THURSDAY, JULY 15, 1909.

REGENERATION.

Experimental-Zoologie. Part ii., Regeneration: Eine Zusammenfassung der durch Versuche ermittelten Gesetzmässigkeiten tierischer Wieder-erzeugung. By Dr. Hans Przibram. Pp. viii+338; 16 plates. (Leipzig and Vienna: Franz Deuticke, 1909.) Price 14 marks.

THE second part of Dr. Hans Przibram's "Experimental Zoology" has so far only been published in German, but it is to be hoped that an English translation will follow in due course. It will be a matter for regret if the efforts of the Cambridge University Press to provide English-speaking biologists with standard editions of works which are otherwise accessible only in a foreign language do not receive sufficient support to justify their continuance. The present volume, which is very considerably larger than the first (reviewed in NATURE, March 4, p. 2), deals with the secondary aftergrowth of lost parts, embracing the phenomena of morphallaxis and deformation. The allied subject of grafting, which finds a place in Prof. Morgan's work on "Regeneration," published eight years ago, is not systematically dealt with, but it may well be that this is reserved for special treatment in the final volume on function. The subject-matter of the part now under notice is divided into eight chapters, dealing successively with the different groups of the animal kingdom, from the Protozoa to the Vertebrata. To these is added a general summary, containing an account of the general laws which govern the regenerative processes and their development in phylogeny. There are sixteen coloured plates, which are bound at the end of the volume, but these are so overcrowded with figures as to tend towards confusion, and the execution is not good. The work is adapted for purposes of reference rather than for continuous reading, and is furnished with an extensive bibliography, in which few omissions are to be detected.

In dealing with the power of compensatory hypertrophy possessed by the generative glands, the author alludes to the fact that although unilateral castration is said to promote an increased growth on the part of the remaining testis, the number of spermatozoa found in the semen is very appreciably diminished, at least according to Lohde's observations. These statements, however, are not necessarily conflicting, since Ancel and Bouin and others have shown that in all probability the interstitial cells of the organs, and not the spermatogenetic tissue, are responsible for the normal testicular influence which is exerted upon the secondary sexual characters and the organism as a whole; and so it may perhaps be, in general, that it is the interstitial rather than the seminiferous portion of the testis which undergoes hypertrophy after one-sided castration. Moreover, the time which Lohde allowed to elapse after extirpating the single testis was probably too short to admit of definite conclusions being drawn regarding the power of compensation possessed by the remaining testis. Dr. Przibram notes the occurrence of thyroid regeneration following the partial removal of that organ, but he omits to state that in certain cases the parathyroids are capable of regenerating tissue containing colloid substance, and so resembling, if not identical with, normal thyroid tissue. Neither does he mention that in rabbits and other animals which can survive thyroidectomy the function of the thyroid appears to be taken over by the pituitary, in which the cells of the *pars intermedia* show an increased activity, as manifested especially by a greater secretion of colloid. Both these processes are probably to be regarded as instances of functional restitution in allied organs of the body.

The regeneration of the uterine mucosa after parturition and menstruation is alluded to, but there is no reference to Heape's papers, which deal more fully than any others with the nature of the post-menstrual recuperative processes. Futhermore, there are certain omissions in the literature dealing with teratological science. Nevertheless, the work, as it stands, contains by far the most comprehensive account of the subject of regeneration that has as yet been written, and, as such, it constitutes an important addition to the literature of experimental zoology.

FRANCIS H. A. MARSHALL.

A NATURALIST IN TASMANIA.

A Naturalist in Tasmania. By G. Smith. Pp. 151. (Oxford: Clarendon Press, 1909.) Price 7*s.* 6*d.* net.

TASMANIA is the smallest of the Australian States, and its scientific interest is out of all proportion to its size, while its magnificent scenery, picturesque lakes, rugged mountains, noble forests, and its combination of vegetation of tropical luxuriance with a temperate summer climate will always make it one of the most attractive of Australian tourist resorts. The State has still a small and scattered population; internal communication and railway construction are exceptionally difficult, so, though it was the second in date of Australian colonies, much of the island is still very imperfectly known.

Mr. Geoffrey Smith, of New College, Oxford, made an expedition to Tasmania in 1907–8, aided by a British Association grant, in order to investigate the primitive shrimps inhabiting its lakes. The short volume gives a charmingly written narrative of his journey, and it is illustrated by some of Beattie's beautiful photographs and excellent drawings of some Tasmanian animals, such as that of the Tasmanian Devil (Sarcophilus), by Mr. Goodchild. It is accompanied by a geological sketch-map based on Johnston's.

Mr. Geoffrey Smith is enthusiastic over the beauty of Tasmanian scenery. He deals especially with the districts near Hobart and around the Great Lake on the Central Plateau. He gives a short note on the aborigines, with illustrations both of their heads and skulls. On the vexed question as to the relation of the Tasmanians, he is emphatic (p. 28) that—

"Whether the Tasmanian race ever inhabited the mainland of Australia or not, it is certain that neither in their physical characters nor in their culture have they anything to do with the Australian blacks, whose

relationship lies rather with the Veddahs of Ceylon and the other straight-haired Proto-Dravidian races that still exist sparsely in India and the Malay Islands."

He says we have a good deal of information as to their burial customs, which differ totally from those of the Australians, and their language "seems to have differed entirely from the Australian and to show remote connection with the Andamanese" (p. 31).

His last chapter discusses the biological relations of Australia and Tasmania, and the evidence for the connection of Australasia with Antarctica. He is convinced that the fauna and flora of Australia entered it from the south and not from Asia. As he truly remarks, the marsupials are most numerous and of the most primitive types in southern Australia, while they are comparatively rare and most specialised in northern Australia. If they had migrated from Asia the opposite arrangement would have been expected.

The author still accepts Galaxias as evidence of the recent connection of Australasia and South America; he admits that it visits estuaries, but considers that it can only have spread across the southern Pacific along the shelf around the Antarctic land. After Mr. Boulenger's letter (NATURE, 1902, vol. lxvii., p. 84), with its convincing evidence that Galaxias breeds in the sea, the distribution of that fish is no indication of a former land connection. One slip, in fact, is the statement that the tree Senecios are unknown in the tropics (p. 133). They are the largest trees in the alpine zone of Kenya and other east African mountains. The author represents Tasmania as not a biological appanage of Australia, as he holds that it acquired its present distinctive characters before its separation from the mainland. Although this view is probable, the striking differences which the author well describes between the faunas of the two areas indicate that the separation happened long enough ago for many of the Tasmanian mammals to have developed into new species. The most striking part of the book is Mr. Smith's valuable contributions to knowledge of the primitive Tasmanian freshwater shrimps, of which he discovered a new genus. They are allied to those of the European Carboniferous Crustacea, and are one of the groups of archaic animals still living in Australasia.

PROPERTIES OF BUILDING MATERIALS.

Introduction to the Chemistry and Physics of Building Materials. By Alan E. Munby. Pp. xx+345. (London: A. Constable and Co., Ltd., 1908.) Price 6*s.* net.

UNLIKE many books intended chiefly as short cuts to success in examination, this work seeks to impart in a clear, concise, and accurate manner the scientific principles underlying the proper use of material in construction.

Part i. contains chapters devoted to natural laws, measurement, the air, heat, chemical principles, water, acids and bases, coal, and a useful outline of geology. In part ii. all the chief building materials are dealt with in detail. The origin and occurrence of each material are described, also the preparation for use, varieties met with, impurities and adulterants, defects, and tests for quality, including both laboratory tests and simple practical tests such as may be applied by the workman. In every case the author is careful to point out the application of correct scientific principles, and from his practical knowledge is able to suggest many useful tests not generally known.

The work is thoroughly up to date, from both a scientific and a practical point of view, and the latest results of investigation into such matters as the setting action of cement, the rusting of iron, and the micrography of metals are clearly and broadly stated in their bearings upon the practical use of material.

This book will prove of great value to students intending to take up architecture as a profession. The builder, also, and the practical man will be glad to take advantage of much of the information given. In fact, many teachers in the architectural and building departments of technical colleges will be glad to know of the book with the view of recommending it to their students.

This being the first edition, it is hardly to be expected that the book is entirely free from defects. The diagrammatic illustrations given seem to be the least satisfactory part of the work. While the work has been written so lucidly as to render numerous figures unnecessary, it would seem that more than nine illustrations might be legitimately employed to assist the reader in grasping the subject. There is room for some improvement, too, in the chapter on timber, several inaccuracies having escaped correction, *e.g.* on p. 295, what is described as decay due to worms should rather be ascribed to the larvæ of certain beetles, &c. Also, on p. 296, the Teredo, although popularly regarded as a worm, should really be classed with the mollusca. In dealing with dry rot on p. 294, the temperature conditions are not referred to, although these play an important part in the development of the fungus.

A few statements in other parts of the book seem to call for reconsideration or correction, *e.g.* p. 20, § 3:—"If two vessels containing the same liquid be connected, the level in each will become the same *whatever*[1] the form or distance of the connecting pipe." Again, the statement, p. 277, "Shearing and torsional stresses are identical, apart from the method of applying the force producing them," although true, needs explanation to the mind not trained in mechanics.

The explanation given on p. 323 as to the optical theory of the production of a green pigment from yellow and blue powders, will hardly explain fully how it happens that the same blue powder, mixed with a red one, will produce purple. Turning to the useful table on p. 63, the tyro may be puzzled again to know why, if the substance denoted by CaO_2H_2 is termed calcium *hydroxide*, the substance PbO_2H_2 is termed lead *hydrate*; or, if CO_2 is called carbon *dioxide*, why SiO_2 is called silicon *oxide*. On p. 18 the author correctly says, "To move a heliostat reflecting a beam of light requires no more effort than would be necessary in the dark," but the heliostat being

[1] Italics not author's.

unknown to most students of building materials, it might be advisable to substitute the more familiar "mirror."

However, in spite of a few minor points like these, the book as a whole is well written, and admirably adapted to the class for whom it is intended. It deserves to take a permanent place among the text-books upon the subject, and in future editions the points referred to will no doubt receive attention.

H. B.

ECONOMIC BACTERIOLOGY.

Bacteria in Relation to Country Life. By Dr. Jacob G. Lipmann. Pp. xx+486. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1908.) Price 6*s.* 6*d.* net.

WRITTEN in non-technical language, this book gives a good account of the activities of micro-organisms. It may therefore be recommended to all those who desire to obtain a general knowledge of the functions of bacteria and the important *rôle* they play in relation to daily life, while the intelligent agriculturist will find a large amount of information which should aid him in his work. After a brief survey of the form, structure, food requirements, and conditions of growth of bacteria, successive chapters deal with these organisms as met with in air, water, and sewage. The relation of water to health and disease is discussed, and the chief factors in connection with the contamination and purification of water are detailed. A readable account is given of the disposal of sewage and of bacterial systems of sewage disposal. Next follow the most important sections of the book, viz. the relation of bacteria to soil fertility and the influence of manures. We here find accounts of the sources of nitrogen in the soil, of nitrification and denitrification, of the action of leguminous crops in fixing nitrogen, and of soil inoculation with pure cultures of nitrogen-fixing organisms. The proper methods of storing farmyard manure are dealt with at some length, and it is shown that under different conditions of storage the losses of organic matter from the manure stack in three or four months may range from 15 to 20 per cent. to 40 to 50 per cent. of the initial quantity, and valuable suggestions are made on the best means of conservation of manurial constituents, both by proper methods of storage and by the use of chemical fixatives.

The chapters which follow on milk, its production and preservation, are also excellent. Details are given which show that *careful* hand-milking yields a better milk as regards bacterial contamination than any milking machine, unless *extreme* precautions are taken in the sterilisation of the latter. The subject of pasteurisation of milk is also critically discussed, and the following extract sums up the author's views on the advantages and disadvantages of the process, views with which we fully agree and which should be widely known:—

"Pasteurisation is effective for the destruction of disease bacteria in milk and for the improvement of its keeping quality. It is agreed that city children fed on pasteurised milk, properly heated and properly cooled, are less subject to intestinal disturbances than children fed on raw milk. At the same time, it must be admitted that the pasteurisation of milk already filled with bacteria, and the products of their acitivities, will not remedy its defects. The undesirable substances formed by the bacteria are not entirely destroyed by the heating, and may still cause injury to the person consuming the milk.

"By resorting to pasteurisation, a dealer may be able to dispose of milk that would otherwise quickly become unsaleable. Similarly, the failure to cool the pasteurised milk quickly and to keep it at a temperature of 50°, or below that, may lead to the rapid multiplication in the milk of germs producing injurious or poisonous substances. Hence, pasteurised milk should be consumed within twelve hours, or should be immediately cooled down to between 45° and 50°."

The subject of tuberculosis in relation to milk is fully discussed. It is pointed out that large numbers of tubercle bacilli may pass into the excreta of tuberculous cows, a fact which was fully confirmed by the experiments of our Royal Commission on Tuberculosis as contained in the last report, and it is concluded that

"Whatever difference of opinion there may prevail as to the extent of human tuberculosis caused by the consumption of milk and milk products, it is conceded by sanitarians that persistent efforts should be made to eradicate bovine tuberculosis."

Subsequent chapters deal with milk beverages, butter and cheese, canning, ensilage and fermented liquors.

The book is adequately illustrated and clearly printed.

R. T. HEWLETT.

FORESTRY.

(1) *Our Forests and Woodlands.* By Dr. J. Nisbet. New and revised edition. Pp. xxiii+348. (London: J. M. Dent and Co., 1909.) Price 3*s.* 6*d.* net.

(2) *Trees: A Handbook of Forest-Botany for the Woodlands and the Laboratory.* By the late H. Marshall Ward. Vol. v., Form and Habit. Pp. xi+308. (Cambridge: University Press, 1909.) Price 4*s.* 6*d.* net.

(1) THE first edition of Dr. Nisbet's well-known book, "Our Forests and Woodlands," appeared in 1902. The second edition has now been issued, and will doubtless be welcomed by a large circle of readers, not only on account of the interesting and important information it contains, but the price is such as to bring it within the reach of many who cannot afford the more expensive, though excellent, works on forestry at present available to the English reader. A very important, and probably the most outstanding feature of the new edition is the preface, in which the author has given a *résumé* of the progress which has been made in forestry since the appearance of the first edition. The doings of the various Governmental committees and commissions which have sat of late years are clearly set forth. There is also given a very striking table in the form of an abstract from the "Annual Statement of the Timber Trade of the United Kingdom" for 1906 and 1907. Here it is shown that the gross total imports of wood and timber, wood-pulp, and manufactured wood-pulp come to about 37,500,000*l.* To supply these

present demands, leaving out of consideration the increasing consumption, which will no doubt continue, the author points out that it would require 3,000,000 acres of conifer and other woodlands, or an annual cut of 50,000 acres of timber worked on a sixty years' rotation. Contrary to opinions held in other quarters, Dr. Nisbet anticipates the decrease in the supply, to this country at least, of pitwood. At present large supplies come from Bordeaux, but signs are not lacking that the quantity of suitable timber is decreasing, while the French collieries themselves show increasing demands. It would be a serious blow to all our industries dependent on coal should the supply of pitwood fail, and in any case the price is likely to increase, which will, other things remaining the same, raise the price of coal.

Another very important question to which the author directs attention is the wood-pulp industry. At the present time the United States dominate the paper market of the world, but there is an increasing shortage of suitable timber for the making of paper-pulp, which is, therefore, naturally increasing in price, and the recent large rise in the price of paper is due to the growing shortage in the supply of spruce. Since 1904, the cost of mechanical wood-pulp in this country has increased from 85*s*. a ton to 120*s*., while in America during the past ten years the price has increased threefold. The demand for pitwood and wood-pulp is bound to continue; in other words, there is a sure market for such produce, and the author, who is a widely recognised authority on such matters, points out that our waste lands and poor pastures are to a very large extent capable of producing conifers and soft-wood crops which could be established at comparatively little cost, and would yield good returns to the owner, and at the same time supply pit-wood for our mining industries and therefore indirectly benefit all industries dependent upon coal; and, lastly, with a sufficient supply of raw material for the making of paper-pulp a new industry would be created in this country.

