F.R.S.; Climates of British Possessions, Dr. W. N. Shaw, F.R.S.; Wind Pressure, Dr. T. E. Stanton; Physical Science in the Time of Nero: being a Translation of Seneca's "Quæstiones Naturales," J. Clarke, with notes on the subject-matter by Sir Archibald Geikie, K.C.B., P.R.S. *The Oxford University Press.*—The Story of the Comets, simply told for General Readers, G. F. Chambers. *Sir Isaac Pitman and Son, Ltd.*—Notes of Lessons in Arithmetic, C. W. Crook, vol. ii. *G. P. Putnam's Sons.*—Nautical Science in its Relation to Practical Navigation, together with a Study of the Tides and Tidal Currents, Prof. C. L. Poor, illustrated; In Starland with a Three-inch Telescope, W. T. Olcott, illustrated. *Alston Rivers, Ltd.*—Problem Papers for Upper

Middle Forms, H. L. Reed. *The University Tutorial Press, Ltd.*—The School Geometry, W. P. Workman and A. G. Cracknell, in 1 vol. and in 2 parts; Introduction to the School Geometry, by the same authors. *T. Fisher Unwin.*—A new edition of Wireless Telegraphy and Wireless Telephony, Prof. A. E. Kennelly, illustrated.

MEDICAL SCIENCE.

F. Alcan (Paris).—Traité international de Psychologie pathologique et de thérapeutique des Maladies mentales, Dr. A. Marie, Tome premier. *Appleton and Co.*—Legal Medicine and Toxicology, R. L. Emerson; Minor Surgery, E. M. Foote; Preparation of the Patient and Treatment after Operation, H. A. Haubold; Diseases of Children, Dr. A. Jacobi; Surgical Diagnosis, A. B. Johnson, 3 vols.; Orthopedic Surgery, H. L. Taylor; Medical Sociology, J. P. Warbasse. *Baillière, Tindall and Cox.*—Cowhouses and the Milk Supply, G. Mayall; Incidents of Sex and Age on Diseases, G. Andrews; and a new edition of Aids to Mathematics of Hygiene, Dr. R. B. Ferguson. *John Bale, Sons and Danielsson, Ltd.*—The Stomach, Pancreas and Intestines, Dr. W. C. Bosanquet and H. S. Clogg. *George Bell and Sons.*—A new edition of Hoblyn's Dictionary of Terms Used in Medicine, and the Collateral Sciences, J. A. P. Price. *A. and C. Black.*—New editions of Text-book of Operative Surgery, Dr. Th. Kocher, translated by Dr. H. J. Stiles, illustrated; Black's Medical Dictionary, edited by Dr. J. D. Comrie, illustrated. *J. and A. Churchill.*—A Text-book of Nervous Diseases, Drs. W. A. Turner and T. G. Stewart, illustrated; A Text-book of Experimental Physiology, Drs. N. H. Alcock and F. O'Brien Ellison, with an introduction by Prof. E. H. Starling, F.R.S., illustrated; Sight-testing Made Easy, Dr. W. W. Hardwicke, illustrated; and a new edition of A Guide to the Paris Medical School, Dr. A. A. Warden. *Constable and Co., Ltd.*—Preventable Diseases, Dr. W. Hutchinson. *Gustav Fischer (Jena).*—Lehrbuch der Protozoenkunde, Zweite Auflage der "Protozoen als Parasiten und Krankheitserreger," Prof. F. Doflein, illustrated; Elektrizität und Licht in der Medizin, Prof. R. Kutner, illustrated; Entwicklung und Fortschritte der Chirurgie, Prof. R. Kutner, illustrated; Vorlesungen über chirurgische Infektionskrankheiten, Profs. Kocher and Tavel, Teil 1, illustrated; Das Virulenzproblem der pathogenen Bakterien, Dr. Laurent; Die Pathologie und Therapie der plötzlich das Leben gefährdenden Krankheitszustände, R. Lenzmann, new edition; J. v. Mering's Lehrbuch der inneren Medizin, illustrated, new edition; Grundzüge der internen Arbeiter versicherungs-Medizin, J. Rubin; Einführung in die Hydro- und Thermotherapie, Prof. J. Strasburger, illustrated; Atlas der menschlichen Blutzellen, Dr. A. Pappenheim, Zweite Lieferung, illustrated. *Henry Frowde and Hodder and Stoughton.*—The third and last volume of A System of Operative Surgery, edited by F. F. Burghard; Practical Pathology, Prof. Sims Woodhead, illustrated; History of Medicine, Prof. Max von Neuburger, translated, 2 vols.; Gallstones, Drs. M. Robson and Cammidge; Constipation, A. F. Hertz; Andrology, E. M. Corner; Infectious Diseases, C. Buchanan Ker, illustrated; Emergencies in General Practice, both Medical and Surgical, Sargent and Russell; Pathology in General Practice, Dr. T. J. Horder. *John Lane.*—The Medical Diseases of Children, R. Miller. *Longmans and Co.*—New editions of Quain's Elements of Anatomy, vol. iii., Neurology, by Profs. E. A. Schäfer, F.R.S., and J. Symington; part ii., containing the descriptive anatomy of the peripheral nerves and of the organs of special sense, illustrated; Anatomy, Descriptive and Applied, H. Gray, edited by R. Howden, Notes on Applied Anatomy revised by A. J. Jex-Blake and W. F. Fedden, illustrated. *Macmillan and Co., Ltd.*—Chronicles of Pharmacy, A. C. Wootton, illustrated; A System of Medicine, by Many Writers, edited by Sir T. Clifford Allbutt, K.C.B., F.R.S., and Dr. H. D. Rolleston, vol. vi., Diseases of the Heart and Blood-vessels, new edition. *Methuen and Co.*—Air and Health, Dr. R. C. Macfie; The Hygiene of School Life, Dr. R. H. Crowley. *John Murray.*—The Life of Sir William Broadbent, Bart., K.C.V.O., F.R.S., edited by his daughter, with portraits. *Nisbet and Co., Ltd.*—Cancer Clinically Considered, J. Bland-Sutton, illustrated; Some of the Common Affections of the Tongue, J. Hutchinson, jun.; Movable Kidney, W. A. Lane; Hip Disease in the Young, J. Berry; Prostatectomy, J. W. T. Walker; Enuresis, J. H. Thursfield; Some Clinical Points in the Surgery of the Intestine, F. C. Wallis.—*Rebman, Ltd.*—Naval Hygiene, Dr. J. D. Gatewood; The Case for Alcohol: or the Actions of Alcohol on Body and Soul, based largely upon the Researches and Discoveries of the late M. Emile Duclaux, Dr. R. Park. *Swan Sonnenschein and Co., Ltd.*—Exercises for Heart Affections, based on the Nauheim Treatment, Dr. J. G. Garson, illustrated; and a new edition of Dobree's Manual of Home Nursing.

METALLURGY.

C. Griffin and Co., Ltd.—Blast Furnace Practice, J. J. Morgan; The Theory and Practice of Enamelling on Iron and Steel, J. Grünwald; and new editions of A Treatise on Electro-metallurgy, W. G. McMillan, revised and enlarged by W. R. Cooper; An Introduction to the Study of Metallurgy, Sir W. Roberts-Austen, K.C.B., F.R.S., revised throughout by F. W. Harbord, illustrated; The Metallurgy of Lead, H. F. Collins, illustrated.

TECHNOLOGY.

Constable and Co.—The Manufacture of Leather, H. G. Bennett, illustrated; Textiles and their Manufacture, A. F. Barker, illustrated. *C. Griffin and Co., Ltd.*—Commercial Peat: its Uses and its Possibilities, F. T. Gissing, illustrated; Ceramic Literature, M. L. Solon; and a new edition of A Manual of Dyeing: for the Use of Practical Dyers, Manufacturers, Students, and all Interested in the Art of Dyeing, Dr. E. Knecht, C. Rawson, and Dr. R. Loewenthal, 2 vols. *Crosby Lockwood and Son.*—Petroleum Mining and Oil-field Development, A. B. Thompson, illustrated; Modern Coking Practice, T. H. Byrom and J. E. Christopher, illustrated; A Pocket Glossary of English-German, German-English Technical Terms, J. G. Horner and A. Schlomann; and a new edition of Refrigeration, Cold Storage and Ice-making, A. J. Wallis-Tayler, illustrated. *Longmans and Co.*—Modern Practice in Mining, R. A. S. Redmayne, 2 vols., illustrated; Laboratory Notes on Iron and Steel Analysis, W. Macfarlane, illustrated. *Milner and Co., Ltd.*—Photography in Principle and Practice, S. E. Bottomley; Up-to-Date Photography, B. Rowley; Cardboard Modelling: the Swedish Course, G. C. Hewitt; Engineers' and Machinists' Handbook: a Guide for Turners, Fitters, Screw-cutters, &c., H. A. Golding; Mechanics' Tables: a Collection of Tables in Everyday Use amongst Mechanics and Engineers; Wool Dyeing, C. Bolton. *Stanley Paul and Co.*—Zinc Oxide and its Uses, C. Smith. *E. and F. N. Spon, Ltd.*—A new edition of Workshop Receipts: for the Use of Manufacturers, Mechanics and Scientific Amateurs, in 4 vols., vol. iv., Rainwater Separator to Whitewashing.