There are altogether eleven chapters in the book, with an index at the end. Some very fine illustrations are also included. The first two chapters are mainly taken up with historical matters, which provide extremely interesting reading. The next two chapters deal with the sylvicultural characteristics of the oak and beech. In chapter v. the remaining hardwoods are considered, while the soft woods, such as alder, birch, lime, and poplars, are dealt with in chapter vi. Coniferous plantations of pines, firs, and larch are treated in chapter vii. Chapter viii. is more arboricultural, as it deals with hedges and hedgerow trees. Chapter ix. is occupied with the consideration of high-woods, copses, and coppicewoods, while the last two chapters, viz. x. and xi., are devoted to woodlands, game and sport, and the improvement of British forestry respectively.

The book is full of sound and trustworthy information. Its price is moderate, and it deserves a hearty reception from all those interested, directly or indirectly, in our forests and woodlands.

(2) This volume dealing with the form of trees is the final one of its series. The volume, like the previous one, has been seen through the press by Dr. Groom, who informs us in the preface that he has reduced changes from the original to a minimum. The few alterations and additions which were found necessary have been indicated by enclosure within square brackets. Part i. deals in a general way with the habit or form of trees, and, in addition to the text, the form or habit of the tree is indicated in many instances by illustrations, while the form of the branch-system is also indicated diagrammatically. A series of Mr. Henry Irving's well-known photographs illustrating the outward appearance of the bark has been included.

In part ii. the trees are detailed according to their form and other external appearances. The system of tabulation adopted is similar to that employed in the previous volumes. At the end we have an appendix which contains a classification of trees and shrubs according to their seedlings, and here we have many excellent drawings by Miss E. Dale from actual seedlings, the scale of magnification or reduction being indicated in each case. No doubt this appendix, as Dr. Groom points out, is not so complete as the author evidently intended to make it, yet it is, including the drawings, valuable so far as it goes, and is well worthy of careful study.

Taking the whole work as it now stands, we have five volumes which deal respectively with buds, leaves, flowers, fruits, and form, and it will be admitted on all hands that the late Prof. Marshall Ward has left behind a monumental work which will long be considered a standard on trees.

NEW BOOKS ON ORGANIC CHEMISTRY.

(1) *Modern Organic Chemistry.* By Dr. C. A. Keane. Pp. xiv+503. (London: The Walter Scott Publishing Co., Ltd., 1909.) Price 6*s*.

(2) *Practical Organic Chemistry.* By Dr. J. J. Sudborough and T. C. James. Pp. xviii+378. (London: Blackie and Son, Ltd., 1909.) Price 5*s*. net.

(3) *The Elements of Organic Chemistry.* By E. I. Lewis. Pp. viii+224. (Cambridge: University Tutorial Press, Ltd., 1909.) Price 2*s*. 6*d*.

(4) *Abhandlung über die Glycole oder Zwei atomige Alkohole.* By Adolf Wurtz. Pp. 96. Ostwald's *Klassiker*, No. 170. (Leipzig: W. Engelmann, 1909.)

(1) TO anyone possessing a sound elementary knowledge of organic chemistry we can strongly recommend Dr. Keane's book. It is not a text-book, for there is no systematic arrangement of the materials, and the properties of individual substances and the relations of different groups are not brought into relief. If, for example, the student wishes to learn something about ordinary phenol, he will find bits of scattered information in four different places. Systematic instruction is obviously not the object of the book. But although the treatment is unconventional, and frequent digressions are made into regions not usually embraced by organic text-books, this very fact rather enhances than detracts from the interest of the

volume. The subject is brought into touch with other branches of the science. Thus, under hydrocarbons, we read a little about thermochemistry; under aldehydes there is a reference to autoxidation; under acids there are a few words about steric hindrance; under ethereal salts (a rather antiquated term) a short account is given of mass action, and so forth. In addition to this there are separate chapters on laboratory methods, stereochemistry, the sugars, dynamic isomerism, heterocyclic compounds, and the physiological properties of organic compounds.

That the subjects are treated rather broadly than deeply seems no serious defect. They are sufficient for the general reader, who is provided with elaborate references if he desires to extend his knowledge. In conclusion, we would direct the author's attention to a few inaccuracies which have been noticed, and which might be modified or corrected in a future reprint. The two isomeric dimethylethylenes, which are stated to be known in only one form, have been prepared by J. Wislicenus (p. 310); the molecular weight of triphenylmethyl has been determined, and corresponds to the double formula (p. 423); Fischer and Slimmer were unsuccessful in effecting an asymmetric synthesis (p. 301); it is incorrect to state that propylene and hydrobromic acid give exclusively isopropyl bromide (p. 45).

We would also suggest the following:—Thiele's hypothesis requires amplification to be understood (p. 46); it is very questionable if the explosiveness of a compound depends upon its breaking up into stable molecules, for many silver salts share with silver oxalate this property, whereas a substance like platinic chloride does not explode; the statement that *ethyl* and *methyl* "cannot exist in the free state because they contain one of the carbon affinities unsaturated" (p. 27) is inconclusive, especially as triphenylmethyl is referred to later as possibly existing (pp. 36, 423); without some qualification it is misleading to say that Dumas's theory of types "was especially developed by Gerhardt," and "received the support of Williamson and Wurtz" (p. 17). In the first place, Williamson originated the idea of Gerhardt's types, which were simple inorganic compounds in which hydrogen could be replaced by radicals. They were intended to denote chemical behaviour and not relationships. Ether had no generic relationship to acetic anhydride, though they belonged to the same type. Dumas's types, on the other hand, were organic substances which were intended to show relationships produced by substitution rather than chemical behaviour.

(2) The "Practical Organic Chemistry" of Sudborough and James is rather a laboratory handbook or book of reference than a course of practical instruction. As stated in the preface, examples are given of different types of operations. These types are grouped together. Thus, there is a chapter on the preparation of hydrocarbons, one on alcohols, another on halogen compounds, acids, esters, nitro-compounds, sulphonic acids, and so forth. In addition, there is a preliminary chapter on organic analysis and molecular-weight determinations, and, at the end of the volume, a number of useful examples of analyses and the determination of physical constants such as are playing an increasingly important *rôle* in the study of structure. The descriptions are clear and full, and the photographic illustrations are masterpieces of their kind. Altogether the book is probably the most complete among those of home manufacture on the subject of practical organic chemistry that has yet appeared.

(3) This modest little volume, which is one of the University Tutorial Series, should form an excellent introduction to the study of organic chemistry, and if the process of practical instruction can be carried on concurrently with theoretical teaching, as the author does with his own class, nothing better could be desired. He takes a few of the commonest organic substances and uses them, as they can easily be used, to illustrate quite a large variety of chemical operations and products. If the substance of the book can be assimilated in the course of four school terms, as the author states, we think that both teacher and student should be satisfied with the result. May we suggest that the name of Wurtz should be spelt without the diæresis and Senderens without an *a*?

(4) One turns from the intricacies of a modern treatise on organic chemistry to Wurtz's classical memoir on the glycols with the same sense of relief that one listens to the simple melody of an early composer after the confused sounds of a modern orchestral symphony. Short and simple though it is, it is difficult to overrate the far-reaching results of Wurtz's research. It was not merely the discovery of a new class of alcohols and organic oxides, or an extension of Williamson's water type. It afforded for the first time clear experimental evidence of the existence of what were then termed "polyatomic" radicals. To quote Wurtz's own words:—

"The main result, which, in my opinion, is derived from these synthetic experiments, is not the discovery of the new compound, glycol—there are enough new compounds in organic chemistry—it is not even the synthesis of glycerine nor the difficulties connected with its preparation which have been successfully overcome; but it is the manner of the formation of glycol and the antecedent reactions which made it possible; it is the conversion of the allyl compound by which the iodide passed into glycerine. All these experiments, which were directed to the same end, have shown that an organic group united to 2 atoms of chlorine or bromine can replace two atoms of silver, and are therefore equivalent to two atoms of hydrogen, and that an organic group united to three atoms of chlorine or bromine can replace three atoms of silver and is equivalent to three atoms of hydrogen."

The theory of polyatomic radicals, like ethylene and glyceryl, soon developed into that of the polyatomic elements or the theory of valency, upon which the whole fabric of modern organic chemistry rests. Wurtz himself held perfectly clear views on the different valency of the elements. In his address to the Chemical Society in London in 1862 on ethylene oxide, he points out that as ethylene oxide represents a diatomic radical united to oxygen, so many of the metals may be regarded as diatomic elements. The paper is well worth re-reading, and is not by any means the least interesting addition to the *Klassiker*.

J. B. C.

PHYSICS FOR THE LECTURE ROOM AND LABORATORY.

(1) *The Elements of Electricity and Magnetism. A Text-book for Colleges and Technical Schools.* By Prof. W. S. Franklin and Barry Macnutt. Pp. viii+351. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1908.) Price 7*s.* net.

(2) *A Short University Course in Electricity, Sound and Light.* By Dr. Robert A. Millikan and J. Mills. Pp. v+389. (Boston and London: Ginn and Co., n.d.) Price 8*s.* 6*d.*

(3) *Naturlehre für höhere Lehranstalten auf Schulerübungen gegrundet.* By Dr. Friedrich Danneman. Teil ii. Physik. Pp. vii+204. (Hanover and Leipzig: Hahnsche Buchhandlung, 1908.) Price 3.50 marks.

(4) *The Elementary Theory of Direct Current Dynamo Electric Machinery.* By C. E. Ashford and E. W. E. Kempson. Pp. vii+120. (Cambridge: University Press, 1908.) Price 3*s.* net.

(5) *Electrical Laboratory Course for Junior Students.* By R. D. Archibald and R. Rankin. Pp. vi+95. (London: Blackie and Son, Ltd., 1908.) Price 1*s.* 6*d.* net.

(1) THE order in which the elements of electricity and magnetism are presented in the first volume under notice is:—(*a*) Electric current; (*b*) magnetism; (*c*) electrostatics; (*d*) electric waves. This order is one which does not make the exposition perfectly happy. Thus it does not seem natural when it is found necessary to refer provisionally to the measurement of currents by their magnetic effect (p. 7) prior to any statement as to how magnetic effects themselves are measured. Surely the natural order is to take magnetism before considering the electric current, even though it may be preferred to deal with both before considering the phenomena of electrostatics. The author passes naturally and easily to the exposition of the last-named phenomena, and as many prefer this order this portion may certainly be commended to them.

The author is convinced that "elementary science instruction must be made to touch upon the things of everyday life if it is to be effective." This sentence may be taken as the keynote to the entire book. Thus electric resistances are usually represented as electric lamps. Those who are accustomed to abstract thinking may smile at these concrete representations; but it must be remembered that this is only an elementary book, and it must be admitted that much of the difficulty which many junior students feel is connected with the unreality of the subject as it appears to them. We commend the book for endeavouring, in this and other ways, to make the subject more real than it usually is.

More attention is given than is customary in an elementary course to phenomena connected with recent discoveries, such as kathode rays, radio-activity, electric waves, &c. We conclude that in America a junior course is in some respects more advanced than with us. This remark applies most to the chapter on electric waves, and to the appendix on ship's magnetism. Both these portions are very well done, though we would have thought them fairly strong meat for those who are making a "first systematic study of the subject." However, whether a student takes them in completely in his first study or not, he will be very glad to find them here ready to hand when required.

(2) The second of the volumes under review "represents primarily an attempt to secure a satisfactory articulation of the laboratory and class-room phases of instruction in physics." Expressed otherwise, it consists of a description of laboratory work, each experiment being preceded by as much theory as is necessary to make a complete logical exposition of the subject under study. We think that this plan is an excellent one; and it has been very satisfactorily carried out. Of course, it will be understood that the theoretical part is not sufficient to replace a text-book dealing specially with the theory.

Although electrostatics is introduced in the first chapter, electric capacity is not defined until later, when it can be measured by means of a ballistic galvanometer. There may be something to be said for this, but we think that the course of experiments would be considerably improved and the student would get a more vivid idea of what capacity is if experiments were added on parallel plate condensers used along with a gold-leaf electroscope or an electrostatic voltmeter.

In sound, a series of experiments on diffraction is included. The experiments on light *begin* with diffraction, a fact which prepares us for the exclusive use of the wave-method in proving the general phenomena of reflection and refraction. The final chapter is on radio-activity, and contains some simple experiments on uranium and thorium salts. The book is altogether a most excellent manual.

(3) We find in our third volume a well-selected series of very elementary experiments in the whole round of physics suitable particularly for school use. Though the subject is dealt with satisfactorily as a rule, it is not beyond criticism. The diagram of the paths of rays in a microscope would be improved if the rays represented as passing through the eyepiece were the same as those transmitted through the objective. The experiment on the "velocity of electricity" would be best left out of such an elementary book; the statement that electricity travels with the velocity of light is, of course, absurd.

(4) We are in entire agreement with the authors of this book, that in the training of an electrical engineer there should be included a knowledge of the theory of the subject built up logically from first principles, each step being illustrated with the help of some piece of machinery or practical appliance of a general and simple rather than an elaborate or necessarily up-to-date type. The present volume is intended to be used only as a note-book accompanying a course of experimental lectures. The authors are to be congratulated on the excellence of their little manual. The diagrams in particular are very carefully designed.

(5) The last of this group of text-books covers an elementary first year's evening course and part of a

second year's course. The first method of proving the inverse square law for magnetic poles will not convince. However, putting aside an occasional criticism of this kind, we think that the book will well serve its purpose of replacing manuscript instruction sheets in a junior laboratory.

OUR BOOK SHELF.

Théorie des Corps déformables. By E. et F. Cosserat. Pp. vi+226. (Paris: A. Hermann et Fils, 1909.) Price 6 francs.

THE authors, who are well known by their writings on general elastic theory, here reprint in separate form an appendix contributed by them to M. Chwolson's "Traité de Physique." The kinematical and dynamical theories of the flexible line, the flexible surface, and the deformable three-dimensional medium are discussed in turn in great detail. The dynamical standpoint adopted is that of the principle of action, which forms, in the authors' opinion, the only satisfactory basis for the "deductive" exposition of the subject. In each case the most general form of the function representing the "action" is sought which is consistent with the necessary invariantive relations. This procedure is, of course, not altogether new, and an expert, turning over the pages, will recognise much that in one form or another is familiar to him. The treatment is necessarily somewhat abstract, and is mathematically very elaborate, Cartesian methods being followed throughout. To many readers the long train of general investigations, unrelieved by a single application, may prove deterrent; but the authors at all events claim that their procedure has never before been carried out so resolutely and completely, and may justly pride themselves on the mathematical elegance of their work. Apart from its other qualities, the treatise has a distinct value as a book of reference, and furnishes a whole arsenal of formulæ which may save trouble to future writers.

The book begins with a kind of philosophical introduction to which the authors attach great importance. This requires to be read in conjunction with a previous treatise, which has also appeared in the French edition of M. Chwolson's work. Those who adopt in its fullest extent the empirical view of mechanics will perhaps consider that too much weight is attached to discussions of this kind. The historical references are, however, interesting, and fairly complete. The authors are indeed exceptionally well read in the history of their subject, and admirably conscientious in their citation of authorities. In their preface they promise a subsequent treatment of the theories of heat and electricity from a similar standpoint.

Practical Physiological Chemistry. A Book designed for Use in Courses in Practical Physiological Chemistry in Schools of Medicine and of Science. By Prof. Philip B. Hawk. Second edition, revised and enlarged. Pp. xvi+447. (London J. and A. Churchill, 1909.) Price 16*s.* net.