MISCELLANEOUS.

F. Alcan (Paris).—Dieu et Science, Prof. E. de Cyon; La Psychologie affective, T. Ribot. *Edward Arnold.*—A Fifth Series of Memories of the Months, the Right Hon. Sir Herbert Maxwell, F.R.S., illustrated. *Chatto and Windus.*—A History of Babylonia and Assyria from the Earliest Times until the Persian Conquest, L. W. King, in 3 vols., illustrated: vol. i., A History of Sumer and Akkad: being an Account of the Primitive Inhabitants of Babylonia from the Earliest Times to about B.C. 2000; vol. ii., A History of Babylon from the Period of the First Dynasty, about B.C. 2000, until the Conquest of Babylon by Cyrus, B.C. 539; vol. iii., A History of Assyria from the Earliest Period until the Fall of Nineveh before the Medes, B.C. 606. *Constable and Co., Ltd.*—Foreign and Colonial Patent Laws, W. C. Fairweather; Modern Methods of Street Cleaning, G. A. Soper, illustrated. *Duckworth and Co.*—The Hills and the Vale, Richard Jefferies, with an introduction by E. Thomas; Science and Religion in Contemporary Philosophy, Prof. E. Boutroux, translated by J. Nield. *Methuen and Co.*—Science from an Easy Chair, Sir E. Ray Lankester, K.C.B., F.R.S., illustrated; A Guide to the Antiquities of Upper Egypt: from Abydos to the Sudan Frontier: A. E. P. Weigall, illustrated. *G. P. Putnam's Sons.*—A Book of Precious Stones: the Identification of Gems and Gem Minerals, and

an Account of their Scientific, Commercial, Artistic and Historical Aspects, J. Wodiska, illustrated. *Rebman, Ltd.*—A new edition of Meteorology, Practical and Applied, Sir J. W. Moore. *Swan Sonnenschein and Co., Ltd.*—A translation of Hegel's Phenomenology of Mind, J. B. Baillie; Thought and Things: a Study of the Development and Meaning of Thought, or Genetic Logic, Prof. J. M. Baldwin, 3 vols., vol. iii., Real Logic; The History of Philosophy, based on the work of Dr. J. E. Erdmann, translated and edited by Prof. W. S. Hough; Physiological Psychology, Prof. W. Wundt, a translation of the fifth and wholly re-written German edition by Prof. E. B. Titchener, in 3 vols., vol. ii., illustrated. *The University Tutorial Press, Ltd.*—Hygiene for Training Colleges, Dr. R. A. Lyster. *T. Fisher Unwin.*—Psychotherapy, Dr. H. Münsterberg. *Williams and Norgate.*—Science, Matter and Immortality, R. C. Macfie.

THE BRITISH ASSOCIATION AT WINNIPEG.

SECTION L.

EDUCATIONAL SCIENCE.

OPENING ADDRESS BY THE REV. H. B. GRAY, D.D., WARDEN OF BRADFIELD COLLEGE, BERKSHIRE, PRESIDENT OF THE SECTION.

The Educational Factors of Imperialism.

AMONG all civilised races and in all epochs of the world's history there has existed an inveterate belief that the particular age in which men live is fundamentally distinct from those that have preceded it.

Even in the most stagnant periods the illusion has prevailed that *the present day* is a period of flux and movement more or less organic, and as such either to be welcomed or to be deplored.

Notoriously difficult, however, as it is to gauge the temper of an age while we live in its midst, yet the phenomena in England at the beginning of the twentieth century seem so unmistakably marked that even a superficial thinker can hardly fail to recognise the spheres in which the symptoms of change and unrest are clearly operating. They are surely in these two—the sphere of education and the sphere of Imperial sentiment.

It may not appear inapposite, therefore, if, meeting as we do in this city of phenomenal growth and infinite enterprise, our thoughts were to be directed in my inaugural address on the science of education towards discovering what may be either called the Imperial factors in education, or conversely, and perhaps more properly, the educational factors in Imperialism.

It may be perhaps safely said in this great Dominion what might possibly be disputed in the academic groves of our ancient English universities, that there was no width of educational outlook within our own little island until the last thirty years of the nineteenth century.

The only strongholds of learning which presumed to give the lead to English secondary education were to be found on the banks of the Isis and the Cam. In these antique, I hesitate to say antiquated, fastnesses, the "grand old fortifying classical curriculum" was, until lately, regarded as the main, if not the only, highroad to educational salvation. They preserved, indeed they preserve to this day, almost the same entrance bars against admission to their thresholds as existed in pre-Reformation days. And, conformably with the pursuit of these ideal studies, the vast mass of their emoluments were, and still are, appropriated to the pursuit of the ancient models of education.

The result of this monopoly on the lower rungs of the educational ladder has been obvious, and, to a scientific thinker, lamentable. The curricula of the public secondary schools have been narrowed, or rather have never been widened coincidently with the development of new spheres of knowledge and enterprise. The students in those institutions have been dominated from above, for just as "where the carcase is, there will the eagles be gathered together," so where the emoluments have been, thither do the cleverest students concentrate their intellectual forces.

The ambition of the ablest boys has been inevitably and exclusively concentrated on a single line of study, and (as often happens in the minds of the young) other no less humane but entirely unendowed departments of human knowledge have been laughed down and despised. Opprobrious epithets, even, have been bestowed on the study of the natural sciences, while those modern linguistic achievements which opened the door to the treasures of French and German literature are still nothing accounted of in the great schools of England.

But (more marvellous than all) even the scientific acquisition of and familiarity with the literature of the mother tongue have been entirely neglected, because no room could be found for it in a time-table, three-quarters of which is confined for the great mass of boy students in the historic schools of England (whatever their tastes and capabilities) to the exclusive study of the grammar, literature, and composition in the languages of ancient Greece and Rome. And the particular methods pursued in this confined curriculum have rendered the course more straitened still. The acquisition of the literatures of the two dead languages and of the great thoughts buried with them has given place to a meticulous study of the subtleties of scholarship, and students are taught to wanton in the abnormalities of the words and phrases in which those literatures were enshrined, so that in the mind of the classical scholar the form has become, or at any rate became until quite lately, more important than the substance.

Nor is this all. Those who cannot find any stomach for such drenching doses of mediæval learning are actually driven away prematurely as lost souls from those moss-grown seats of learning, which we acclaim as the great public schools of England; and, with moral characters only half-fledged, have either been condemned to the limbo of private tuition or sent as "submerged tenths" to find, or lose, their fortunes in the great dependencies and dominions of the Empire like that in which I am speaking to-day. There has been no serious attempt made until the twentieth century by the leaders of our best-known places of secondary education to discover the bents and aptitudes of the boys committed to their charge and to give them any educational chance if they have not possessed that particular kind of perception which could find its way through the subtleties of a Euripides or a Horace. Boys have been entirely denied the opportunity of showing their mental powers in any other sphere of learning. How many unsung Hampdens or mute, inglorious Miltons of mechanical genius have been lost to the world by the non-elastic systems prevailing (even now) in our best-known educational institutions, is a tremendous responsibility for conscientious trainers of the young to contemplate and atone for.

In how many, or rather how few, places of learning in England, at the present time, can the establishment of scientifically equipped carpentering and engineering shops be found in which a young mind which finds it impossible to digest the crude morsels of Latin and Greek grammar can find resource and development? In how few schools has the connection between mind and hand and eye been scientifically trained? Such establishments, even in the first decade of the twentieth century, can be counted on the fingers of one hand.