PROF. HAWK'S text-book falls into the front rank with the numerous additions and improvements which have been introduced into the new edition. It is not only a practical guide, and, as such, should be found in all physiological laboratories, but forms a very complete, readable, and up-to-date account of our present knowledge of the chemical side of physiology.

A special feature has been made of the illustrations, which are beautifully executed, and most of which will be new to workers in physiological chemistry. The crystalline forms of the many protein derivatives which the work of Emil Fischer and his colleagues has been instrumental in rendering familiar to the students of this branch of science will be found among them.

One small slip we notice in connection with the matter of protein nomenclature. The initiation of the new system of terminology which is now being adopted for the albuminous substances is wrongly attributed to the British Medical Association. It was really a committee of the Physiological and Chemical Societies of this country which set the ball rolling.

The mistake is, however, a pardonable one, seeing that it was at the meeting of the British Medical Association held at Toronto in 1906 that the opportunity of presenting the subject to our American colleagues was taken advantage of. The success that has attended this effort to secure uniformity of nomenclature amongst English-speaking people has been very gratifying; the American system, adopted under the auspices of the American Physiological Society and the American Society of Biological Chemists, differs in only small and unimportant details from our own. W. D. H.

Behind the Veil in Bird-land. Some Nature Secrets revealed by Pen and Camera. By Oliver G. Pike, with a number of pen sketches by E. R. Paton. Pp. 106. (London: The Religious Tract Society, 1908.) Price 10*s.* 6*d.* net.

SINCE the Keartons, some years ago, showed what splendid results could be achieved by an intelligent use of the camera as an aid to the study of natural history, a host of nature-photographers has arisen, but only a very few have attained the high standard of merit set by the founders of this branch of photography. Mr. R. B. Lodge and Miss E. L. Turner in this country, Schillings in Germany, and H. K. Job in America have in some respects even surpassed the Keartons; while in this display of resource and dogged persistence in the most trying circumstances they stand unrivalled.

Mr. Pike in this rather pretentious volume has given some very excellent photographs, but the "Nature Secrets revealed by Pen and Camera" which he promises in his title-page are conspicuous by their absence. His pages contain hardly one single new fact, but a great deal that is banal. He solemnly assures us, in writing of the kestrel, that "The first summer rose, a delicate pink amidst the surrounding green, is a greater picture of spring than ever the sunlit sea could be"—which statement contains a great deal of truth!—"and," he continues, "a kestrel hovering over a meadow, yellow with summer's flowers, tells us a deeper story than the eagle soaring over a wind-swept moor." We fail to grasp why this should be so.

"Bird-land's veil" is constantly being "lifted up" for him, like the drop-scene at the theatre, and on the stage appear blackbirds, which tell him "the story of the leaves and flowers," and wrens, which reveal "the secrets of the hedgerows," while skylarks, to complete the illusion, like the celebrated Grigolati troupe in the pantomime, fly to and fro across the stage, and sing "happy songs"! Perfectly charming! W. P. P.

An Account of the Deep-sea Asteroidea collected by the R.I.M.S.S. "Investigator." By Prof. René Koehler. Pp. 143; 13 plates. (Calcutta: Indian Museum, 1909.) Price 12 rupees.

THIS substantial contribution to the material of the echinoderm "system" consists of 126 pages of minute description, and nine pages of general remarks. It is a continuation of certain reports of a preliminary and incentive character published many years ago by the naturalists and pioneers of the Indian Marine Survey, but, except that some doubtful identifications

are disposed of and some errors criticised, it does not incorporate that earlier work.

In the descriptive part of the memoir thirty-nine species are enumerated, of which thirty are regarded as new, and are exhaustively described. The general remarks refer to eighty-eight species—the thirty-nine species treated by the author, and forty-nine species dealt with in the earlier reports—and furnish the evidence of the author's main conclusions. These conclusions are that the deep-sea starfish of the Bay of Bengal and Arabian Sea are much more Phanerozonia than Cryptozonia, and that their geographical affinities, so far as they can be discerned at all, are exclusively Indo-Pacific, with a slight Hawaiian touch.

Of the new species described by Prof. Koehler, five are separated as types of new genera. These are Johannaster, which is placed with very justifiable hesitation among the Plutonasteridæ, for some of its characters suggest a pentagonasterid connection; Phidiaster, which seems scarcely distinct from Psilaster; Sidonaster, which agrees in all points with Porcellanaster, except that, as in other porcellanasterid genera, the elements of the cribriform organs are papillar instead of lamellar; and Circeaster and Lydiaster, both of which are Antheneids having the abactinal plates of the disk much smaller than those of the rays.

It may be thought that the limits of some at least of these genera are cut too fine to last; and of the descriptions of species it may almost be said that they are accurate expositions of specimens rather than impressive definitions of nature's products; but such is the way of systematic zoology nowadays.

The memoir is most bountifully and most beautifully illustrated by the author's own hand; the plates, which are thirteen in number, are quite above criticism.

Antimony: its History, Chemistry, Mineralogy, Geology, Metallurgy, Uses, Preparations, Analysis, Production, and Valuation; with complete Bibliographies for Students, Manufacturers, and Users of Antimony. By Chung Yu Wang. Pp. x+217; illustrated. (London: C. Griffin and Co., Ltd., 1909.) Price 12*s.* 6*d.* net.

MR. WANG observes in his preface that a metallurgical work in English by a Chinese author is unusual. After reading the book, the conclusion is irresistible that English metallurgists would gain if Chinese authors were more numerous. Mr. Wang has treated his subject with the greatest respect, and has drawn up with methodical care a complete treatise which will be very useful to all students of the subject. The long and apparently exhaustive bibliography at the end of each chapter would alone give the book a right to a place on metallurgists' shelves, but in many cases the facts are sufficiently set forth in the present work.

The author carried out some practical tests of the latest volatilisation process of extracting antimony from its ores, which was patented last year by M. Herrenschmidt, and seems to have been much impressed by its merits. The account of these tests is, however, almost the only original matter in the book, which is mainly a compilation of previously published material, printed without comment. Its merits lie chiefly in the logical sequence and the accuracy of the extracts.

Étirage, Tréfilage, Dressage des Produits métallurgiques. By M. Georges Soliman. Pp. 164. (Paris: Gauthier-Villars and Masson et Cie., n.d.) Price 3 francs.

THIS interesting little work, one of the well-known "Aide-Mémoire" series, deals with its subject from a practical point of view. It is divided into five chapters, the first considering shortly the general mechanical properties of metals and alloys such as tensile, shock, bending, hardness, and torsion tests. Chapter ii. shows the influence of annealing and of cold work. Chapter iii. is devoted to "étirage," or drawing, defined as "an operation which has for its object the completing of work done by rolling and giving to the metal a cross-section which cannot be obtained by rolling," after the manner of wire-drawing ("tréfilage," chapter iv.), which is a special case of drawing where the cross-section is circular. Chapter v. gives a short account of methods of straightening ("dressage"). A. McW.

Nutrition and Evolution. By Hermann Reinheimer. Pp. xii+284. (London: John M. Watkins, 1909.) Price 6*s.* net.

THIS is an essay on the importance of nutrition as a factor in evolution, and the author is in good company. For was it not Claude Bernard who said, "l'évolution, c'est l'ensemble constant de ces alternatives de la nutrition; c'est la nutrition considerée dans sa réalité, embrassée d'un coup d'œil à travers le temps"? To have had this thesis worked out in a methodical manner would have been great gain, but the author is not strong in scientific method. He has gleaned far and wide to illustrate "the evolutionary aspects of nutrition," and while he has a crow to pick with most of his authorities, who have not the "central key of a uniform analysis," he uses them when they suit him to back up his conclusion "that in its silent effects nutrition is one of the most formidable factors in the shaping of individual and racial destinies." The conclusion is sound, but we cannot say this of many of the arguments.

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.*]

Bessel's Functions.

I ONCE stated that a good style of writing English is not a strong point amongst British mathematicians, and the justice of this remark is exemplified by Prof. Hill's letter on this subject (NATURE, July 8), since it contains the phrases Meissel's tables, Smith's tables, Aldis' tables, Isherwood's tables, which are correct; and Bessel functions, British Association tables, which are wrong. It is not in general permissible in English to employ a proper noun as an adjective, for the rules of grammar require either the use of the genitive case, or the conversion of the noun into an adjective, as in the words Newtonian, Lagrangean.

The British Association is one of the most important societies in the British Empire; it long ago discarded the insularity of our ancestors, and has become cosmopolitan in its operations. It is therefore not too much to expect that it will conform to the rules of grammar in its publications, and employ its influence in encouraging a good literary style.

I do not understand what Prof. Hill means by Neumann's functions. I believe that Neumann was the first mathematician who studied the properties of zonal harmonics and allied functions of degree $n+\frac{1}{2}$, where n is zero or a positive integer; but the subject was afterwards taken up and greatly extended by Prof. W. M. Hicks in connection with circular vortex motion. Hicks calls these harmonics *toroidal functions*, which is a much better phrase, since it puts in evidence the fact that these functions are connected with the potentials of *anchor rings* or *tores*.

There is also another class of functions which are zonal harmonics of complex degree $in-\frac{1}{2}$. These have been studied by Hobson (*Trans. Camb. Phil. Soc.*, vol. xiv., p. 211), who calls them *conal harmonics*.

A. B. BASSET.

Fledborough Hall, Holyport, Berks, July 9.

Musical Sands.

MAY I record the existence of musical sands along the shore at the Sandbanks, Poole Harbour?

Some years ago the Poole authorities erected a series of box groynes along this coast between Poole Head and the Haven, and these have considerably increased the natural accumulations of sand, so that it is "making" everywhere, and the growth of the marram grass on the dunes is in many places (independently of that recently planted) rapidly extending seawards.

The beach now, between each groyne, consists of wide and flat deposits of sand, shells, and flint pebbles, but about midway between the dunes and the sea, where the sand is comparatively free from these, musical zones are of frequent occurrence.

In walking along the shore in a westerly direction, starting from the first groyne, the sounding qualities of the sand notably increase. Thus between the first and second groynes there are no musical patches, between the second and third the sounds are very faint, and between each of the other groynes, until one reaches the last at the Haven Point, the intensity of the sound increases. In a small cove at the Point, formed by the last groyne (constructed of barrels of concrete and an old ship), the sand is remarkably musical.

The increase of sound observed when walking in a westerly direction is due, I think, to the fact that the prevailing westerly winds, and the littoral drift, separate the finer particles from the sand and carry them eastwards, and a microscopic examination of samples obtained from distances about a mile apart on this shore confirms this.

This musical sand is of the Studland Bay type, and near the Haven gives even better results than any I have found there. The occurrence of musical sands along this particular shore through the conserving influence of the groynes is an interesting fact, for their existence there previously was very unusual, being only once noted in very small quantity during the last twenty years.

Parkstone-on-Sea, July 4. CECIL CARUS-WILSON.

The Commutative Law of Addition, and Infinity.

REFERRING to the review of Hilbert's "Grundlagen der Geometrie," on p. 394 of No. 2066 of NATURE (June 3), may I point out that the commutative law of addition can be proved without the help of any axioms at all, other than those of general logic? The method, indeed, used by Peano in 1889 ("Arithmetices Principia . . .," Turin, 1889, p. 4), which is only based on axioms of a general nature (such as the principle of mathematical induction), and not on such special laws as the distributive ones, appears in so far superior to Hilbert's; and, since all Peano's axioms were proved in Mr. Russell's "Principles of Mathematics" of 1903, Hilbert's proof seems quite superseded. Further, the difficulties arising out of Dedekind's proof of the existence of infinite systems can be avoided without the introduction of "metaphysical" arguments about time and consciousness (see Russell, *Hibbert Journal*, July, 1904, pp. 809–12), as, indeed, your reviewer seems to think possible. But the connection of the fact that the existence of an infinity of thoughts (which must be in time) with Hamilton's idea that algebra was interpretable especially in the time-manifold, just as geometry is in the space-manifold, is not obvious. PHILIP E. B. JOURDAIN.

The Manor House, Broadwindsor, Beaminster, Dorset, July 2.

NEITHER Dr. Hilbert nor the reviewer make any suggestion that the commutative law of addition is best proved as a deduction from the laws of multiplication. But the laws of multiplication are so often treated as deductions from those of addition that it is interesting to have a case of the converse procedure. The fact that both these operations and their laws have been treated independently and in a strictly logical manner by Dedekind, Peano, and others is, of course, perfectly well known to all who have paid any attention to this part of mathematics. Whether Dedekind's critics have really avoided metaphysical arguments without at the same time making metaphysical assumptions is a question on which a difference of opinion is permissible.

G. B. M.

THE THEORY OF CROOKES'S RADIOMETER.

I HAVE noticed that the theory of this instrument is usually shirked in elementary books, even the best of them confining themselves to an account, and not attempting an explanation.[1] Indeed, if it were necessary to follow Maxwell's and O. Reynolds's calculations, such restraint could easily be understood. In their mathematical work the authors named start from the case of ordinary gas in complete temperature equilibrium, and endeavour to determine the first effects of a small departure from that condition. So far as regards the internal condition of the gas, their efforts may be considered to be, in the main, successful, although (I believe) discrepancies are still outstanding. When they come to include the influence of solid bodies which communicate heat to the gas and the reaction of the gas upon the solids, the difficulties thicken. A critical examination of these memoirs, and a re-discussion of the whole question, would be a useful piece of work, and one that may be commended to our younger mathematical physicists.

Another way of approaching the problem is to select the case at the opposite extreme, regarding the gas as so attenuated as to lie entirely outside the field of the ordinary gaseous laws. Some suggestions tending in this direction are to be found in O. Reynolds's memoir, but the idea does not appear to have been consistently followed out. It is true that in making this supposition we may be transcending the conditions of experiment, but the object is to propose the problem in its simplest form, and thus to obtain an easy and unambiguous solution—such as may suffice for the purposes of elementary exposition, although the physicist will naturally wish to go further. We suppose, then, that the gas is so rare that the mutual encounters of the molecules in their passage from the vanes to the envelope, or from one part of the envelope to another part, may be neglected, and, further, that the vanes are so small that a molecule, after impact with a vane, will strike the envelope a large number of times before hitting the vane again.

Under ordinary conditions, if the vanes and the envelope be all at one temperature, the included gas will tend to assume the same temperature, and when equilibrium is attained the forces of bombardment on the front and back faces of a vane balance one another. If, as we suppose, the gas is very rare, the idea of temperature does not fully apply, but at any rate the gas tends to a definite condition which includes the balance of the forces of bombardment. If the temperature be raised throughout, the velocities of the molecules are increased, but the balance, of course, persists. The question we have to consider is what happens when one vane only, or, rather, one face of one vane, acquires a raised temperature.

The molecules arriving at the heated face have, at any rate in the first instance, the frequencies and the velocities appropriate to the original temperature. As the result of the collision, the velocities are increased. We cannot say that they are increased to the values appropriate to the raised temperature of the surface from which they rebound. To effect this fully would probably require numerous collisions. Any general increase in the velocity of rebound is sufficient to cause an unbalanced force tending to drive the heated surface back, as O. Reynolds first indicated. If we follow the course of the molecules after collision with the heated surface, we see that, in accordance with our suppositions, they will return by repeated collisions with the envelope to the original lower scale of velocities before there is any question of another collision with the heated face. On the whole, then,

[1] See for example Poynting and Thomson's "Heat," p. 150.

the heated face tends to retreat with a force proportional both to the density of the gas and to the area of the surface.

A calculation of the absolute value of the excess of pressure cannot be made without further hypothesis. If we were to suppose that the molecules, after collision with the heated face, rebound with the same velocities ($v+dv$) as they would have were the temperature raised throughout, the pressure would be increased in the ratio $v+(v+dv) : 2v$ or $1+dv/2v : 1$. On the other hand, if the temperature were actually raised throughout, the pressure, according to the usual gaseous laws, would be increased in the ratio $(v+dv)^2 : v^2$ or $1+2dv/v : 1$. On this hypothesis, therefore, the unbalanced increment of pressure on the heated face is one-quarter of the increment that would be caused by a general rise of temperature to the same amount. This estimate is necessarily in excess of the truth, but it is probably of the right order of magnitude.

The supposition upon which our reasoning has been based, viz. that the mean free path of a molecule is large in comparison with the linear dimension of the vessel, has been made for the sake of simplicity, and is certainly a very extreme one. It is not difficult to recognise that in the extreme form it may be dispensed with. All that is really necessary to justify our conclusions is that the mean free path should be very large in comparison with the *vane*. The magnitude and distribution of the velocities with which the molecules impinge will then be independent of the fact that the face of the vane is heated, and this is all that the argument requires. The repulsion by heat of a silk fibre suspended in a moderately rare gas was, it will be remembered, verified by O. Reynolds.

RAYLEIGH.

LIFE IN AN OASIS.[1]

ALTHOUGH the oases of the Libyan Desert have been frequently visited by travellers—Poncet in the seventeenth century, Browne in the eighteenth century, and Cailliaud, Drovetti, Edmonstone, Hoskins, Rohlfs, Zittel, Schweinfurth, Brugsch, and others in the nineteenth century—yet none of these authors enjoyed anything like the opportunities for the study of these remarkable districts which have fallen to the lot of the writer of the work before us. For nine years Mr. Beadnell, as a member of that active body the Egyptian Geological Survey, was engaged in the study of the Libyan Desert—including the four oases of Baharia, Farafra, Dakhla, and Kharga—while during the last three years, as director of the operations of a development company, he has resided in the last mentioned, and has carried out important observations and experiments in connection with the questions of water supply, the effects of moving masses of sand in increasing the fertility of some areas, while overwhelming and destroying others, as well as of many other problems of great historical and antiquarian interest.

Now that the opening of a railway from Qena, a little north of Luxor, to the village of Kharga has been completed, the long and tedious camel-journey of four or five days along very rough caravan routes is avoided, and excursions from the Nile valley to this typical oasis will doubtless become much more frequent. The appearance of the present work is, therefore, very opportune. The detailed topographical and geological survey of the Libyan Desert with its oases was undertaken in 1897–8. Mr. Beadnell carried out the mapping of the Farafra and Dakhla oases, while Dr. Ball was engaged in surveying that of Kharga, the work in the Baharia Oasis being shared between the two investigators. Dr. Ball's map of the Kharga Oasis, with the accompanying official report, is a work of great geological value and interest, and Mr. Beadnell's residence in the district has enabled him to add not a few important scientific details to the admirable sketch given by his colleague.

The whole Libyan Desert forms a plateau, having an elevation which, at its maximum, is but little less than 2000 feet above sea-level, yet with a fairly general slope towards the north. In this great expanse of rough limestone and flint-covered flats, with hillocks and troughs of drifting sand, the oases are deep depressions, the bottoms of which vary from 100 to 300 feet above sea-level, surrounded, for the most part, by steep escarpments, through which only a few passes can be found which are capable of being used as camel-tracks. The whole of the deserts are underlain by great beds of sandstone (the Nubian series), forming two divisions, the "surface-water sandstones," never more than 160 feet thick, separated by 250 feet of impervious grey shales, from a much thicker series of sandstones below, the "artesian-water sandstone," which has been penetrated by borings to the depth of 400 feet.

It is by the removal, through denudation, of great masses of Eocene and Upper Cretaceous limestones and shales that the "surface-water sandstones" have been exposed on the floors of the oases. These beds are the source of springs, and, since the districts have been occupied by human beings, a great part of the area of the Kharga Oasis was covered by shallow lakes, probably formed by the outflow from these springs. But these great lakes have been gradually dried up, and the constant drain on the limited supplies of water afforded by the "surface-water sandstones" has greatly reduced its importance as a means of irrigation. The accounts of the various deposits laid down in these old lakes, with their interesting contents of worked flint-flakes and pottery, are among the most novel and interesting portions of Mr. Beadnell's book.

Far more important, however, than the surface-water sandstones, as a source of irrigation water, are the "artesian-water sandstones," which, by means of borings, have been drawn upon from the earliest times, and constitute even now a practically inexhaustible means for promoting the cultivation of the oases. On all questions connected with the nature and amount of the yield of the different kinds of wells, the author of this book writes as an authority, and he is able to give the results of numerous ingenious experiments, carried on, in some instances, for many months. That the enormous quantities of water contained in the thick sandstones of the Nubian system have their source, in part in the highlands of Abyssinia, in part in the Sudan, and to some extent in the upper waters of the Nile, where it flows over these pervious sandstones, there can be little doubt, though as to the proportional parts played by these several factors of the supply there is still much room for doubt—a doubt which can only be removed by prolonged observations.

The manner in which the ancient wells have been made, kept open, and from time to time repaired, has engaged the author's attentive study. It is surprising to learn how much has been accomplished with the aid of very simple appliances; and the long subterranean aqueducts—tunnels driven for miles into the sandstones for the purpose of increasing the flow of water—with numerous manholes up to the surface,

[1] "An Egyptian Oasis: an Account of the Oasis of Kharga in the Libyan Desert, with special reference to its History, Physical Geography, and Water Supply." By H. J. Llewellyn Beadnell. Pp. x+248; with 28 plates and 4 maps and sections. (London: John Murray, 1909.) Price 10*s.* 6*d.* net.

are wonderful monuments of persevering toil. The introduction of modern boring machines and other labour-saving contrivances may probably do much towards increasing the productiveness of the land of these oases in the future. Very interesting information is given concerning the cultivation carried on in the Kharga Oasis, and its possible extension in the future. The chief crops at present are rice, date and doum palms, and lucerne, though grapes, oranges, and other fruits are produced to a small extent. Many of these fruits, with cotton and other useful vegetable products, may be largely supplied from these districts, now that communication has been improved by the construction of the railway. In spite of the traditions concerning the existence of deposits of gold, silver, and other metals in the oases, it is probable, considering the geological structure of the district, that it is never likely to yield mineral products of greater value than the ochre, alum, and epsom salts, which the ancients obtained in small quantities as the result of an altogether disproportionate expenditure of labour and pains.

The author, being evidently a keen sportsman, is able to give many interesting details concerning the feral life in these singular depressions of the desert. The wild mammals consist of the Dorcas gazelle, with three species of fox, and occasional striped hyænas and jackals; the birds, of sand-grouse, rock-pigeons, turtle-doves, and quail. But British sportsmen must be prepared to find, among the primitive inhabitants of these lands, competing sportsmen, as enthusiastic and probably more experienced and persevering than themselves.

Although it is to the questions of water supply, and the dependent problem of agricultural development, that we look mainly for information to this work, yet its author has not been unmindful of many other points of general interest concerning the population of 8000 to 9000 souls and its distribution. They belong to Berber tribes, quite distinct from the fellahin of the Nile Valley, but with admixture from various other sources, and the author has been able, during his sojourn among them, to learn much that is of interest about their habits and customs. Their personal characteristics, peculiarities of land- and water-tenure, their taxation and commercial methods are well described, and the features of their villages and farms are admirably illustrated. Their modes of combating their great enemy the drifting sands from the north, which tend to form ever-advancing sand-dunes, receive especial attention. Some of the results attending this constant sand-drift are illustrated in the figures taken from the work.

The Egyptian kings, certainly from as far back as the eighteenth dynasty (1545–1350 B.C.), have claimed dominion over these oases. When Egypt fell under Persian rule, Cambyses sent an ill-equipped expedition to conquer the oases, but the whole army of 50,000 men, probably through the treachery of guides, perished miserably in the desert. The Romans long held sway in the oases, and many of the most remarkable of the monuments of the district must be referred to the period of their rule. The work before us indicates the great numbers of objects of archæological interest which are found in the district, including many Græco-Roman temples and a wonderful early-Christian necropolis, as well as very early flint implements and pottery. We learn that Mr. Pierpont Morgan has already had explorations commenced for the enrichment of American museums, and the completion of the railway may not improbably lead to excursions to Kharga and its temples becoming as popular as the trips to the cataracts and temples of the Nile are now. The book before us, which is dedicated to the memory of an old colleague of the author, Mr. Thomas Barrow, who fell a victim to the climate during explorations in the Sudan, ought to help to make known the points of interest attaching to these wonderful depressions in the great Sahara.

JOHN W. JUDD.

Encroachment of Sand-dunes at Meheriq. From "An Egyptian Oasis."

THE ISLE OF WIGHT.[1]

NOWHERE else in this country can the geologist find, along a coast line of only sixty miles, so many varied and magnificent cliff sections of the Cretaceous and Tertiary formations, and in no British area of equal size—a hundred and sixty square miles—can the botanist collect so many species of flowering plants, as in the "Garden Isle," which has long been a happy hunting-ground for field naturalists. Its rich flora and fauna, conditioned largely by its diversified soil, has already been dealt with in various works, notably in Venables' "Guide to the Isle of Wight" (1860), and in the Hampshire section of the "Victoria County History" series.

This new "Guide" contains a large number of new records, and will at least form a good basis upon which resident and visiting naturalists may build a complete natural history of the district. There can be no question as to Mr. Morey's qualifications for the editorship of this volume, since he has worked at the fauna and flora of the island for forty years, and in producing the "Guide" has obtained the services of a capable band of systematists in the various branches dealt with. One cannot but admire his industry, versatility, and enthusiasm. He tells us, "when, nearly three years ago, I decided to bring out a work which should fairly illustrate the fauna and flora and the natural history generally of the Isle of Wight, I did so, almost literally, with fear and trembling, fully realising the difficult task that I was undertaking"; and he expresses himself content to have served as a "horrible example" if by doing so those who come after him are enabled to profit by his mistakes of omission and commission. Such modesty disarms criticism, and Mr. Morey's energy and enterprise deserve the warm thanks and congratulations of all who are interested in the natural history of the Isle of Wight.

As is the case with all compilations, the book is unequal in quality, but we feel bound to point out two defects which, though common enough in works of this kind, detract considerably from its value and interest.

A book which attempts to compress into a comparatively small space an enumeration of the entire fauna and flora of a rich district, with an account of its geology, to say nothing of articles on palæolithic implements, meteorology, and even earthquakes, must necessarily consist largely of a census catalogue of species. Lists of species are undeniably useful, and not to be despised when compiled carefully, but the ideal to be aimed at in a real natural history is surely something that shall go beyond, and in some respects be the antithesis of, a mere list. Beyond a few vague references to the bare fact that the distribution of species of flowering plants, mosses, &c., is affected by the characters of rocks and soils, we look in vain for any evidence of the scientific ecological spirit which animates such works as Baker's "North Yorkshire," Lees' "West Yorkshire," and Wheldon and Wilson's "West Lancashire," and has made them valuable contributions to the growing literature of plant ecology. The three books cited are, of course, limited

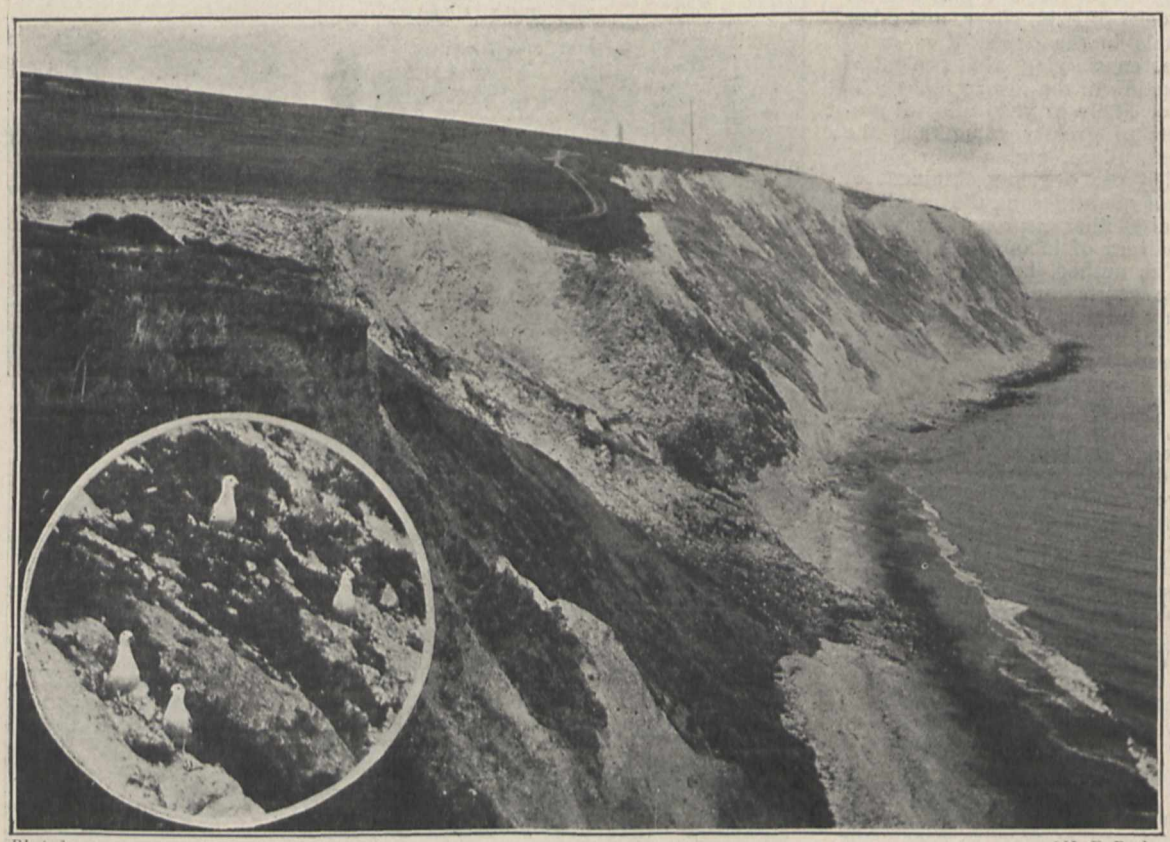


Photo.] [*H. F. Poole.*

FIG. 1.—The Culver Cliffs: Inset showing Herring Gulls at their Nests. From "A Guide to the Natural History of the Isle of Wight."

[1] "A Guide to the Natural History of the Isle of Wight." A Series of Contributions by Specialists, relating to the various branches of Natural History and kindred subjects. Edited by Frank Morey. Pp. xx+560. (Newport, I.W.: County Press; London: W. Wesley and Son, 1909.) Price 8*s.* 6*d.* net.

to the botany of each district, but a general sketch of the distribution of the flowering plants, at any rate, should have been given in this "Guide." The island would afford excellent scope for a botanical survey, on the lines of the well-known work done by Dr. Smith, Dr. Moss, and other ecologists, in various parts of Britain. It is greatly to be hoped that in a future edition of, or supplement to, this "Guide" it will be found possible to include a chapter on plant distribution, with a vegetation map of the island, and, for comparison and correlation, a geological map. This would, if carefully done, preferably by an ecologically-minded botanist residing in the district, undoubtedly enhance the value of the book and secure for it more than the local interest that attaches to a merely floristic work.

Photo.] [*H. F. Poole.*

FIG. 2.—White Stork—a rare visitor—captured at Shorwell in 1902. From "A Guide to the Natural History of the Isle of Wight."