And yet, in spite of it all, the surprising fact remains—a fact which speaks volumes for the innate vigour and originality of the English race—that, out of the stream of young men which flows out annually from our public schools[1] and colleges, so many accommodate themselves as happily as they do to the startlingly new conditions which confront them when they pass over the seas and swell the tide of population in great centres of industry and enterprise such as that in which we stand to-day. Their educational vision, however, has had such a narrow and limited horizon that no wonder a large proportion are not very adaptable to the practical life of the prairie and the forest, or even of the counting-house and the office stool. Am I, or am I not, correct in hazarding the conjecture that many specimens of this really fine English breed from the old country come to you here in this Dominion without an elementary knowledge of the

[1] It should be noted in the forefront of this address that the expression "public schools" is used throughout in its English (not in its more proper and American) sense—*i.e.*, as the educational centres of the upper classes.

laws of the world in which they live, full of antiquated prejudice and tradition, derived principally from the straitened area of their island-home experience, so that not seldom they put their hand to the plough (either literally or metaphorically) and look back, becoming wastrels instead of forceful citizens in this ever-widening Empire? "No English need apply" has been, if I mistake not, written as a memorandum inside the breast of more than one leader of industry in this great continent, and small wonder is it when the cramping character of the ultra-mediæval training which our young men have received at some of our historical public secondary schools in England is taken into account.

What remedy (you may ask) have I to propose? My answer is this: I want to force upon the attention of English educationists certain Imperial factors which should occupy an indispensable place in the educational curricula of the great schools in the Mother Country.

I would give a prominent place to the scientific teaching of geography, and particularly to historical geography, with special reference, of course, to the origin, growth, and progress of the British Empire. Such a volume as the "Sketch of a Historical Geography," by Keith Johnston, should be placed in the hands of every boy, and be known by him from cover to cover. It can hardly be realised that in many of our great classical schools to this day not more than one, or at most two, hours a week are devoted to this subject, and that it is often not taught at all beyond the middle classes in a school.

Again, I would enforce an elementary knowledge of science on every boy who passes through the stage of secondary education.

I am aware that many hard things have been said about the teaching of science in secondary education. A learned professor, who is the president of another section of the association, has passed his opinion that, as taught in our schools, it has proved of little practical or educational value. But because the methods employed have been halting, insufficient, and unscientific, it by no means follows that it should be left out of the category of school subjects. On the contrary, it appears astounding that two-thirds of the public-school boys of England should grow to man's estate without even an elementary knowledge of the laws of the world in which they live.

Lord Avebury, in his presidential address at the International Moral Education meeting held in London last autumn, told his audience an amusing story of how, walking back one beautiful summer night from the House of Commons arm-in-arm with a leading luminary on the Government benches, his companion, who had been at Eton and Oxford, gazing at the great luminary in the heavens, pensively observed: "I wonder, my dear Lubbock, whether we shall ever know why the moon changes her shape once a week at least?"

To one who aspires to seek his fortune in the wide and half-unexplored continents of Greater Britain the value of the knowledge of chemistry, geology, botany, and arboriculture can hardly be overestimated. And yet many present here could bear critical witness to the fact that a large proportion of young men go out to the North-West totally unequipped, after their public-school training, with even the most elementary knowledge of those departments of science to which I have alluded. No wonder, again, "No English need apply." Every youth we export to you ought educationally to bear this label on his back: "Every seed tested before being sent out."

But above and beyond all there should be brought into the foreground a co-ordinated study of English language and English literature. Nothing impressed me more in my visit to the United States in 1903 as one of the Mosely Commission than to observe how greatly the cultivated classes in the Federation outstripped our island-bred people in the facility and power with which they manipulated the English tongue. Awkwardness, poverty of expression, and stammering utterance mark many Englishmen of high academic distinction. But the American who, on account of the incessant tide of immigration, has to assimilate the congeries of all the nations of the earth in the shortest possible space of time, has so co-ordinated the study of his ancestral tongue in the schools of his country, that the pupil emerges completely equipped for the use of persuasive and oratorical language wherein to express his thoughts and wherewith to gain his ends.

In connection with this, may I add that it was indeed a happy augury that, at the eve of the meeting of the British Association in this great Dominion, there should have been a gathering of delegates of the Imperial Press in the centre of our small island home? "Little they know of England who only England know." The phenomenal, or rather abysmal, ignorance of the geography and of the vastness of the productive power of the British Empire which exists among the upper and middle classes in England would be ludicrous if it were not so deplorable. The loyalty and devotion of the Colonies, right unto the utmost corners of the earth, admit of no dispute. It is observable on every hand and in every national crisis. The doubt is of the loyalty of the centre of the Empire towards its extremities, through the crass ignorance which exists as to the geographical and political meaning of that Empire. I would annihilate that ignorance, as aforesaid, by putting political, historical, and physical geography in the forefront of our educational system; by lectures from your able men in Canada, or Australia, and South Africa, vivified by lantern-slides, and encouraged and endowed by the Mother Country. I would bring all visible means of presentment to bear on the education of childhood, boyhood, and youth in the Motherland.

Let me touch on one further educational factor of Imperialism. The sentiment of patriotism, unlike that of charity, is not equally capable of indefinite intension and extension. The peculiar system of education which finds vogue in England in most of our greatest institutions—the institutions from which are drawn the future leaders of the nation—is, as everyone knows, the barrack system, otherwise called the boarding system. It is not the time or place here to enlarge on the obvious advantages of that system, its unique characteristics, its power of moulding character and developing enterprise. But it has its cramping and confining side—it has a tendency to localise patriotism, to narrow a young man's mental horizon, and to ignore whatever lies outside its immediate survey. Hence the abnormal and gladiatorial devotion to games and comparatively selfish amusements, which absorb, and, in my opinion, not seldom paralyse and stifle wider, more generous, more enlightened—in fine, more Imperial instincts. However much in the field of sports the individual youth may subordinate his own self-regarding impulses to the welfare of the tiny community for which he is exercising his energies, his horizon is not wide enough to bid him rise to a sentiment of self-sacrifice and self-abandonment on behalf of a greater and more abstract ideal—love of Fatherland and loyalty to Empire.

But it is a welcome thing to be able to point to a larger sentiment lately awakened in this direction. There is no doubt that the patriotic spirit in our schools and colleges has, from whatever cause, received a great impetus in the last two years, and that the general principles of an intelligent defence of our shores from foreign aggression have been taught and construed into terms of scientific training and co-operative action with a rapidity equally surprising and welcome to those who, a few years ago, looked with something more than apprehension on the supineness of the youth of England in all patriotic regards.

"The flannelled fool and muddied oaf,"

though they have not yet received their quietus, have been less rampant lately in our educational institutions, and something like an Imperial instinct, born of increasing knowledge both of the glory and dangers of our vast Empire, has, at least in the more cultured classes, taken the place of apathy, disregard, and ignorance. In hours formerly lavished to an abnormal extent on trivial amusements, and even in hours hitherto devoted to more academically intellectual training, we find young men in our schools and colleges now with arms in their hands, shooting, signalling, scouting, and studying scientifically the art of defensive warfare. This, at least, is "a beam in darkness, of which we pray that it may grow."

Time and your patience will not allow me to touch on more than the fringe of the great educational problems

which have to be solved before we can approach in English education to what I venture to call the ideal of Imperial responsibility.

In criticising the old mediæval system of education which prevailed in England until comparatively recent years, and which still has far too great a hold on the more venerable and important institutions of our island home, I would not have you suppose that I am an advocate of a complete, or even approximately complete, basis of utilitarian education. It is an easy charge for those who desire *stare super antiquas vias* to throw in one's teeth. I have little hesitation in expressing my belief that the time has come (and I speak as one whose training was that of a classical scholar, for I was brought up in the straitest sect of academical Pharisees)—I say I have no hesitation in expressing my belief that the time has come, not only that the study of the two ancient languages should be reduced to one for all except scholastic specialists, but also that both should yield pride of place in our educational system to the claims of English, modern languages, mathematics, natural science, and, not least, manual training, so that our young men should be fitly equipped to put their hand to any work which may confront them amid all the complex problems and critical situations to be found within the world-wide boundaries of the British Empire.

Germany, France, and the United States have been beforehand with us in the working out of such a reformed system of education. I am by no means one of those who believe that we should be wise in copying the methods in their entirety of any of these three peoples in their educational methods. Undoubtedly in all three there has been a more organised connection between the actual teaching given in their respective schools and the industrial, social, and political needs of the respective peoples. But no one nation is exactly like another nation in its temper and genius, and I should be sorry to advocate, for instance, the highly organised system of State education in Germany, under which it could be predicted to a certainty that boys and girls in every secondary or primary school on any given Friday morning should be studying (say) the geographical importance of Natal or the outlines of the coast of Lincolnshire. There must be many educational differences, because the idiosyncrasies of each nation differ from those of another, and I do not think we need ever fear that our intrinsic individuality will be crushed into any Teutonic cast-iron mould or ground down beneath the heel of some bureaucratic educational despotism. But that we ought to change our ways still more than we have, and adopt saner educational models, many searchings of heart through a long educational career have gradually, but overwhelmingly, convinced me. If we are apt to think, speak, and act Imperially, our education must take form from a strong Imperial sentiment, and must aim at instilling Imperial instincts in the young lives which that education is meant to control and develop.