The second suggestion we venture to make, with reference generally to books similar in scope to this "Guide," is that most of the systematists responsible for the various lists of plants and animals given in local naturalistic compilations would do well to obtain the cooperation of a biological botanist or zoologist when writing their prefatory remarks on the group of plants or animals they are dealing with. So far as this "Guide" is concerned, we refer chiefly, as examples, to the sections dealing with some of the cryptogamic plants. It would be far better for the average cryptogamic systematist to pass straight on to his list and say nothing whatever about the life-history and development of his group than to write a string of incoherent and inaccurate sentences, repeating and perpetuating long since exploded errors and mare's-nests. Lichenologists, we know, are a stiff-necked generation, but surely it is time they hesitated to record in print their refusal to recognise the dual nature of the lichen thallus, which has been fully and finally established. There can be no excuse, either, for the hepaticologist who tells us that the liverworts are "linked to the lichens" by means of their thalloid forms! The account of the relationship between the liverwort Frullania and the rotifer which sometimes occupies its pitchers is entirely imaginative. The list of hepatics (liverworts) is conspicuous by the omission of several species which are certainly found in the island, and often abundantly in places, such as *Anthoceros laevis*, *Scapania nemorosa*, and *Lepidozia reptans*.

The articles by Mr. G. W. Colenutt (geology), Mr. P. Wadham (fishes, mammals, &c.), and Mr. R. H. Fox (birds) stand out as refreshing oases in the arid desert of species lists, being written in a "nature-study" spirit which can hardly be said to characterise the work of the other contributors. The "Guide" is illustrated by twenty-six excellent plates, chiefly from photographs by Mr. H. F. Poole, two of which we are permitted to reproduce here. F. C.

SLEEPING SICKNESS.[1]

IT may be taken as definitely established that sleeping sickness is due to infection with a trypanosome (*Trypanosoma gambiense*), and that this trypanosome is conveyed by a tsetse-fly (*Glossina palpalis*). But if we proceed to analyse and extend this proposition we soon get into difficulties. We do not know for certain whether man is the only "reservoir" of this trypanosome, or whether monkeys and other mammals, especially native dogs, can also harbour it. Should this prove to be so—though the balance of evidence is against the supposition—it must materially affect prophylactic measures. If we consider next the mode by which the trypanosome is conveyed we find ourselves in the midst of the most conflicting evidence. It is still uncertain whether the transmission is mechanical or whether there is a cycle of development[2] of the trypanosome in the fly; facts appear to be all in favour of the first view, analogy all in favour of the latter. Nor is the question a purely academical one, for if the transmission is mechanical, then the flies are no longer infective after the infecting reservoir (man) is removed; if, however, there is a cycle of development, then it remains to be determined how long an infected fly can remain infective after the infecting source is removed.

If, again, we consider the question, Can sleeping sickness be conveyed by any other species of tsetse-fly than *Gl. palpalis*? we must confess our ignorance. The balance of evidence certainly seems to be against the possibility, but should it be shown that other species can convey the disease, then the question of prophylaxis would be even more difficult than it now is. These reports show that these are some of the questions that urgently need solution, but there are others of equal importance which arise in the immediate carrying out of prophylactic measures. They concern the fly itself, its habits, duration of its life, its breeding grounds, its food, its powers of flight, its likes and dislikes in regard to foliage, trees, shrubs, grass, &c. These questions are all important, and

[1] "Reports of the Sleeping Sickness Commission of the Royal Society." No. ix.

[2] The existence of such a cycle is now practically established by the recent work of Kleine confirmed by Bruce.

in our opinion it is imperative to appoint one or more officers with special entomological knowledge to study these points minutely. It is true that these reports afford evidence that the officers concerned in these investigations have made additions to our knowledge on these points, but the other duties of these officers are so multifarious that valuable time is being lost through this defect. It is true also that in the epidemic in Uganda the condition of things is so terrible that it is impossible to wait for the solution of all these questions, however important, before any action is taken, and we may now consider what, with the present available knowledge, is being done to check the epidemic. The means of prophylaxis may be considered under three aspects :—(1) Those directed against the fly; (2) those directed against the carrier of the trypanosome, *i.e.* man; (3) those directed against the trypanosome itself.

(1) With regard to measures directed against the fly. It has been found, and it is a matter of the highest importance, that the "natural range" of the fly, *i.e.* the distance to which flies follow from water in search of blood, is, as a rule, under 50 yards. The still more important fact has been determined that clearing and burning or removing the undergrowth for a distance of 100 yards in either direction, *e.g.* from a ferry for a strip 50–100 yards broad, has the effect of banishing the fly. It is this method, then, *i.e.* banishing the fly by clearing from its "normal fly range," that is the basis of the methods now being carried out in Uganda. It is not necessary to clear extensively around a village, but simply to clear comparatively small strips of the "fly range" frequented by man. Although flies may occur in the village itself, unless there is a "fly area" present these flies are those which have followed their victims beyond the "fly range" to the village. If the flies of the "fly range" are banished, then, *ipso facto*, the "following" flies also disappear. A typical fly area, though there are exceptions, consists of more or less open water with contiguous and especially overhanging shade and generally a fairly well-defined bank or shore. If, then, clearing can permanently banish the fly, and we believe that this will be found to be the case, because the fly still has plenty of uncleared area to frequent—though the fact that its human blood supply is at the same time removed may modify the result—it is an important measure of prophylaxis, though its value is perhaps restricted to somewhat small areas and special conditions.

If the fly cannot be removed by clearing, then the population must be deported from the vicinity of the fly. This measure has been extensively carried out in Uganda by the removal of populations from the lake to inland fly-free areas two miles away, to prevent traffic from the lake, which is responsible for the great bulk of the infection; but in many cases there are serious difficulties in the way. Further, the removal of populations still non-infected from a potentially dangerous fly area to a safe fly-free area would be of the greatest importance, and would form a more striking object-lesson to the native of the value of these measures than the removal of an infected population, because a certain, probably high, percentage of these latter will eventually die of sleeping sickness, although in a safe area; whereas this would not be the case if the population removed was non-infected.

(2) As the two measures, clearing and deportation, of the healthy, are undertaken with the object in view of preventing access of the fly to man, so segregation of the sick prevents fresh infection of the fly, and diminution of the infectivity of the fly in a fly area. This implies the removal of the sick of a village to another village or camp in a fly-free area, and it is important to note that such areas are numerous, and may often be only a few hundred yards away. Fresh infection of the fly is also avoided by preventing the removal of infected natives to uninfected fly areas. The applicability of this measure depends mainly upon the "attitude" of the native.

(3) Measures directed against the trypanosome itself, *i.e.* the treatment of infected persons, are bound up closely with the segregation of the sick. The treatment of the segregated in fly-free areas by atoxyl or other arsenic preparations is the only one that is at all effective, but it must be admitted that the results are disappointing, and that the good results of the drug are in many cases only temporary. The patient's blood becomes free from trypanosomes (and presumably non-infective, though this is not proved), and so the chance of infection of the fly, if patients come in contact with fly areas, becomes less.

Time will show how far these measures, the numerous important details of which we have to leave unconsidered, will be successful. Those engaged in carrying out these arduous and dangerous measures have hope that although sleeping sickness may not be eradicated or the fly totally annihilated, yet that the epidemic will soon be under control. It must be the sincere wish of everyone that this hope may be justified. J. W. W. S.

THE CONTAMINATION OF MILK.

THE contamination of milk has been the subject of a detailed research by Dr. Orr, carried out on behalf of the councils of the county boroughs of Bradford, Hull, Leeds, Rotherham and Sheffield, and the administrative counties of the East and West Ridings of Yorkshire. Of previous investigations, Delépine concluded that though his results did not exclude the possibility of infection at the home of the consumer, or during transit from the farm, they did indicate that infection at the farm, or through vessels infected at the farm and used by the farmer for the storage and carriage of milk, was of paramount importance. On the other hand, Newsholme attaches little importance to infection at the cowshed. Dr. Orr's investigation was carried out in a systematic manner, and not only were the bacteriological examinations carefully performed, but, in addition, the condition of the cows and cowsheds and the effects of season and atmospheric temperature were noted. First, the bacterial content of the milk in the udder was estimated, and it was found that the fore-milk (that first milked) contained from 18,000 to 48,000 microorganisms per cubic centimetre, and the milk after the removal of the fore-milk 890 to 4800 per cubic centimetre.

It is generally agreed that the milk as secreted is sterile, the microorganisms in the milk as drawn being derived from lodgment and multiplication in the teats and cistern.

Dirt on the udder is a fruitful source of contamination, and, during milking, dust, &c., from the udder adds much to the bacterial content of the milk. Dust in the cowsheds, and the entrance of dirt during transit and delivery, further add to the contamination, so that the milk, when it reaches the consumer, may contain an appalling number of microbes. The chief conclusions derived from Dr. Orr's work are :—

(1) Of the total organisms in the milk used by the consumer, the greatest number are contributed by the farmer. During railway transit, at the retailer's premises, and in the consumer's house, smaller amounts are added, the amount in each instance being apparently about the same.

(2) Of the glucose-fermenting or intestinal organisms and the streptococci, by far the greatest number are added

at the farm. The retailer adds a certain number, the consumer none.

(3) The sediment or "dirt" gains entrance to the milk chiefly at the cowshed. In 86·8 per cent. of the samples examined there was no increase in the sediment when sold by the retailer, but a decrease in 68·8 per cent.

(4) The farmer was responsible for the *Bacillus enteritidis sporogenes* (Klein) in the milk consumed in 66·6 per cent. of the samples. In 11·1 per cent. of the samples these bacilli were added by the retailer or the consumer, while in 22·2 per cent. the source was doubtful.

Various suggestions are made for improving the milk supply, and the imposition of the following standards is advocated:—

(1) A bacterial standard of not more than 50,000 organisms per c.c.

(2) Milk not to contain glucose-fermenting bacteria in less than 1/10 c.c.

(3) A sediment standard (at first) not exceeding 40 volumes per million.

Altogether, this report on the milk supply is one of the most important that has appeared in this country, and should be brought to the notice of all producers and retailers of this important article of diet.

THE WINNIPEG MEETING OF THE BRITISH ASSOCIATION.

WE are now in a position to give some further details about the local arrangements for the British Association meeting in Winnipeg during the last week in August next, and also the provisional programmes of the sections.

The Drill Hall will be used as the reception room. The main floor is 147 feet by 87 feet, so that there is no fear of undue crowding. Arrangements will be made for free access to the Parliament building grounds adjoining.

On the opposite side of Broadway are the University building and grounds. The University is a small and by no means beautiful structure. It resembles, in fact, in size and general style the public elementary schools of the city. But it must be explained that the University at present only teaches scientific subjects. Arts, medicine, and agriculture are taught in "affiliated" colleges which are scattered in various parts of the city. Thus, the classics and modern languages are taught in the four "affiliated" denominational colleges, St. Boniface (Roman Catholic), St. John's (Church of England), Manitoba College (Presbyterian), and Wesley College (Methodist); medicine is taught in the Manitoba Medical College, and agriculture in the Manitoba Agricultural College (Provincial Government) at Tuxedo Park. The University of Manitoba (also a Government institution) has been a teaching institution for five or six years. Founded in 1871 as an examining board, the University itself at present undertakes instruction in mathematics, chemistry, physics, botany, physiology, pathology and bacteriology, and civil and electrical engineering. But chairs in English history and political economy have been recently established, and these new departments will commence work next October. The government and organisation of the University is undoubtedly in an unsatisfactory state, and is, in fact, the subject of a Government Commission at the present time. There is a widespread feeling that the province ought to have a provincial university of the type provided in many States of the Republic to the south, and entirely free from any denominational influences.

Five of the sections (B, D, G, I, K) will meet in the University building. Section A will find its temporary home in Wesley College, where three rooms will be set aside for the meetings. Section E will be placed in the Convocation Hall at Manitoba College, and Section F in a class-room of the same institution.

Section L will have the honour of sitting in the Legislative Chamber of the Provincial Government, while agriculture (subsection of K), and Sections H and C, will meet in the Alexandra, Carlton, and Isbister Schools respectively.

All these meeting places are conveniently near the reception room.

The local sectional secretaries are as follows:—A, Prof. F. Allen, professor of physics, University of Manitoba; B, J. W. Shipley, assistant to the professor of chemistry, University of Manitoba; C, R. T. Hodgson, Brandon Collegiate Institute, Brandon;

University of Manitoba. (For Sections B, D, G, I, and K.)

D, C. A. Baragar, University of Manitoba; E, Alex. McIntyre, Normal School, Winnipeg; F, W. Manahan, Winnipeg; G, Prof. E. Brydone-Jack, professor of civil engineering, University of Manitoba; H, not yet appointed; I, Dr. Wm. Webster, demonstrator of physiology, University of Manitoba; K, Prof. A. H. Reginald Buller, professor of physiology, University of Manitoba; Principal W. J. Black, Manitoba Agricultural College; L, D. M. Duncan, registrar of the University of Manitoba.

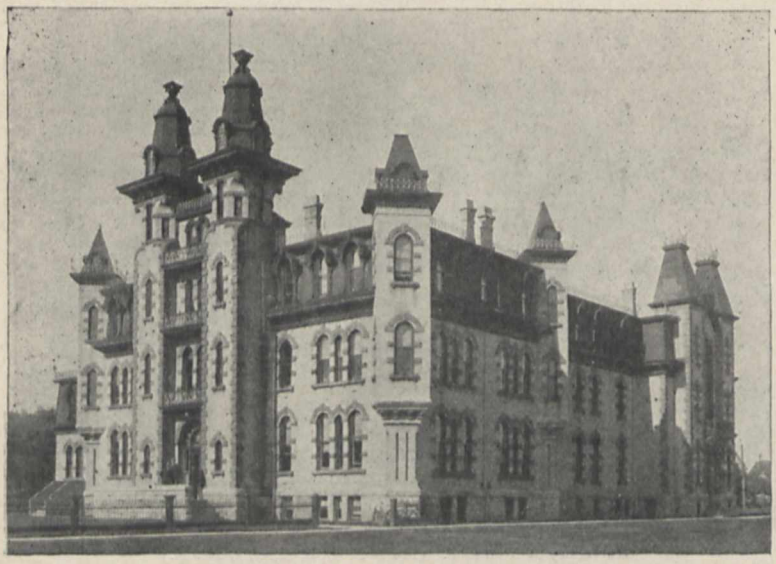
A few hints to travellers may not be out of place. For the ocean voyage, heavy coats and wraps and a travelling rug would be great comforts, if not absolute necessities, as it is never very warm on the North Atlantic route. These, however, should be packed away for the overland journey, otherwise they will give rise to considerable inconvenience.

Travellers from Europe are specially warned not to carry with them in the train more baggage than is absolutely necessary for the journey. Each person ought, indeed, to be content with a suit-case and perhaps a small handbag. All kit-bags, gladstone bags, and such like are quite out of place, as there is no space provided for these, and they may be a great

nuisance to everybody. An elaborate toilet, at any rate, is not possible during the railway journey, but the railway companies' sleeping cars are provided with sufficient lavatory accommodation. Everything except the suit-case and hand baggage should be *checked through* to destination.

To any American, or indeed to anyone who has ever travelled on the North American continent, such advice may seem quite superfluous, but it is rare that one travels across the country or witnesses the departure of trains without noticing some Englishman struggling to convey huge piles of luggage into a railway car; he is usually prevented from so doing by the porter, but if he succeeds his belongings soon become a trouble to himself and a nuisance to his fellow-travellers.

In regard to clothing, for Winnipeg during the week of the visit travellers should be provided with the same sort of selection as would be desirable at a meeting in Great Britain. The days in the latter part of August are usually hot, and the nights pleasantly cool. Those undertaking the excursion to the Pacific coast should be provided with some warm clothing for the mountains.



Manitoba College. (For Sections E and F.)

Those intending to visit Winnipeg for the meeting have been provided with postcard forms to fill in, giving various particulars of use to the local committee. These may be obtained from the assistant secretary in London, and should, with any other communications with regard to the meeting, be addressed to the local secretaries, University of Manitoba, Winnipeg.