I have spoken hitherto of this subject mainly from the point of view of secondary education, with which I am the most conversant; not only for that reason, however, but because most of those who are destined to proceed to the distant outlying parts of the British Empire, and, when there, to take prominent parts in the development of that Empire, obtain their educational equipment from the secondary schools of England. It is, therefore, on curricula offered or desiderated in them that I have exclusively dwelt. But I do not blink the fact that the proper educational organisation of our elementary schools on the one hand, and of our universities on the other, exercises a large influence on the solution of Imperial problems.

On elementary education, however, I do not propose to touch in this address, mainly because I look forward to experts in primary schools directing the thoughts of this association more directly to them. But I will touch with great brevity on the subject of university education.

Whether Oxford and Cambridge—particularly Oxford—will ever so reform themselves as to contribute largely to such solution remains to be seen. Personally, I look with far greater confidence to the more recently organised universities—those of London, Leeds, Sheffield, Manchester, and the like—to equip men educationally with those moral, physical, and intellectual qualities which are most in requisition in our great dependencies and commonwealths.

Such institutions, from their newness, their eagerness, their freedom from antiquated prejudices and vested interests, are more likely to be counted upon for many years to come to send forth a stream of young men who have learned in the school of hardness to face the difficulties and to adapt themselves to the austere conditions which are inseparable from life in unworked regions and half-discovered continents. And it is at once a hopeful and inspiring thought that the great Dominion of Canada will welcome such to herself as sufficient and efficient citizens of her all but boundless territories, that she will recognise in them "bone of her bone and flesh of her flesh," physically, mentally, and morally capable, in company with those of her own sons who have long settled in the land, of extending the borders of the Empire by enlarging its resources, and of lifting, securing, and consolidating thereby the destinies of the Anglo-Saxon race.

There is still one more educational factor on which I would ask attention before I close this address. It is this—the necessity of a closer touch educationally (in the sense of "academically") between the secondary schools and colleges of the Mother Country and similar institutions in the great Dominion and commonwealths which own her parentage. How this can be effected without great modification of our existing English system it is hard to see. But one point is quite clear. We must give up that part of our system which insists on choking the passage of the student from point to point in his educato the privileges of further education, if such examination on entrance and throughout his academical course. It would be of incalculable advantage to the Empire at large if an extension of educational intercommunion, such as was inaugurated by the noble benefactions of the late Cecil Rhodes, could be secured throughout the Empire. Undoubtedly examination would be the surest test for determining the question of the admission of a student to the privileges of further education if such examination could be conducted within a limited geographical area. But it is quite an impossible system if adopted as between the outlying parts of a great empire. The United States of America have taught us a better way. For instance, in the State of Minnesota, the university has legislated that if and when the principal of a high school of recognised position certifies that a student has successfully pursued for a specified length of time those studies in that high school that would entitle him to admission to the university, he should be admitted thereto without further delay or hindrance. What a paralysing curse the Charybdis of examination has been to all true learning only those who have suffered from it for thirty years can bear adequate testimony. It would be one of the most fertilising sources from which to secure good and progressive citizens if, instead of admitting within her borders all or any who came of their own spontaneity or from compulsion (leaving their country, perchance, for their country's good), the Government authorities in the Dominion could get into closer touch with the educational authorities of the Mother Country, who would act as guarantee that the material sent out by the Mother Country should be of an approved and first-rate quality. This might be worked on the American "accredited school" system, under which the authorities of the school sending the pupil should feel the *maximum* of responsibility in recommending his admission to the academical, or the technical, or the industrial organisations existing in the Dominion.

Since penning the first sentences of the above paragraph last June my eye has been caught by a notice which appeared in the columns of the *Times* on the 28th day of that month while I was engaged in the very act of correcting the proofs of this address; but I prefer to leave the paragraph written as it stands, as the notice in question is an eloquent commentary on my suggestion of educational intercommunion.

I may, perhaps, be allowed to read the extract from the *Times verbatim*, though it may be familiar to some

at least among my audience. It is headed "International Interchange of Students—a New Movement."

"We have received," says the *Times*, "the following interesting particulars of a new educational movement to provide for the interchange of University students among the English-speaking peoples.

"The object is to provide opportunities for as many as possible of the educated youth of the United Kingdom, Canada, and the United States (who, it is reasonable to suppose, will become leaders in thought, action, civic and national government in the future) to obtain some real insight into the life, customs, and progress of other nations at a time when their own opinions are forming, with a *minimum* of inconvenience to their academic work and the least possible expense, with a view to broadening their conceptions and rendering them of greater economic and social value, such knowledge being, it is believed, essential for effectual leadership.

. . . . . .

"The additional objects of the movement are to increase the value and efficiency of, as well as to extend, present University training by the provision of certain Travelling Scholarships for practical observation in other countries under suitable guidance. These scholarships will enable those students to benefit who might otherwise be unable to do so through financial restrictions. It also enables the administration to exercise greater power of direction in the form the travel is to take. In addition to academic qualifications, the selected candidate should be what is popularly known as an 'all-round' man; the selection to be along the lines of the Rhodes Scholarships.

"The further objects are to extend the influence of such education indirectly among the men who are not selected as scholars (through intercourse with those who have travelled) by systematic arrangements of the periods' eligibility while they are still undergraduates.

"To promote interest in imperial, international, and domestic relations, civic and social problems, and to foster a mutual sympathy and understanding imperially and internationally among students.

"To afford technical and industrial students facilities to examine into questions of particular interest to them in manufactures, &c., by observation in other countries and by providing them with introductions to leaders in industrial activity.

"To promote interest in travel as an educational factor among the authorities of Universities, with a view to the possibility of some kind of such training being included in the regular curricula.

"To promote interest in other Universities, their aims and student life, the compulsory physical training, and methods of working their ways through college, for example, being valuable points for investigation.

"To promote international interchange for academic work among English-speaking Universities; and, in the case of the British Empire, to afford facilities for students of one division to gain, under favourable circumstances, information relative to the needs, development, and potentialities of other divisions; and to promote an academic interchange of students among the Universities of the Empire.

"As already indicated, there is a widespread interest in the movements so far as the United Kingdom is concerned; while in Canada and the United States there is also a widespread recognition of the value of the scheme; and although committees have not been actually organised there as in this country, a very large body of the most prominent educationists are strongly in favour of the plan, and have promised their co-operation if the scheme is financed.

"It is proposed to establish two students' travelling bureaux, one in New York and one in London; an American secretary (resident in New York) and a British secretary (resident in London), both of whom shall be college men appointed to afford every facility to any graduate or undergraduate of any University who wishes to visit the United States, Canada, or the United Kingdom for the purpose of obtaining an insight into the student, national, and industrial life of those countries. The bureaux will undertake the work of providing information relating to United States, Canadian, British, and other English-speaking Universities for the use of students, undergraduates, and others. They will also provide information relating to educational tours of any description in English-speaking countries, and the arrangement of tours suitable to the needs of the inquirer with a view to his obtaining the greatest facilities for education with a *minimum* of expense. Furthermore it will be their duty to provide information as to the best places for the study of educational, governmental, industrial, and social problems in the United States, Canada, the United Kingdom, and other parts of the Empire, as well as to provide introductions to leaders in the above-named spheres of activity, besides undertaking the organisation and conduct of special tours for educational purposes, if necessary.

"It is proposed to provide 28 travelling scholarships, 14 of these being available for Universities in the United Kingdom, 10 for Universities in America, and four for Universities in Canada. The arrangements will be controlled by general committees, one for the United Kingdom and one for Canada and the United States, unless it is found necessary to inaugurate a separate committee for each of the latter."

You will observe, then, that a scheme which I had ventured to suggest as being "of incalculable advantage to the Empire" had, before I wrote the words quoted, been advocated entirely without my knowledge by a body of influential educational leaders in England, whose names were appended to the notice which I have read; and I need only add that it is quite certain that I am interpreting the sentiments of all here assembled in wishing God-speed to the development of the scheme, which seems likely to prove, if carried into effect, a great, if not the greatest, educational factor of Imperialism.

But it may be objected here, Is not your own horizon circumscribed? Why should educational ideals be limited, even by so extended a conception as Imperialism? Should not the ultimate aim of all education be, not the federation of one race only, but the federation of the world at large—the brotherhood of man?