In connection with the meeting, arrangements have been made by Mr. M. B. Cotsworth, of the Natural History Society of British Columbia, Victoria, B.C., on behalf of some of the members of the Association, to make a trip northward along the Pacific coast from Victoria or Vancouver to Alaska. The journey to Prince Rupert, Skagway, and back occupies ten days, costs about 14*l.*, and may be made either before the meeting at Winnipeg or from September 10 to 19. An extension to Dawson (Klondike) and back brings the total time up to three weeks, and the cost to about 32*l.*, while the round trip from Vancouver to Dawson, thence down the Yukon river to Nome and back by the Bering Sea and Aleutian Islands, occupies about a month, and costs 40*l.* Climatic considerations, however, make it desirable to carry out such extended trips before the meeting, and it is understood that some members have already arranged to do this. The excursions are not among the official arrangements of the Association, but further particulars may be obtained from the London office, Burlington House, W.

We are informed that Sir Joseph Thomson, in his presidential address to the Association, will touch on the following subjects:—The importance of original research as a means of education; the advantages and disadvantages as a training for work in science of the systems of education now in force in our schools and universities; the light thrown by recent investigation on the nature of electricity; on the relation between matter and æther, and the part played by the æther in modern physics; and a discussion of some problems raised by the discovery of radium.

Sectional Programmes.

Section A (Mathematical and Physical Science). President, Prof. E. Rutherford, F.R.S.—The arrangements for the meetings of this section are at present very provisional. After the address of the president of the section, the most important items in the provisional programme are two discussions, one on positive electricity, to be opened by Sir J. J. Thomson, F.R.S., and the second on earth tides, to be opened by Prof. A. E. H. Love, F.R.S. The papers promised include the following:—photographs of recent comets, Prof. E. Barnard; new photographs of Jupiter taken at Flagstaff Observatory, Percival Lowell; on sun-spots and magnetic effects, Dr. L. A. Bauer; the structure of the stellar system, G. C. Comstock; the asymptotic expansions of Legendre functions, Dr. J. W. Nicholson; on a continuant expressed as the product of linear factors, W. H. Metzler; luminosity and persistence-of-vision curves, Prof. Frank Allen; variation of the specific heat of mercury at high temperatures, Prof. H. T. Barnes; the effect of temperature-variations on the luminous discharge in gases for low pressures, R. F. Earhart. This list includes only those papers for which definite titles have been received; many others are promised. Friday morning, August 27, will be set aside for papers of interest to chemists, and the section will meet in joint session with Section B (Chemistry).

Section B (Chemistry). President, Prof. H. E. Armstrong, F.R.S.—The provisional programme is as follows:—Joint sitting with the Section of Botany and Subsection of Agriculture to discuss "wheat" from several points of view, including requirements of the wheat crop, influence of external conditions, review of the chemical work on strength, the miller's requirements, wheat breeding, the history of the wheat plant, and the economics of the subject. (See programme of the Subsection of Agriculture.) Joint sitting with the Physiology Section to discuss food. Combustion, Prof. W. A. Bone, F.R.S.; chlorophyll, Prof. Willstätter; papers dealing with the physical chemistry of sulphur, Prof. Alex. Smith; (1) rotatory dispersion, (2) the cadmium arc, Dr. T. M. Lowry; (1) mercurous sulphate for standard cells, (2) on the constancy of the hydrogen gas electrode, Dr. C. J. J. Fox. Reports of committees:—(*a*) hydroaromatic substances; (*b*) aromatic nitroamines; (*c*) electroanalysis; (*d*) dynamic isomerism. This report will be presented in such form as to initiate discussion.

Section C (Geology). President, Dr. A. Smith Woodward, F.R.S.—Dr. Woodward's presidential address will be on the evolution of the vertebrates. There will be reports of research committees on:—the erratic blocks of

the British Isles, Dr. A. R. Dwerryhouse; the fauna and flora of the Trias of the British Isles, which will be supplemented by an account of the progress of this investigation, illustrated by lantern slides, H. C. Beasley; and the fossiliferous drift deposits of Kirmington, Lincolnshire, and the East Riding of Yorkshire. This is the final report of the Committee. The papers will include:—the composition and origin of the crystalline rocks of Anglesea, E. Greenly; the faunal succession in the Carboniferous Limestone of the British Isles, Dr. A. Vaughan, which will be supplemented by an account of the progress of these researches, illustrated by lantern slides, by Prof. Sidney H. Reynolds, of Bristol; critical sections in the Palæozoic rocks of Wales and the west of England, W. G. Fearnsides; the microscopical and chemical composition of Charnwood Rocks, Prof. T. T. Groom; the igneous and associated rocks of Glensaul and Lough Nafovey areas, co. Galway, Prof. S. H. Reynolds; geological photographs, with illustrations of British scenery in relation to geology, Prof. S. H. Reynolds; the Glacial Lake Agassiz, Prof. Warren Upham; the advances in the knowledge of the glacial geology of South Wales, Dr. Aubrey Strahan; unconformities in limestone and their contemporaneous pipes and swallow-holes, E. E. L. Dixon; on new faunal horizons in the Bristol coalfield, Herbert Bolton; on the Permian succession in the north of England, Dr. D. Woollacot; a mineralogical paper, A. Hutchinson. Prof. J. W. Gregory, F.R.S., and Dr. Tempest Anderson are now making extended tours in Australia and the South Seas, and it is expected that they will have valuable and interesting communications to make to the section. An extended tour for four days has been arranged to the mining districts of Corall and Sudbury, under the direction of Prof. W. G. Miller, and Dr. J. W. Spencer will lead a party to Niagara and the glacial outlet of Lake Erie.

SECTION E (GEOGRAPHY). President, Sir Duncan Johnston, K.C.M.G.—The following are among the papers to be brought before the section:—some characteristics of the Canadian Rockies, A. O. Wheeler; the evolution of wheat culture in North America, Prof. A. P. Brigham; water routes from Lake Superior to the west, Lawrence J. Burpee; Yellowhead Pass and Mt. Robson, the highest point in the Canadian Rockies, Prof. A. P. Coleman; the influence of traffic or transportation upon the framework of cities, with an introductory reference to the influence of geography in the same direction, G. E. Hooker; the cycle of Alpine glaciation, Prof. W. H. Hobbs; the teaching of geography in secondary schools in America, Prof. R. E. Dodge (to be read at a joint meeting with Section L); the formation of arroyos in the south-west of the United States, Prof. Dodge; the development of Nantasket Beach, near Boston, Mass., Prof. D. W. Johnson; floods in the great interior valley of America, Miss Luella A. Owen; the precious metals as a geographical factor in the settlement and development of towns in the United States, Prof. Hubbard. Mr. J. Stanley Gardiner, F.R.S., will give a lecture, illustrated by lantern slides, on his work in the Seychelles, and there will probably be papers also by Prof. Goode, Dr. C. H. Leete, and Prof. Hoke.

SECTION G (ENGINEERING). President, Sir W. H. White, K.C.B., F.R.S.—In addition to Sir W. H. White's presidential address, a report will be presented by the committee on gas explosions, and a paper on the some subject will be contributed by Mr. Dugald Clerk. Other papers are as follows:—Skimming boats, Sir John Thornycroft; the Isthmian Canal, Col. Goethals; the work of the International Electrotechnical Commission, Ormond Higman; torsion tests on materials, C. E. Larrard; dielectric stress in three-phase cables, Prof. W. M. Thornton. Papers on grain handling and transportation in Western Canada, on the navigation of the St. Lawrence, and on high-tension overhead lines are in preparation.

SECTION K (BOTANY). President, Lieut.-Colonel D. Prain, F.R.S.—The following are some of the communications to be brought before the section:—*On Thallophyta:* On the production, liberation, and dispersion of the spores of Hymenomycetes, Prof. Buller; numerical determinations of the bacteria in the air of Winnipeg, Prof. Buller and Mr. Lowe; the nuclear phenomena of Ascomycetes in relation to heredity, Miss H. C. I. Fraser; the nucleus of the yeast plant, H. Wager, F.R.S., and Miss Peniston; some problems connected with the life-history of *Trichodiscus elegans*, Miss E. J. Welsford. *Ecological papers:* The fundamental causes of succession among plant associations, Prof. H. C. Cowles; some observations on *Spiraea Ulmaria*, Prof. Yapp. *Other papers:* A paper on the anatomy of the Osmundaceæ, Prof. Gwynne-Vaughan; (1) the evolution of the inflorescence, (2) the rubber industry, J. Parkin. The annual semi-popular lecture will be given by Mr. Harold Wager, F.R.S., on the perception of light in plants. In addition to the above, there will be a joint sitting with Section B and the Agricultural Subsection of K for a discussion on "wheat." Dr. O. Stapf, F.R.S., will contribute a paper towards this discussion, on the systematic history of wheat. Several other papers have been promised by prominent American botanists, but the titles are not yet to hand.

SUBSECTION K (AGRICULTURE). President, Major P. G. Craigie, C.B.—*Joint meetings:* (1) With the Economic Section, Thursday afternoon, August 26. The future possibilities of extending the food production of Canada, Prof. Mavor. (2) With the Chemical and Botanical Sections, Monday morning, August 30. Subject, wheat problems. Papers:—the miller's requirements; a review of recent chemical work on the strength of wheat, Dr. E. F. Armstrong; factors determining the yield of wheat, A. D. Hall, F.R.S., and Dr. E. J. Russell; milling properties of certain Canadian wheats, Prof. R. Harcourt; Canadian wheats, F. T. Shutt; wheat breeding in Canada, C. E. Saunders. Papers also by Dr. W. Saunders and by C. A. Zavitz. *Ordinary meetings:* Presidential address, Major Craigie; methods of crop reporting in different countries, E. W. Godfrey; the experimental farm system in Canada, Dr. W. Saunders; the fruit industry of British Columbia, R. W. Palmer. *Prairie soil problems:* Geography of the prairie soils, R. W. Brock; chemical characteristics of the prairie soils, F. T. Shutt; soil moisture and crop production, Prof. F. H. King; soil moisture as related to dry farming, Prof. F. J. Alway. Papers by A. D. Hall, F.R.S., and Dr. E. J. Russell. *Live-stock problems:* Paper by Prof. W. Somerville; the evolution of a breed of cattle, Prof. J. Wilson; some special features of the Danish system of cattle breeding, P. A. Morkeberg; paper by J. G. Rutherford. *Forestry problems:* Paper by Prof. W. Somerville; Canadian forest resources, R. H. Campbell; the insect pest problem, Prof. Lochhead; some forestry problems of the great plains of North America, C. E. Bessey.

SECTION L (EDUCATIONAL SCIENCE). President, Dr. H. B. Gray.—After the president's address on August 26 a discussion on moral instruction in schools will be opened by Prof. L. P. Jacks, editor of the *Hibbert Journal*. He will be followed by Mr. Hugh Richardson, and it is hoped that American and Canadian educationists will also take part. On Friday, August 27, there will be a discussion on practical work in schools, which will be opened on behalf of the subcommittee of the association which is now considering the question by Mr. W. M. Heller. Dr. C. W. Kimmins will contribute some account of the London trades schools, Miss Lilian J. Clarke will speak on practical work in girls' secondary schools, and Mr. W. Hewitt on practical work in evening and continuation schools. On Monday, August 30, there will be a joint meeting with the Geographical Section of the association for the discussion of geography teaching. Prof. R. E. Dodge, of Columbia, and Mr. G. G. Chisholm, of Edinburgh, are expected to open the discussion. There will also be a discussion on the relations of universities and secondary schools, with special reference to the accrediting and examining systems. On August 31 the president of the section will open a discussion on education as a preparation for agricultural life, with special reference to Canadian conditions. Should time permit, it is also intended to discuss the subject of consolidation schools. The organising committee of the section is in correspondence with educationists in Canada and America, and it is hoped to arrange that each subject shall be opened by representatives of American, Canadian, and British education.

NOTES.

WE announce with deep regret the death of Prof. Simon Newcomb, Foreign Member of the Royal Society, on July 11, at seventy-four years of age.

THE next international congress of mining and metallurgy is to be held in June, 1910, at Dusseldorf. The last congress was in 1905, and the place of meeting Liége.

AT an audience on July 10, the King conferred upon Mr. E. H. Shackleton the Insignia of a Commander of the Royal Victorian Order in recognition of his work in the Antarctic.

IT is stated by the St. Petersburg correspondent of the *Globe* that a Bill for the substitution of the new style for the old style of date reckoning in Russia will be brought before the Council of the Empire and the Duma in the autumn. There is at present a difference of thirteen days between the Russian calendar (old style) and the reformed Gregorian calendar introduced in 1582 and used in our country since 1752.

ANOTHER exhibition, arranged in connection with the *Model Engineer*, on similar lines to that which proved successful in 1907, will be held at the Royal Horticultural Hall, Westminster, S.W., in October next. The exhibits will include engineering models, electrical and scientific apparatus, lathes and light workshop appliances, model aëroplanes, and technical education equipment. An attractive feature will be the exhibits in the competitions for model and scientific apparatus making, several classes for both amateur and professional workers having been arranged, for which valuable prizes are being offered. Full particulars may be obtained from the organisers, Messrs. Percival Marshall and Co., 26–29 Poppins Court, Fleet Street, London, E.C.

THE first Gustave Canet lecture was delivered by Lieut. Trevor Dawson at the twenty-fifth anniversary meeting of the Junior Institution of Engineers on June 30. The lecturer is the recipient of the first gold medal, which is to be awarded every fourth year by Madame Canet in memory of her husband, the award being made through the council of the institution. In his lecture, Lieut. Dawson gave many instances of the increased power and accuracy of guns. One photograph showed six 100-lb. shots striking the water, having been fired as a volley from 6-inch guns on a British cruiser at a range of 7300 yards. The total space embraced by the six shots was only 88 yards. Towards the end of the lecture the question of airship attack was dealt with, and the special ordnance to be used against these vessels described.

THE British and Irish Millers' Convention was held at Chester on July 7, when a paper was read by Mr. A. E. Humphries, of Weybridge, on "Ideal British Wheats." Mr. Humphries pointed out that the British farmer no longer grows what the miller wants; instead of producing a strong wheat, capable of making large, shapely loaves, he produces a weak wheat, the flour from which is usually a drug in the market. The home-grown wheat committee of the British Millers' Association has been investigating the question of improvement, and is very hopeful about the future; it is believed that wheats will be produced of better quality, with better straw, less susceptibility to disease, and greater cropping power than those now available. The committee asks for a national cereal-breeding station, and commends this to the Board of Agriculture and the Chancellor of the Exchequer as one important means of agricultural development.

AT the end of last year we observed with regret the report that Mr. James Parsons, principal mineral surveyor of Ceylon, had disappeared in the jungle, and his death was presumed. It seems that on the morning of December 29 last Mr. Parsons left his hotel at Nuwara Eliya for a walk in the open country, intending to return in time for lunch. About noon he was seen traversing a certain tea-estate, but from that date he was never seen alive. We now learn that, after three months' search, his remains were found in the jungle on April 11. Death was probably due to exposure. Mr. Parsons went to Ceylon in 1902 as assistant to Dr. A. K. Coomaraswamy to undertake a mineralogical survey of Ceylon. On Dr. Coomaraswamy's retirement he took his place in 1906. His last writings were two papers in *Spolia Zeylanica* on fluor-spar in Ceylon and votive offerings of weapons.