I am not concerned to deny that such a lofty conception is the true end of all physical, moral, and mental training.

But if the master mind of a Milton was content to define true education to be "that which fits a man to perform justly, skilfully and magnanimously all the offices, both public and private, of peace and war," it may well suffice us if we extend our (at present) too narrow conceptions (the aim of which seems to be the cultivation of a mere island patriotism) to a sphere which has for its end the imperialistic sentiment of a whole race.

It may, indeed, be well doubted whether a race-sentiment is not an ultimate factor beyond which it is impossible in an imperfect world to go. Universal philanthropy in its most catholic sense is a sentiment which the limited conditions of the earth's surface seem to render impossible. So long as men's ambitions are an unlimited quantity, and so long as the habitable globe remains, as it ever must remain, a limited quantity, so long will the populations of the world be continually liable to shifting movements and frequent dislocations. Practical educationists, then, must inevitably confine the scientific consideration of aims and methods in education to the development of the highest interests of their race rather than of mankind at large.

And that being so, the last point on which I would insist in dealing with the educational factors of Imperialism is to emphasise the importance of what the educationists of the United States call "civics" as the binding power which should fasten together all the separate educational faggots in any Imperial scheme of education—the duty of personal service to the State, the positive obligation which makes us all members incorporate in one Imperial system. In our love of individual freedom, in our jealousy of interference with our individual liberty of action, in our insular disregard and depreciation of intellectual forces working in our sister communities beyond the seas, we have lost sight of this civic responsibility which has ever lain on our shoulders and from which we can never dissociate ourselves, so long as our Empire remains as part of our ancestral heritage.

It is this positive duty towards each other and our race beyond the seas which those who live in our island home have been slow in realising, and it has been a real blot on our educational system that such ideas as Imperial responsibility and Imperial necessities have not been inculcated in the young people in our schools and colleges. As an illustration, I may observe that it has been even debated and doubted in some responsible quarters in England whether the Union Jack should wave over our educational institutions on the days of national festivity and national observance.

To sum up. By these and other kindred means I would urge a closer educational touch between the Mother Country and the Empire at large.

Long ago a great Minister was able to say: "Our hold of the Colonies is in the close affection which grows from common names, from kindred blood, and from similar privileges. These are ties which, though light as air, are strong as links of iron."

But times have changed. To-day we are confronted with the problems of a vast and complicated Empire—great commonwealths, great dominions, sundered from each other by long seas and half a world, and however closely science has geographically brought them together, we cannot in soul and sympathy, nor ultimately in destiny, remain attached, affiliated, as mother and children should be, unless we grapple to each other and understand each other in the greatest of all interests—the educational training which we give to our children in the one part of our Empire to make them suitable citizens in another.

In suggesting reforms and modifications in which this educational unity may best be expressed, forgive me if I have but touched, and touched inadequately, on the fringe of a great subject, the transcendent importance of which it requires no elaboration of mine to impress on the earnest attention of the people of this great Dominion—which great Dominion may I be allowed to salute, without flattery or favour, as the most favoured by natural beauty and by virgin wealth of all the children of our common Motherland? May I salute her in terms which formed the old toast with which the two greatest of our English public schools, Winchester and Eton, pledged each other when we met in our annual cricket contest: *Mater pulchra, filia pulchrior!*

GEOLOGY AT THE BRITISH ASSOCIATION.

IF the number of geologists from the British Isles who attended the meeting of Section C was somewhat limited, the number from the American continent was considerable, and it was greatly to them, and especially to those from Canada, that the markedly successful character of the sectional meetings was due. The Canadian geologists not only contributed a particularly interesting series of papers, but also arranged two excursions, which were largely attended.

The papers read before the section may be classified in four groups.

(1) *Stratigraphical Geology.*

Mr. J. B. Tyrrell's account of the geology of Western Canada, which followed the president's address, afforded an excellent introduction to the succeeding series of papers on local geology. *Pre-Cambrian geology* naturally occupied a good deal of the attention of the section, which had the advantage of hearing papers by Prof. A. P. Coleman on the bearing of pre-Cambrian geology on uniformitarianism, and by Prof. W. G. Miller on the pre-Cambrian rocks of Canada. Prof. Coleman described the somewhat complicated subdivision which Canadian geologists recognise in the pre-Cambrian rocks, and pointed out the varied nature of their origin, including as they do quartzites, sandstones sometimes passing into arkose, carbonaceous shale, limestone, igneous rocks both volcanic and intrusive, and metamorphic rocks in great variety. The most interesting point about Prof. Coleman's paper was the evidence he brought forward for the existence of glacial conditions in pre-Cambrian (Huronian) times, and the bearing of this on uniformitarianism. He exhibited stones which he had extracted from the pre-Cambrian conglomerate of the Cobalt district, the upper surface of which was scratched by the Pleistocene glaciation, while the lower (embedded) surface after extraction, also showed striæ which it was difficult to distinguish from those produced by the Pleistocene ice. In the subsequent discussion Drs. Fairchild, Strahan, Warren Upham, and Dwerryhouse expressed the opinion that Prof. Coleman had established his contention.

Prof. Miller's paper was chiefly directed to bringing into prominence the almost limitless mining possibilities of the Canadian pre-Cambrian rocks. He pointed out that although they have as yet been very imperfectly explored, they are already, in the Cobalt and Sudbury districts, the chief, or among the chief, world's source of nickel, cobalt, silver, and arsenic, while in the Michigan district their yield of copper and iron is one of the most important in the world. The same may be said with regard to the mica mines of Ontario.

The stratigraphy of the Palæozoic rocks of the British Isles was represented by the reports of several of the association's committees, including the following:—(1) Mr. E. S. Cobbold, on the Cambrian rocks of Comley, Shropshire; (2) Prof. S. H. Reynolds, on the igneous and associated rocks of the Glensaul district, Co. Galway; and (3) Dr. A. Vaughan, on the faunal succession of the Lower Carboniferous (Avonian) of the British Isles. The latter report included an important series of tables embodying Dr. Vaughan's latest views on the subdivision of the Lower Carboniferous rocks, and the correlation of the sequence in various parts of the British Isles. With the view of helping to bring Dr. Vaughan's work to the notice of Canadian geologists, Prof. S. H. Reynolds exhibited a series of lantern-slides of the two principal sections of the Bristol district, those of the Avon and of Burrington. He also contributed a paper on the lithology of the Burrington section. Another stratigraphical paper having reference to the Carboniferous rocks of the south-west of England was that by Mr. H. Bolton, on new faunal horizons in the Bristol coalfield, in which further evidence was brought forward of the occurrence of marine episodes in the Coal-measures of this part of the country. The only remaining stratigraphical paper was one by Dr. D. Woolacott, on the classification of the Permian rocks of the north-east of England.

(2) *Glacial Geology.*

Glacial geology naturally had much attention paid to it by the section when meeting in Canada, and the members were to be congratulated on hearing from Dr. Warren Upham an account of the glacial Lake Agassiz, in connection with which his name is so well known. At its maximum extent, according to Dr. Upham, it covered an area of about 110,000 square miles, exceeding the combined areas of the five great lakes tributary to the St. Lawrence. Lake Winnipeg forms its reduced representative at the present day. Dr. Upham's paper was followed by an interesting discussion, in which many leading Canadian and American geologists took part. Members of the section had, further, the opportunity of seeing some of the glacial and other deposits of Lake Agassiz on excursions which were made to Stony Mountain and Bird's Hill.

Prof. A. P. Coleman, in a paper on the extent of the ice sheets in the Great Plains, pointed out that while boulders from the Archæan region to the east are spread over the great plains as far west as Calgary, further to the west an older drift, derived from the Rocky Mountain region, is met with, this sometimes passing below the eastern drift. In places boulders from the eastern drift are found stranded 5000 feet up on the sides of the Rocky Mountains. These Prof. Coleman believes were stranded from ice-dammed lakes at a time when the Rocky Mountain region stood at a lower level than it does at present.

Glacial geology was further represented by a paper by Dr. A. Strahan, on the glacial geology of South Wales; by a lantern lecture by Dr. A. R. Dwerryhouse, on the glacial geology of Britain, as illustrative of the work of the committee on erratic blocks, and by the report of the committee for the investigation of the fossiliferous drift at Kirmington, Lincolnshire, and elsewhere.