THE recently issued account of the income and expenditure of the British Museum for the year ended March 31 last, and the return of the number of persons admitted to visit the Museum and the Natural History Museum, South Kensington, in each year 1903 to 1908, both years inclusive, provides much information of interest. The number of visits made by the public to the Natural History Museum during 1908 was 517,043, as compared with 497,437 in 1907, showing an increase of 19,606. The attendance on Sunday afternoons showed a slight falling off, the figures being 65,986, as against 66,367 in the previous year. The average daily attendance for all open days was 1420·4. The total number of gifts received during the year by the several departments was 2259, as compared with 2105 in 1907. Among other donors may be mentioned Mr. F. D. Godman, valuable collections of insects from Central America and other localities, and a series of water-colour drawings of butterflies of the family Hesperiidæ; the Hon. Walter Rothschild, mounted specimens of a male and female Californian sea-elephant, from the island of Guadeloupe, and a male sea-lion from California; the trustees of the Percy Sladen Fund, a large collection of reptiles, batrachians, and fishes from the Seychelles, Chagos Islands, and the Indian Ocean; Mr. C. D. Sherborn, a valuable collection of specimens of the handwritings of naturalists, consisting of some 8000 letters and other documents; and Mrs. R. P. Murray, the extensive herbarium made by the late Rev. R. P. Murray, comprising about 15,000 sheets.

ACCORDING to the curator's report for 1908–9, the Otago University Museum at Dunedin has been augmented by a new wing—the Hocken wing—which will shortly be opened to the public, and is mainly devoted to art and literature. A living tuatara lizard has been kept alive for some time on the museum premises.

THE report of the Rhodesia Museum at Bulawayo for 1908 shows continued progress on the part of that comparatively juvenile institution, despite the fact that one source of revenue has been cut off, while the Government has declined to be responsible for an annual subsidy to the funds. The largest increase to the collection has taken place in the entomological section.

THE most important additions to the Giza Zoological Gardens, as we learn from Captain Flower's report for 1908, were the hippopotamus and the Nubian bustard. The curator finds it necessary to take special precautions to protect the smaller mammals and birds from nocturnal four-footed marauders, of which the worst is the jungle-cat, although jackals, dogs, and foxes also do much harm. During the year a jungle-cat killed a pelican. The pro

tective measures rendered necessary by these raids have given rise to protests from European visitors ignorant of the true facts of the case.

Naturwissenschaftliche Wochenschrift for June 27 includes an illustrated article, by the Rev. E. Wasmann, on the origin of slavery and social parasitism among ants, in which it is urged that, before these can be properly understood, it is essential that we should acquire a knowledge of a series of independent developmental histories of different species, genera, and subfamilies, which commenced in past geological times. Only with such histories before us will it be possible to construct anything like a true working hypothesis of the origin of the phenomena in question.

To Mr. G. Gilson, director of the Royal Museum of Natural History of Belgium, we are indebted for a copy of an address read before a conference held in the apartments of the Royal Zoological and Malacological Society of Belgium on June 12, on the subject of the proposed establishment of an educational museum in Brussels. The address is chiefly concerned with the aims and objects of such a museum and the manner in which the scheme should be carried out. A teaching museum, it is urged, should be kept entirely apart from museums of the ordinary type, and run on totally different lines. As regards the selection and installation of the objects to be shown in the museum, it is pointed out that this task should be entrusted, in the first instance, to scientific experts, but that after this the collections should be handed over to the actual teaching staff.

To the July number of the *Century Magazine* Mr. R. W. Yerkes contributes an article on "imitation in animals," a considerable portion of which is devoted to an account of the behaviour of three Manx kittens, which had never previously seen mice, when confronted with one of these rodents. When the first introduction was made the kittens were five months' old, and the mouse was uninjured. Six weeks later the experiment was repeated, when the kittens were hungry, but still no attempt was made to devour the mouse. Later on the parent cat was introduced into the cage, when the mouse was killed by her, and, little by little, the kittens eventually learnt to follow their mother's example. The experiments, in the author's opinion, serve to show that these particular kittens had no instinctive propensity to kill and eat mice, and that they only learnt to do so by the force of example. Whether this holds good for kittens generally remains to be proved.

UNDER the title of *Technitella thompsoni* (after Prof. D'Arcy Thompson) Messrs. E. Heron Allen and A. Earland describe in the Journal of the Quekett Microscopical Club a new species of arenaceous foraminifera which constructs its enveloping test entirely out of regularly arranged calcareous plates of echinoderms. Of this foraminifer two specimens only have been found from dredgings in the North Sea. It possesses no oral aperture, the perforations in the echinoderm plates furnishing a sufficient outlet for the pseudopodia. Other species of the genus make their tests out of sponge spicules, but it is believed that the present species stands preeminent in its selective power of building material.

THE annual address to the Armstrong College Agricultural Students' Association, by Mr. A. Tindall, has been printed in the Proceedings of that body, and will be interesting to students of agricultural economics. It deals with the history and development of the Newcastle cattle market, and includes a number of valuable statistics, such as prices of cattle, &c., as well as accounts of sale customs. In the same publication will be found a short article on milk production and milk products by Mr. John Anderson.

THE United States Department of Agriculture Bureau of Entomology has issued a circular (No. 42) on the control of the San José scale. This pest has, in the past, proved a serious menace to the fruit-growing industry, but experience both in California and in the eastern States shows that it can be controlled. Seven methods have proved successful when properly carried out, viz. :—(1) the lime-sulphur wash; (2) soap wash; (3) pure kerosene; (4) crude petroleum; (5) mechanical mixtures of either of these two oils with water; (6) petroleum emulsion and soap; (7) miscible oils. Instructions are given for carrying out each of these methods.

BULLETIN No. 166 of the Maine Agricultural Experiment Station contains a discussion, by Messrs. Raymond Pearl and Frank M. Surface, of the inheritance of fecundity in poultry. The daughters of "200-egg" hens (*i.e.* hens laying 200 or more eggs in twelve months) were kept under observation. It is, as yet, too soon to draw general conclusions, but no evidence was obtained to show that a good winter layer necessarily produces another good winter layer, as is said to be assumed by practical poultry-breeders. On the contrary, the exact opposite happened here: the mothers, on the whole, were exceptionally good, and the daughters unusually poor, as winter layers.

RECENT bulletins from the Colorado Agricultural College include three on strawberry growing, dewberry growing, and the pruning of fruit trees, one on animal diseases, and one on bacterial diseases of plants. A disease of lucerne, first described by Paddock in 1906, and shown to be bacterial, is dealt with at some length. The bacteria seem to come from the soil and work up the stem, giving rise to a "watery, semi-transparent brownish appearance of the tissue, which turns black with age." Blisters are present, containing a sticky, yellow liquid swarming with bacteria. Other diseases dealt with are pear blight, soft rot of sugar beet, black rot of cabbage, bacterial blights of the potato family, of beans, and of cucumbers; specific organisms have in several of these cases been isolated.

THE endoparasites of Australian stock and native fauna form the subject of two papers by Dr. Georgina Sweet, of the Melbourne University. The work, which is still going on, aims at making a systematic and thorough inquiry into the nature of the internal parasites infesting Australian animals, both native and domesticated, and then into the life-history and conditions of increase and spread of these injurious forms. The work is both of scientific and practical importance; species exist in Australia that have not been recorded elsewhere, and it is desirable that their life-histories should be worked out; methods of control are also necessary, since Australia is largely dependent on its livestock, and suffers great losses of revenue as a result of parasitic diseases. In part i. the author gives a census of forms recorded up to date, in which the work of Dr. N. A. Cobb in New South Wales and others has been drawn upon; part ii. contains the new and hitherto unrecorded species.

WE are in receipt of the *Journal of Agriculture of South Australia*, a publication which is devoted almost exclusively to practical matters of local interest. The statistics for 1907 are discussed in one of the articles. The area under crop was 2,265,017 acres, nearly one-fourth of the whole

area of the State, and 100,000 acres more than in the previous year. South Australia was at one time the granary of Australia, but here, as elsewhere, there is a strong tendency for other branches of husbandry to be taken up, and for wheat to lose in relative importance. The exports of wool were nearly 51 million pounds, again a considerable increase on the previous year. The acreage under barley and oats is the highest on record, while the fruit industry has made very rapid progress. Perhaps the best indication of improvement in method is found in the increasing use of artificial manures. Not many years ago the use of artificial manures was practically unknown. In 1897 it is estimated that 3000 tons were used for cereal crops; the consumption then steadily increased, and has been uniformly greater every year; in 1906 no fewer than 59,000 tons were used. In another article there is an account of the Roseworthy Agricultural College, an institution which not only provides instruction for those intending to be farmers, but also conducts investigations in the area it serves.

A FRIENDLY, and for the most part favourable, criticism of forest practice is provided by an American forester, Mr. B. Moore, in an article on the forests of northern India and Burma, published in the April and May numbers of the *Indian Forester*. He expresses a very decided opinion in favour of a regulated fire policy for forests of young teak and sal where the forests are situated in a moist climate, as in Assam. He also agrees with those who consider that Indian foresters in training should gain their practical experience in India.

A SERIES of papers by Dr. B. L. Robinson, Miss A. Eastwood, and Mr. H. H. Bartlett, describing chiefly new or little-known Mexican and Central American plants, are collected in vol. xliv., No. 21, of the Proceedings of the American Academy of Arts and Sciences. The most important is the synopsis of Mexican species of Castilleja, with diagnoses and clavis compiled by Miss Eastwood; seventeen new species contribute to a total of fifty-four species for the genus. Dr. Robinson furnishes a revision of the genus Rumfordia with six species, and diagnoses of various tropical American phanerogams. New identifications are presented by Mr. Bartlett in a synopsis of American species of Litsæa and other articles.

MR. G. MASSEE is responsible for two articles in the *Kew Bulletin* (No. 5), the one being a list of exotic fungi, the other a note on witches' broom of cacao. The latter is produced by a Colletotrichum receiving the specific name *luxificum*. Both vegetative and flowering branches are attacked, with the consequent production of hypertrophied shoots and flowers and diseased pods. The fungi are all new species of Boletus—except one Strobilomyces—collected by Mr. Ridley in Singapore. Another article in the bulletin is devoted to notes, by Richard Spruce, on the vegetation of the Pastasa and Bombonasa rivers, providing a description supplementary to chapter xvii. of the second volume of "Notes of a Botanist on the Amazon and Andes."

WE have been favoured with a copy of the address delivered by Prof. J. W. Moll before the members of the Koninklijke Akademie van Wetenschappen te Amsterdam when presenting the dissertation of Dr. K. Zijlstra on the transport of carbon dioxide in leaves. Prof. Moll presents an excellent summary of the investigations, which prove that, to a limited extent, the transport of carbon dioxide is possible through the intercellular spaces; but it is obvious that such transport, if it takes place under natural conditions, is of no appreciable advantage to the plant, and could not enable the plant to absorb carbon dioxide from the soil. Thus the primary conclusion of Prof. Moll's original investigations is confirmed.

THE prosperity of Egypt depends largely on the successful cultivation of the particular types of cotton known as "Egyptian." During the last twelve years, however, the yield of cotton has steadily and appreciably diminished, the loss amounting at current rates to about 5*l*. per feddan (1·109 acres). Many causes have been suggested as contributing to this result, and in "Cotton Investigations in 1908" (*Cairo Scientific Journal*, February, 1909) Mr. W. Lawrence Balls puts forward the view, for which there is some direct evidence, that a rise in the water-table in Egypt has been an important factor. Owing to improvements in irrigation, the supply of water in Egypt is greater than formerly, whilst the natural loss remains more or less constant. Artificial drainage is lacking, and in his view Egypt is in danger of becoming water-logged, in which condition the soil is rendered impervious to the roots of most plants. The remedy advocated is extension of the drainage system, an expensive proceeding, but justifiable if the reduced yield is due to the rise in level of stagnant water. Another important matter dwelt on in Mr. Balls's paper is the depreciation of cottons grown in Egypt owing to the hybridising of the Egyptian varieties by the less valuable "American Upland" races, cultivated because of their heavy yield. To combat this he proposes the breeding of a cotton bearing flowers in which the stigma is buried deeply amongst the stamens, thus reducing to a minimum the risk of natural crossing. The report is accompanied by a photograph of a section of such a synthesised flower. Egypt is leading the way in the practical application of Mendel's discoveries, for 1909 has seen the establishment by the Khedivial Agricultural Society of a Mendelian experiment station.

IN the June number of *Folk-lore* Mr. T. C. Hodson, author of a valuable monograph on the Meithei tribe in Manipur, describes the custom of head-hunting among the hill tribes of Assam. The custom is, in the first place, ancillary to and a part of the funeral rite, which is affected by the social status of the deceased and the manner of his death. The funeral of a Kuki chief is incomplete without the head of a victim. The corpse is placed within the trunk of a tree, where it remains until it is sufficiently desiccated to allow of the preservation of the bones. The heads, again, are presented before piles of stones, the abode of the Lai, a powerful, mysterious entity, not always or necessarily anthropomorphised. The rite of deposition of the head of the victim is thus partly piacular, intended to propitiate the spirit of the deceased; partly religious, inasmuch as it is devoted to the vaguely conceived tribal spirit. The custom has also its social side, as success in a raid is held to be a proof of manliness, marking the transition from adolescence to maturity. It is also protective, because the spirit of the owner of the head becomes guardian of the village; and hence, as a necessary corollary, the head of a stranger is most highly valued, because, being ignorant of its surroundings, it is less likely to escape from the village of which, perforce, it has become protector.

AN account of the life and philosophical doctrines of Henri Poincaré is given in the *Revue des Idées* for June 15 by M. Jules Sagret.

PROF. GARBASSO, writing in the *Atti della Società italiana per il progresso della Scienza* (Rome: G. Bertero, 1909), discusses the structure of the atom, and gives a brief account of the theories of Briot, Kirchhoff, Bunsen, Helm-

holtz, Hertz, Lockyer, Kayser and Runge, Rydberg, Puccianti, Stoney, and J. J. Thomson.

IN the *Sitzungsberichte* of the Vienna Academy, cxvii., 8, 9, Dr. Philipp Forchheimer discusses certain mathematical solutions of the problem of underground flow of water in a homogeneous stratum bounded by a plane impervious floor, the equation of continuity in this case being the ordinary two-dimensional form of Laplace's equation, with the square of the depth as the dependent variable.

THE theory of the polar planimeter is treated in a novel way by Dr. Gabriele Torelli in the *Rendiconto* of the Naples Academy, xiv., 8–12 (1908). The author finds that the treatment of the subject given in text-books is far from convincing, and he proposes an alternative treatment based on the use of Jacobians. Those who have worked with planimeters in this country will fully agree with the author as to the need of a more satisfactory investigation of their principle, and if such a need exists in the case of the polar planimeter it is still more necessary for the so-called "hatchet planimeter," which is usually worked by rule, with little attempt, if any, to explain its principle.

AN important contribution to our theories of wave-propagation in wireless telegraphy is given by Prof. A. Sommerfeld in the *Annalen der Physik*, xxviii., pp. 665–736 (1909). The investigation, while taking account both of surface waves and of waves distributed in space, tends to support the view that we have to deal with waves propagated along the surface of the earth in accounting for the transmission of Marconi signals. Prof. Sommerfeld, further, in his analytical results obtains analogues of properties associated with electrodynamic waves in wires and certain optical phenomena (Brewster's law).

IN the *Rassegna contemporanea* for May, 1908, Mr. Gino Cuchetti discusses the project for anti-seismic houses, due to Prof. Giuseppe Torres, of Venice. This project is based on the view that circular structures are the best calculated to withstand earthquake shocks, and in the designs shown in the illustrations each building consists of several circular turrets of different diameter communicating with each other, an arrangement having considerable artistic merits, though wasteful of space. In the succeeding number of the *Rassegna* Dr. Enrico Pantano discusses the problem of "internal colonisation" as applied to Italy, and we note with considerable interest the important bearing on this problem of the campaign against malaria.