(3) *Economic Geology.*

This subject, as might have been expected, was well to the fore, a series of most interesting papers on the ore deposits of Canada being given by Canadian geologists, Prof. W. G Miller dealing with the gold, silver, and iron

ores, Prof. A. P. Coleman with copper and nickel, Mr. J. B. Tyrrell with placer mining, and Prof. T. L. Waller with the rare metals. Prof. Miller prefaced his description of the gold and silver mining with a general account of mining in Canada. He pointed out that, until a few years ago, the central part of Canada was regarded as purely agricultural. The discovery of the rich ore deposits of Sudbury and Cobalt in 1908 completely changed this, and the value of the mineral produce rose from about a million dollars in 1901 to eighty-seven million dollars in 1908. The most interesting feature of the mineral wealth of Canada is its great variety. Canada is now the largest producer in the world of nickel, cobalt, asbestos, and corundum. As regards the immediate subject of his paper, Prof. Miller stated that the output of gold from the Archæan districts was not great, but it was found in British Columbia and the Yukon, the latter district standing third in the world's output. Gold is found also in Nova Scotia, and has recently been discovered at Prince Albert, in Saskatchewan. The great silver-producing region is Cobalt. The Canadian production of iron is as yet comparatively unimportant.

Prof. Coleman pointed out that copper is found in many parts of Canada, and in British Columbia some very low-grade ores are worked to a profit. Most of the copper of Ontario is found associated with nickel, the great locality for these substances being Sudbury, where the deposits occur in the marginal portion of a laccolitic mass of norite intruded between the Upper Huronian and the Animikie.

In dealing with placer mining, Mr. J. B. Tyrrell pointed out that it was almost confined to the mountainous region of the west, and that the industry had gradually spread along the river valleys from California northwards until eventually the Klondyke deposits were met with. These owed their value rather to exceptional conditions of erosion than to special richness. Mr. Tyrrell estimated that the Yukon district had yielded hitherto about six million ounces of gold, and might yield another four million.

Prof. T. L. Waller concluded the series of papers on the mineral resources of Canada with a description of the rare metals. Platinum and palladium are found in small quantities in the native state in placer workings at various points. Platinum has also been found combined with arsenic in the decomposed superficial deposits of the Sudbury district. Canada is also rich in undeveloped deposits of molybdenum and tungsten.

(4) *Palaeontology and other Subjects.*

In addition to the president's masterly address on the evolution of vertebrate life as shown by fossils, vertebrate palæontology was represented by two short papers, also by the president, recording the discovery of dinosaurian remains in the Cretaceous rocks of Australia and the Trias of Brazil, and by the report of the committee appointed to investigate the footprints of the Trias of Great Britain.

Other papers read before the section were by Mr. E. Dixon, on unconformities on limestone and their contemporaneous pipes and swallow-holes; by Prof. E. F. Chandler, on the rainfall run-off ratio in the prairies of Central North America; and by Dr. Tempest Anderson, on the volcano of Metavanu, in the Samoa Islands. The eruptive phenomena of this volcano closely resemble those of Kilauea, in the Sandwich Islands; but while the latter volcano, according to Dr. Anderson, is in its old age, the former shows the same phenomena with the exuberance of youth. A further interesting point in Dr. Anderson's paper was his confirmation by actual observation of the subaqueous production of the "pillow" structure in lavas.

The reports of the following committees were also presented:—on South African strata, by Prof. J. W. Gregory; on topographical and geological terms in South Africa; on geological photographs, this taking the form of an exhibition of lantern-slides illustrating certain aspects of British scenery; on the crystalline rocks of Anglesey; on the composition of the Charnwood rocks; on further excavations on Neolithic sites in north Greece; and on the salt lakes of Biskra. This latter report, which was represented merely by the title, refers to the work upon which the late recorder of Section C, Mr. Joseph Lomas, was engaged at the time of his lamented death.

ENGINEERING AT THE BRITISH ASSOCIATION.

THE proceedings in Section G consisted largely of papers by Canadian engineers on a closely related group of subjects, determined by the conditions of Winnipeg. Winnipeg occupies a peculiar geographical position, similar in some respects to Singapore or Buenos Ayres, as the gate of a great productive area. This position, and the bearing on it of the communications to the section, are most easily explained by recalling the geography of the country. Canada consists roughly of five sections.

(1) The Laurentian area, the so-called shield of Canada, is defined by the St. Lawrence and the chain of lakes which extends through Winnipeg, Athabasca, and the Great Slave and Bear Lakes to the polar regions. This vast district lying round Hudson's Bay is in the main a wilderness of lakes, rocks, and forests, swept clean of all cultivable soil by Glacial ice, except in certain areas where later Palæozoic rocks have been left over the Laurentian.

(2) The rich agricultural country between the Laurentian area and the Rocky Mountains. This, the modern provinces of Manitoba, Saskatchewan, and Alberta, is the northern section, reaching to 60° N. lat., of that geographical area of which the southern section is the basin of the Mississippi.

(3) The mountain region between the eastern foothills of the Rockies and the Pacific, a strip 400 miles wide extending up the whole coast.

(4) The fertile lands along the south of the St. Lawrence, New Brunswick, Nova Scotia, and the peninsula between Erie and Huron.

(5) The Arctic regions of tundra and ice.

To these five sections must be added for administrative purposes another of equal importance.

(6) The navigable route of St. Lawrence and the lakes.

Winnipeg is the gate between (2) and (6).

This section (2), 1200 miles long from north-west to south-east, and from 300 to 500 miles wide, is of extraordinary fertility, and especially adapted for growing wheat. The isothermals take a strong bend upwards in this region, and wheat has been ripened as far north as the Great Slave Lake, in 62° N. lat. The fertility of the soil is such that wheat can be grown remuneratively for many years in succession, and where the practice has obtained of allowing the land to be fallow one year in four to prevent exhaustion, it has to be sparsely tilled in the seasons following the fallow years to prevent the crops choking themselves by their own exuberance. Of this area, only 5 per cent. is yet cultivated, but in 1908 this produced 30 million quarters of grain, and carried nearly 4 million head of stock.

So long as the United States grows enough wheat for her own consumption, and until a new route is opened to the Atlantic by the Nelson or Churchill rivers on Hudson's Bay, the main trade of the provinces must pass east between Lake Winnipeg and Lake of the Woods. Here on the Red River, where the fertile lands end and the Laurentian wilderness begins, is Winnipeg, on the site of an old Hudson Bay Co.'s fort, Upper Fort Garry. A better site would have been at Selkirk or Lower Fort Garry, lower down the river and nearer the lake, but the site of the great depôt was ultimately fixed by the Canadian Pacific Railway for indirect reasons.

The great engineering questions of the city are to find the best means to develop the agricultural industry of the north-west, and to improve the trade routes, especially to the Atlantic. The papers presented to the Engineering Section dealt largely with these two subjects. Two papers on the grain industry, each of considerable length, were contributed by Mr. John Miller, an official at the experimental farm at Indian Head, Saskatchewan, and by Mr. George Harcourt, Deputy Minister of Agriculture of the Province of Alberta. The latter of these, especially, was a paper of exceptional ability and interest, the author being intimately acquainted with his subject and an admirable lecturer. He exhibited a map showing some of the extreme points in which wheat has been successfully ripened, and the area of potential grain-growing country. The subjects of these papers were not strictly those of engineers, but the urgent need for improved communications with which other papers dealt could hardly have been realised without

them. These other papers fell into two groups, viz. deep water and railway communications. The problems of wheat transport are (1) to bring ocean steamers to the nearest possible point to the wheat fields, and (2) to handle and transport the grain to the ports as efficiently as possible. At present ocean-going steamers drawing not more than 27½ feet of water can reach Montreal at all tides, and this depth is being increased to 30 feet. Ships drawing 14 feet of water can pass between Montreal and Lake Erie by the lower Ottawa river, the Lachine and Rideau canals, Lake Ontario, and the Welland canal. Erie, Huron, Michigan, and Superior can be navigated by vessels drawing 20 feet of water, the depth of water in the Soo locks. If the depth of water in the lower Ottawa river, and in the Lachine, Rideau, and Welland canals, in all of which the depth is now 14 feet, could be increased to 22 feet, ocean steamers of, say, 7000 tons, by taking in or discharging the last 1000 tons at Montreal, could reach Lake Superior and charge or discharge cargo at Port Arthur, the nearest point to Winnipeg. Thus, subject to a small proportion being transhipped at Montreal, cargoes could be carried in bulk by ocean steamers of the size of ordinary tramps between Port Arthur, in the very heart of the continent, and any Atlantic port.

This route, however, is open to serious objection in that it lies through the Detroit River, and is liable to interruption by political difficulties with the United States. A new canal route which is not subject to this objection has been surveyed. The scheme, which is called the Georgian Bay Canal Scheme, provides for a canal between Montreal and Lake Superior by way of the Ottawa River, Lake Nipissing, and the Pickerel and French rivers, having a minimum depth of 22 feet and locks 650 feet long, at a cost of 20 millions sterling. This canal would accommodate ships of the type now used to carry ore and coal between Cleveland and Lake Superior, as well as ordinary ocean-going tramp steamers. As a set-off to the cost, the water-powers that would become available are put at one million horse-power, and the value of the country that would be opened up would be very large. It seems probable that the work will be started before long.

On this side of the subject three considerable papers were read. Colonel Anderson described the navigation works on the St. Lawrence up to Montreal, and showed maps of all the lights and buoys, and of the dredging accomplished and still to be done. Mr. St. Laurent placed in the president's hands copies of the Government reports and plans of the Georgian Bay Canal surveys, and the latter read a paper to the section on the subject. In addition, Major George Stephens contributed an admirable paper on the St. Lawrence River as an imperial highway, and on the importance of Montreal as a central port of distribution.

The Hudson Bay route is not likely to be developed in the immediate future, and little reference was made to it. The Canadian Northern Railway has surveyed a route to Churchill, on the Hudson Bay, though the mouth of the Nelson may ultimately be preferred, as it is said that this river, draining lands far to the south, even beyond the U.S. frontier, is very free from shore ice. In the future Canadians look to the Nelson River being made navigable up to Lake Winnipeg, and from there the Saskatchewan may carry ships to the foothills of the Rockies.

Mr. T. E. Schwitzer, assistant chief engineer of the Canadian Pacific Railway, contributed a paper on some important works on that railway. The Lethbridge Viaduct is an immense structure, more than a mile long and more than 300 feet high, and the mode of construction was strikingly bold and effective. The revision of the grades in Kicking Horse Pass, involving the construction of two long spiral tunnels in the rock, was also described, and the great increase obtained in the loads hauled by a given engine-power. Careful grading on lines where the heavy loads of grain and other material usual in Canada are hauled is of extreme importance, and much was said on the cost of rail transport both in this paper and in two others by Mr. Macpherson and Mr. Lanigan. Mr. Duncan Macpherson described the organisation of the surveying parties for the new line between Monckton and Winnipeg, to be continued to the Pacific coast as the Grand Trunk Pacific. It is this line which is interrupted near Quebec by the failure of the great cantilever bridge while under construction. Mr. H. W. Lanigan wrote on the organisation for the collection and transport of grain in the wheat area. As assistant manager of freight traffic on the Canadian Pacific Railway at Winnipeg he has an intimate knowledge of that subject. The policy of the Canadian Government is to forbid the owners of elevators to trade in wheat and to restrict them to the duties of collecting and despatching, much as railways are restricted to the work of carriers. The Government undertakes the inspection and grading of the wheat, and performs this work with extreme care, so that the wheat is sold by the farmer and bought by the ultimate purchaser strictly by grade, not by sample. That is to say, the quality of the wheat having been determined by the Government inspector, the price paid per bushel is the current price for that quality. The system is too complex for more than reference here, but the advantage both to farmer and purchaser of an authoritative determination of quality is obvious.

Besides the papers we have referred to, which are all mainly of Canadian interest, three electrical papers were contributed by Prof. Marchant, Prof. Thornton, and Mr. E. A. Watson respectively, all dealing with three-phase transmission lines. Other papers were by Sir John Thornycroft, on skimming boats; by Colonel Ruttan, the city engineer of Winnipeg, on the high-pressure water plant of the city; by Mr. C. B. Smith, on a new hydro-electric power plant now being erected by the city authorities; by Mr. C. E. Larard, on torsional tests on materials—a very elaborate and detailed paper; by Prof. Coker, on an optical method of exhibiting strain; by Mr. Dugald Clerk, on the work of the gaseous explosions committee; and by Prof. Foster, on a systematic examination of the properties of the different coals of Canada now being carried out at McGill University. We have left to the last a paper on the Panama Canal by Colonel Goethals and Sir William White's address. Colonel Goethals is engineer-in-chief and president of the Isthmian Canal Commission. The paper was a long one, and very fully illustrated by lantern-slides. Colonel Goethals himself was unable to come to Winnipeg to deliver it, but Lieut. Goethals, of the United States Army, who has been engaged on the canal under his father, gave an account of it and exhibited the illustrations. It will be remembered that the failure of the French operations was largely due to two causes, one of which was the excessive mortality among the labourers and staff from tropical fevers, and the other the violent floods of the Chagres river. Since that time the cause of tropical fevers has been traced to the mosquito, and the American engineers, with characteristic thoroughness, have extirpated the mosquito over the whole of the canal zone, thereby bringing the rate of mortality to the figure of a well-organised town in a temperate climate. The measures which have enabled them to do this are of extraordinary interest, and the results are almost romantic. The engineering difficulties, which were mainly the floods of the Chagres, mentioned above, and the enormous excavation of the Culebra ridge, have been met by a design which promises to be quite successful. The Culebra ridge is much nearer to the Pacific than to the Atlantic shore, and deep valleys run down from the divide to the Caribbean Sea, one of which carries the Chagres river. Across this an immense earthwork dam, the Gatun dam, is being constructed, forming a great lake 160 square miles in area in the centre of the isthmus. The floods of the Chagres and of the other rivers, its tributaries, flowing down these mountain valleys, can discharge themselves into this large body of water without doing any damage to the canal works, however violent the floods may be. The level of the water in the lake is regulated by a spillway, built in a natural hill which forms part of the Gatun dam, discharging below the dam into the old bed of the Chagres. The surface of the lake is 85 feet above the mean sea-level, and is reached by three locks on each side. The lake is amply sufficient to provide the necessary water for lockage and waste during the dry seasons. Lastly, this high summit-level has reduced very largely the necessary amount of excavation in the Culebra cut. Even then, however, this amounted to 150 million cubic yards. Besides photographic views of the works and machinery, there were exhibited copies of

some of the working plans and surveys, and it is much to be hoped that the whole paper may be published in full. A recommendation to this effect was made by the committee.

Sir William White was expected to deal in his presidential address with problems of naval organisation and construction, peculiarly interesting at a time when the Imperial Naval Conference was sitting in London. His address was, however, an admirable preface to the series of papers on questions of water and railway transport which followed it, and was a masterly review of the position of Canadian commerce.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Prof. Jordan Lloyd has accepted the invitation of the council to succeed Prof. Bennett May in the chair of surgery.

Prof. Peter Thompson, of King's College, London, has been appointed professor of anatomy in the place of Prof. Arthur Robinson.

The chair of zoology, rendered vacant by the death of Prof. T. W. Bridge, F.R.S., has been filled by the election of Dr. Frederick William Gamble, F.R.S.

The following appointments have been also made:—Dr. Jessie S. Bayliss, as lecturer in botany; Messrs. F. W. Aston and H. B. Keene, as demonstrators in physics; Mr. T. F. Wall, as assistant lecturer and demonstrator in electrical engineering; and Mr. Cyril S. Fox, as demonstrator in coal mining and lecturer in mine surveying.

CAMBRIDGE.—The professorship of zoology and comparative anatomy is vacant by the resignation of Prof. Sedgwick. The electors will meet for the purpose of electing a professor on Friday, October 29. Candidates are requested to send in their names to the Vice-Chancellor on or before October 22.

Notice is given that the Quick professorship of biology is vacant, as the period of three years for which Dr. Nuttall was appointed has now ended. The election will take place on Friday, October 29. Candidates are requested to send in their applications to the Vice-Chancellor on or before Friday, October 22.

Mr. F. A. Potts, of Trinity Hall, has been appointed demonstrator of comparative anatomy for one year from Michaelmas, 1909. Mr. L. A. Borradaile, of Selwyn College, has been appointed demonstrator of animal morphology for one year from Michaelmas, 1909. Mr. F. T. Brooks, of Emmanuel College, has been appointed senior demonstrator of botany for two years ending September 30, 1911, and Mr. D. Thoday, of Trinity College, has been appointed junior demonstrator of botany for the same period.

An anonymous benefactor has promised the sum of 100*l.* towards the construction of a field laboratory in the vicinity of Cambridge, in connection with the Quick Biological Laboratory. The sum of 100*l.* has been granted by the advisory committee of the tropical diseases research fund towards the expenses of the Quick Laboratory in the present year.

GLASGOW.—The University is to benefit to the extent of 10,000*l.* from the estate of the late Dr. Robert Pollok. The amount in question is given for the endowment of a university lectureship for original research in materia medica.

MANCHESTER.—The new chemical laboratories (to be known as the John Morley Chemical Laboratories, after the Chancellor of the University) were opened on Monday last by Sir Henry Roscoe, F.R.S., professor emeritus of chemistry in the University.

OXFORD.—It is proposed to confer the degree of D.C.L., *honoris causa*, upon his Excellency Osman Hamdy Bey, director-general of the Imperial Ottoman Museum of Antiquities, Constantinople.

Mr. John Finnigan has been appointed secretary to the Senate of Queen's University, Belfast.

THE new laboratories for physiology, chemistry, and physics of the London Hospital Medical College are to be opened on Friday of next week by Prof. W. Osler, F.R.S., who will afterwards deliver the Schorstein lecture.

COURSES of lectures on the fermentation industries are announced for delivery at the Sir John Cass Technical Institute, Aldgate. The inaugural lecture (on chemistry in relation to brewing and malting) was given by Mr. A. R. Ling on Tuesday last.

MR. H. A. S. WORTLEY, of Downing College, Cambridge, has been appointed assistant lecturer in the day training department of the University College of North Wales, Bangor. The inaugural lecture of the present session was delivered on Tuesday last by Prof. W. M. Flinders Petrie, F.R.S., who spoke on recent excavations in Egypt.

A COURSE of ten lectures on economics, by Mr. Alfred Milnes, has been arranged for delivery at Bedford College for Women in connection with the course of scientific instruction in hygiene at the institution. The lectures are specially designed for women preparing to be factory inspectors or desiring to take part in other public work. They will be delivered on Mondays, beginning on October 11.

THE new chemical laboratory of the Pharmaceutical Society's School of Pharmacy was opened on Wednesday of last week. On the same day began the new session of the school, when the opening address was delivered by Prof. Alexander Tschirch, of the University of Bern, who took as his subject "The Future of Pharmacognosy." At the conclusion of the address the Hanbury gold medal was presented to Prof. Tschirch.

THE Leathersellers' Technical College, which has been erected at a cost of nearly 20,000*l.* in the Tower Bridge Road, was opened by the Lord Mayor of London on Friday last. In declaring the college open, Sir G. Wyatt Truscott said that no subject was of greater interest than the development of technical education and the splendid part which the city guilds had played in that development. The city companies had found, in assisting technical education, an opportunity of re-associating themselves with the interests of the trades that they represented. In the leather trade, unfortunately, the system of apprenticeship had somewhat died out, but he hoped that it might be revived.

IN opening a new wing of the Leicester Technical and Art Schools on Thursday last, Prof. Silvanus P. Thompson, F.R.S., said the conclusion he came to after a tour of the industrial centres of Europe was that the most successful technical schools were those which carefully studied the needs of their own special industries. The disastrous tale of the manufacture of dyes from coal-tar products was not without its warning to this country. The trained brains sent out by German universities and technical colleges profited by the inventions of English chemists, and we paid 2,000,000*l.* a year for dyes manufactured abroad from coal-tar products. Thanks largely to technical education, a similar disaster was averted when the electrical engineering industry was developed.

ACCORDING to a note in the *Engineer*, arrangements have been made with several of the leading engineering firms in Glasgow and elsewhere by which students of the South-western Polytechnic Institute are allowed to enter their apprenticeship. Students who satisfactorily perform the work in the mechanical engineering department in the first year may proceed at once and continue their work at one of the firms arranged for, and students who have satisfactorily finished the second-year course are allowed to proceed with their apprenticeship and return to the college and continue their third session. Furthermore, students who obtain the diploma of their college will have their apprenticeship reduced. Under these conditions a student can obtain a first-class training as an engineer, and apprentices who perform satisfactorily in the workshop are allowed to enter the drawing-office.

ATTENTION has often been directed in these columns to the complete equipment and excellent arrangements of the London polytechnics. Among these institutions, the Batter-

sea Polytechnic takes a prominent place. The calendar for the session which has just commenced shows that for this winter entirely new classes have been started in engineering estimates, electrochemistry, chemical engineering, dyeing and cleaning, analysis of foods and drugs, and sanitation. In addition to this, it is of interest to notice that new accommodation, in the form of laboratories, workshops, and equipment, is being provided in mechanical, electrical, and motor engineering, chemistry, natural science, art, and domestic economy, these extensions having been rendered possible by the assistance of the London County Council, and it is expected that they will be to some extent ready for use during the current session.

THE following free courses of advanced science lectures are announced by the University of London :—the geographical distribution of plants, by Prof. Percy Groom and Mr. A. W. Hill; evolutionary aspects of palæobotany, by Mr. E. A. N. Arber; fertilisation, by Prof. J. B. Farmer, F.R.S.; the anatomy of plants in relation to external conditions, by Mr. L. A. Boodle; geology and evolution, by Prof. J. W. Judd, C.B., F.R.S.; the geology and physiography of Arctic Europe, by Prof. E. J. Garwood; a course by Prof. W. W. Watts, F.R.S.; dynamical meteorology, with special reference to the forecasting of weather, by Dr. W. N. Shaw, F.R.S.; recent researches on chloroform anæsthesia, by Prof. G. A. Buckmaster and Mr. J. A. Gardner; a course by Mr. W. B. Hardy, F.R.S.; the physiology of the peripheral nerves, by Dr. N. H. Alcock; protozoan parasites, with special reference to those of man, by Prof. E. A. Minchin; the distribution of the Oligochæta, by Mr. F. E. Beddard, F.R.S.; the phylogeny of calcareous sponges, by Prof. A. Dendy, F.R.S.; symbiosis, by Dr. F. W. Keeble; the Marsipobranchii, by Mr. F. G. Cole; Amphioxus, by Prof. E. W. MacBride, F.R.S.; the morphology of swim bladders, by Dr. W. N. F. Woodland.

THE two universities created by the Irish Universities Act of 1908 came into existence on October 1. The *Times* Dublin correspondent last Friday described the state of preparation of the new universities. The commissions appointed under the Act to draft statutes and lay the foundation for the two new universities were given a period of two years for their work. They have sat often and worked hard, with the result that they are now well in advance of schedule time. The National University consists of a Senate and officers with large powers, but with no buildings of its own. The University has its concrete embodiment in the new University Colleges, formerly Queen's Colleges, at Cork and Galway. University College, Dublin, is so far only concrete in the sense that its governing body has been called into existence. At the present time it has no teaching and no college buildings. The commissioners will meet shortly to appoint a teaching staff, and the college will open early next month. As regards staffs, the Dublin College is differently situated from those at Cork and Galway, where teaching staffs exist in the staffs of the old Queen's Colleges, which are to be taken over in accordance with the provisions of the Act. Only a very few chairs remain to be filled. In University College, Dublin, it is taken for granted that most of the old staff will be translated to corresponding chairs in the new college. In this case, however, the commissioners will have also to fill a number of new chairs. Nothing has yet been done in connection with the buildings of the new college in Dublin, though various sites have been suggested. Meanwhile, the college will probably begin its work in the Royal University buildings, and will solve the immediate problem of class-rooms by renting the Roman Catholic University College and the buildings of the Roman Catholic Medical School. The cases of Queen's University, Belfast, and of the University Colleges at Cork and Galway present no difficulties. These institutions will have teaching staffs within a couple of weeks, and all their buildings and class-rooms are in going order. It may be taken for granted that by the middle of November, at latest, the work of the two new Irish universities in all its departments will have been organised and practically initiated.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, September 27.—M. Bouchard in the chair.—The existence of intrusive Pliocene rocks in the volcanic *massif* of Cantal: A. **Lacroix.**—Aniline antimonyl tartrate in the treatment of trypanosomiasis: A. **Laveran.** Experiments on experimentally infected guinea-pigs having given favourable results on treatment with this drug, M. Thiroux has tried it in Senegal on natives suffering with sleeping sickness. The immediate results were very satisfactory, the intra-venous injection of 15 centigrams causing the disappearance of the trypanosomes from the blood of an adult man. The action is more rapid than when atoxyl is used, two patients who had commenced to sleep recovering after the injection of 15 centigrams. It has still to be proved that the cure is permanent.—The Brownian movement of rotation: Jean **Perrin.** Einstein has deduced a formula for the rotation of a spherical particle in a fluid of a given viscosity. The author has succeeded in measuring the velocity of rotation experimentally, the result being in complete agreement with Einstein's theory. It appears probable that the molecular kinetic hypothesis affords a safe basis in the study of Brownian motion.—The electro-diapason: A. **Guillet.**—Thermochemistry of some phosphorus compounds: P. **Lemoult.**

CONTENTS.