A REPORT on the resistance of rivets is presented by M. Ch. Fremont to the *Bulletin de la Société d'Encouragement* for April. It is pointed out that the resistance of riveted plates to statical forces or shocks should be borne as much as possible by the adhesion of the plates and as little as possible by shearing of the rivets themselves, and the author emphasises the necessity of standardising the heads of rivets and of regulating the maximum temperature during the process of heating, so as not to destroy the elastic qualities of the rivet. The increased efficiency obtained by the application of continued pressure during the riveting is also mentioned.

IN a paper on the most general problem of optics, published in the Proceedings of the Turin Academy of Sciences, Prof. Antonio Garbasso and Guido Fubini point out that little has been done in solving problems of propagation of light waves in a medium which is neither homogeneous nor isotropic. The authors propose a theory for the special case of a medium in which the ellipsoids of elasticity are of revolution having their axes parallel, and the lengths of these axes are the same at all points in a plane perpendicular to the axis of revolution. An illustration of such a medium is afforded by a stratum of gelatin placed in contact with a solution of zinc chloride and subjected to pressure; the colours seen in such a medium under polarised light are shown in a plate accompanying the paper.

WE have received part iii. of "Klimatographie von Oesterreich," issued by the Meteorological Office of Vienna, in which the climatology of Styria is fully and ably discussed by Dr. Robert Klein. The treatment of the subject follows closely along the lines laid down by Hann in his "Handbuch der Klimatologie," and is, indeed, similar to that adopted by that author in the earlier parts of the work which deal with Austria proper. The book is a model of what the treatment of the special climatology of a restricted area should be. It gives for each region the probabilities of the occurrence of phenomena such as frosts of different degrees of intensity, heavy rainfall, and others. At the same time, the underlying principles are not lost sight of. Styria presents many features of special interest, as the altitudes included in its boundaries vary from about 200 metres to 4000 metres above sea-level. The cultivated region extends up to about 1500 metres. We have thus a great variety of meteorological conditions brought before us in the records from the stations of the second order which are discussed in the volume.

IN the April number of *Meteorologische Zeitschrift* Mr. E. Alt gives an interesting account of the double daily oscillation of the barometer over the globe, especially with reference to the Arctic regions. He preludes his paper by a *résumé* of the efforts hitherto made to elucidate this intricate problem by harmonic analysis, by Lamont, Angot, Hann, and others, and gives useful explanations of the several terms of the series. The theory now generally accepted is that referred to by Lord Kelvin (Proc. Roy. Soc. Edin., 1882) and developed by Prof. Margules (*Sitzungsber.* Vienna Acad., 1890). Mr. Alt has discussed a large number of observations both on land and at sea, and has exhibited the synchronous distribution of the double wave of air pressure by a series of charts. With reference to the Arctic regions, observations taken mostly from the *Challenger* report show that the maxima of the oscillations occur, on an average, about 11h. 20m. a.m. and p.m., and of the minima, on an average, about 5h. 20m. a.m. and p.m. (G.M.T.). The amplitude is small, amounting, on the average, to about 1/10 mm. The investigations of several physicists, including Prof. Margules, point to the view that the synchronism of the oscillation in the polar region is due to the existence of a second half-daily oscillation of the atmosphere which occurs in the direction of the meridians.

WE direct attention to a very laborious and important work by Dr. H. Fritsche entitled "The Mean Temperature of the Air at Sea-level exhibited as a Function of Longitude, Latitude, and Period of the Year" (Meteorologische Publication I.). The author has, *inter alia*, calculated from the constants of the harmonic formula the resulting values of mean temperature for the whole surface of the earth, for each 10° of longitude and 5° of latitude, for twenty-four equidistant epochs of the year, and for the whole year, with maxima, minima, and phase times. But this general description in no wise gives an idea of the immense work covered by some 184 closely printed tables; these are rather difficult to follow, being, with the explanations in German, printed in facsimile lithography. The calculations are based mostly on Buchan's monthly and yearly isothermal charts ("Atlas of Meteorology," by Bartholomew and Herbertson). The mean yearly temperature of the globe is given as 14·6° C., and the amplitude

as 4·2°; the coldest period is at the end of January, 12·5°, and the warmest in the middle of July, 16·7°. The mean temperature of the northern hemisphere, 15·3° C., is nearly 1½° higher than that of the southern. The work includes seven isothermal charts between 30° and 90° S. latitude for the year, for mid-January, and each alternate month.

THE *Halbmonatliches Literaturverzeichnis* of the *Fortschritte der Physik*, issued under the auspices of the German Physical Society, still continues to furnish more promptly than any other periodical a list of the papers dealing with topics of interest to physicists which appear in the various journals and proceedings of societies. As instances of the promptness with which titles of papers are published, we may mention that the number for June 15 contains the titles of several papers read at the meetings of the Royal Society and of the Physical Society of London in April and May.

THE prestige of the "principle of relativity" as a basis for our treatment of electrodynamics in moving media has been increased by a preliminary communication made to the German Physical Society by Dr. E. Hupka, an account of which is given in the *Verhandlungen* of the society for June 15. Three or four months ago Dr. A. H. Bucherer announced that the results of his experiments on the inertia of the negatively charged particles of the β rays from radium were distinctly in favour of the principle as against its most formidable rival the "sphere theory." Now Dr. Hupka, working with the electrons produced when light falls on negatively charged bodies, has shown that when these electrons are accelerated by the action of an electric field, and then deflected by passing through a magnetic field, the deflections observed are again in favour of the principle, which may be stated as follows:—The electrodynamic phenomena exhibited within two systems moving with respect to each other in a straight line will follow the same laws, provided that in each system the unit of time be so chosen that the velocity of light is expressed by the same number.

"SUPPLEMENTARY INVESTIGATIONS OF INFRA-RED SPECTRA," by Prof. Wm. W. Coblentz (parts v., vi., vii.), has been received from the Carnegie Institution of Washington. This publication contains supplementary data on the doubtful points which arose in the author's preceding work, and also some additional observations on the emission spectra of metal filaments and insulators, thus rounding up the subject as completely as possible at the moment. Although, as Prof. Coblentz goes on to say, the programme of investigation is completed, the subject is not exhausted—not even thoroughly initiated. The value and importance of the author's work in the infra-red region of the spectrum are too well known to need any further diploma of merit at this time; moreover, it is impossible to deal in detail with the account of the many new observations described in the present monograph. There are three separate lines of work, namely, infra-red reflection spectra, transmission spectra, and emission spectra. To these is added a valuable chapter on the instruments and methods used in the work. Two points of special interest may be noted, one of which is the relation between the maxima in the reflection spectra of the carbonates and the atomic weight of the metal, where the maxima steadily shift towards the red with increase in molecular weight. The second point of interest is the infra-red spectra of the colloidal metals in relation to the coloured glasses. There is no doubt that, quite apart from its general importance, Prof. Coblentz's work, owing to the range of spectrum dealt with, will have considerable bearing upon the relation between absorption and chemical constitution.

A NEW form of gearing, which has been invented by Mr. Jules Lecoche, and is being introduced by the Anglo-Foreign Inventions Syndicate, Ltd., of 10 Camomile Street, E.C., is illustrated in *Engineering* for July 2. The gearing essentially consists of two wheels having spiral or helical teeth which run out of contact, a mechanical clearance of about 1/32-inch separating the tops of the teeth on the two wheels. One of the wheels is provided with field magnets in such a way that a magnetic flux is generated between its teeth and the corresponding teeth on the other wheel. The mechanical drive is obtained entirely by means of the magnetic flux, the form of the teeth being such that, when the wheels are running together, the tops of any two teeth in magnetic mesh lie immediately one over the other, and follow each the same path. As two teeth leave each other, the magnetic flux will be transferred from the leaving teeth to the approaching teeth, thus ensuring continuity of drive. As there is no contact there can be no friction; and as the power consumed in the field coils is only about 3 per cent. of the power transmitted, a gearing efficiency of about 97 per cent. is attainable. Another advantage lies in the high speed of transmission possible. Ball bearings are used for the spindles, an example at present being shown in London by the Albany Engineering Company, of Ossory Road, S.E., having a gearing loss of 1·79 per cent. and an over-all efficiency of more than 90 per cent. The advantages of this gear should open a wide field for its applications.

WE have received a copy of the report of the Indian Association for the Cultivation of Science for the year 1907. The association arranges courses of lectures upon scientific subjects, maintains a laboratory and library, and conducts an annual examination of candidates for prizes and medals. Interesting speeches were given at the annual meeting held last November, and altogether the association appears to be doing useful work in spreading a knowledge of and interest in science.

THE July number of the *Fortnightly Review* contains an article by Dr. Marie C. Stopes entitled "An Expedition to the Southern Coal Mines." Dr. Stopes was sent by the Royal Society for special palæobotanical work to Japan, where she spent a year and a half in close touch with the Japanese. In addition to devoting a large part of her stay to research work in the Imperial University, Dr. Stopes travelled widely on tours of inspection and investigation. She entered a great many of the coal mines in Japan, and penetrated to the heart of the country searching for interesting specimens. Her article is in the form of a diary, not written for scientific workers, but intended to supply a series of pictures of life in many parts of Japan.

OUR ASTRONOMICAL COLUMN.

RADIAL MOTION IN SUN-SPOT VAPOURS.—Referring to some comments and queries, by Mr. Buss, in the May number, Mr. Evershed gives further details of the radial motion discovered in sun-spot vapours, in No. 411 of the *Observatory*. He has found that when the slit of the spectroscope does not bisect the spot symmetrically, but crosses the penumbra on the side of the spot nearer to the centre of the sun's disc, the lines are always convex towards the violet; whereas if the slit crosses the opposite side of the penumbra they are convex towards the red. That the line displacements are due solely to motion is shown by the change in position angle of the maximum shift as the spot traverses the disc. The maximum displacement is always such as to indicate that the maximum motion is along the radius, but the observations are not yet sufficiently delicate to disprove the existence of a superimposed,

relatively slow spiral motion; on the other hand, there is no direct evidence that such an outward spiral motion exists.

Recent work shows that the radial motion is confined to the lower chromosphere—the "reversing layer." In the higher chromosphere the absorption lines H_3, K_3, and probably Hα, are usually twisted in the opposite direction to the other lines, thus indicating an inward movement of the vapours. This apparently agrees with Prof. Hale's observation of a dark flocculus moving towards the centre of the spot. There is still an apparent discrepancy between this radial movement and the vortex motions invoked by Prof. Hale to explain the Zeeman effect in sun-spot lines, and, according to Mr. Evershed's results, the vortex, if it exists, either above or below a sun-spot, does not affect the absorbing gases of the "reversing layer" in the penumbræ of spots.

BINARY STAR ORBITS.—In No. 4, vol. xxix., of the *Astrophysical Journal*, Father Stein discusses the photometric observations of the binary star *RZ* Cassiopeiæ on the assumption that it is an Algol variable. Assuming that the orbit is circular, and that the mean densities of the two components are equal, he finds that the mass of the system is 1·002 the sun's mass, the mass of the bright body, the primary, being 0·646 sun's mass; the radius of the bright body is 1·43, and that of the satellite 1·17 the sun's radius, the mean density of each body being 0·222 that of the sun's density. The centres of the two bodies are separated by 0·022 astronomical unit.

No. 13, vol. i., of the publications of the Allegheny Observatory, contains a discussion of the orbits of the spectroscopic components of 2 Lacertæ, by Mr. R. H. Baker. In spectrograms of this star taken on fine-grained plates, the lines of the components are, at certain epochs, separated, and it is interesting to note that the "blend" curve differs considerably from various parts of the primary curve, thus suggesting that for all spectroscopic binaries having a large range of velocities it is desirable that spectrograms should be taken on the finest-grained plates obtainable at the epochs of maximum velocity. The measurement of such plates might, supposing the lines to be separated, considerably modify the results obtained from coarser-grained plates on which the component spectra are inseparable. Mr. Baker finds the period of this star to be 2·6164 days.

MICROMETRIC MEASURES OF DOUBLE STARS.—In No. 4336 of the *Astronomische Nachrichten*, Mr. Phillip Fox publishes the measures of a number of miscellaneous double stars made with the 12-inch and 40-inch refractors of the Yerkes Observatory. The 40-inch is not used regularly for this work, but is employed when conditions are not suitable for securing parallax plates. Mr. Fox's observing-list is mainly made up of Holden double-stars, about half of which have now been observed, but these measures are reserved until the complete list is ready. The present publication includes the measures, made during 1907–8, of about 130 multiple systems.

THE IDENTITY OF COMETS 1908*a* AND 1908*b* (ENCKE).—In No. 4332 of the *Astronomische Nachrichten*, Dr. Ebell discusses the question of the identity of comet 1908*a* with Encke's comet. It will be remembered that when 1908*a* was first discovered by Prof. Wolf, it was announced as being Encke's comet, but the latter was not discovered until May, 1908, when it was found by Mr. Woodgate at the Cape Observatory. Dr. Ebell finds that both the motion and the brightness of comet 1908*a* are against the theory of identity with Encke's, for the latter was, theoretically, much fainter, about 3·5 magnitudes, than the observed object. There still remains the question as to whether 1908*a* was a fragment of Encke's, split off by some accidental encounter or explosion, and this question is being investigated at Pulkowa.

COMET 1909*a*.—Photographs of comet 1909*a* (Borrelly-Daniel) were obtained at the Greenwich Observatory, with the 30-inch reflector, on June 22 and 30, and the resulting positions are published in No. 4337 of the *Astronomische Nachrichten*. The same journal also contains a set of elements computed by Prof. R. T. Crawford, and elements and ephemeris calculated by Prof. Kobold.

THE KING ON INCREASED PROVISION FOR ADVANCED SCIENTIFIC INSTRUCTION AND RESEARCH.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

THE King laid the first stone of the new buildings of the Imperial College of Science and Technology on Thursday, July 8. The plans exhibited were those of the Royal School of Mines and an extension of the City and Guilds of London Institute, which will occupy the block of ground at the corner of Exhibition and Prince Consort Roads, South Kensington, and extend as far west as the Royal College of Music. The Imperial College of Science and Technology consists at present of the Royal School of Mines, the Royal College of Science, and the City and Guilds of London Institute, and is administered by a Board of governors appointed by Royal charter, and under the presidency of Lord Crewe.

It is interesting to note that the first building to be erected by the governors of the Imperial College is the much-needed one for the Royal School of Mines, and that the funds for the purpose have been provided chiefly by the late Mr. Alfred Beit and Sir Julius Wernher, of the mining house of Messrs. Wernher, Beit and Co.

The life of the Royal School of Mines has been one of many vicissitudes. Even from the time of its foundation in 1851, difficulty has been experienced in providing adequate accommodation. The move from Jermyn Street to South Kensington, which began in 1872, and, as was stated by Lord Crewe in his address to his Majesty, was not completed until 1880, furnished better accommodation for subjects such as chemistry, physics and mechanics; geology was probably in but little worse position than in Jermyn Street, and metallurgy had better laboratories than before, but mining, which was the last to move, has had but poor quarters. The demand for scientific education, however, has grown so rapidly that even the laboratories for chemistry and physics soon became too small, and the fine buildings in Imperial Institute Road, in which the Royal College of Science has its chemical and physical laboratories, have for the past two years received the students. The buildings now to be erected will comprise well equipped laboratories, museums, lecture- and class-rooms, and drawing offices for the mining, metallurgical, and geological sections, and, in a one-storied building, 250 feet by 120 feet, under a separate roof, ore-dressing testing works and an experimental metallurgical laboratory are to be erected, the equipment being provided by the Bessemer Memorial Committee.

The extension of the City and Guilds of London Institute will include a laboratory for the study of hydraulics, equipped by Mr. G. Hawksley, but the extension is chiefly necessary on account of the number of students having already outgrown the space available, and the introduction of advanced courses on special subjects requiring more room. Here, again, top-lighted courts will allow the extension of the mechanical laboratories of the institute. The Goldsmiths' Company has provided a large sum towards this work.

In the course of his reply to the address delivered by Lord Crewe on behalf of the governors, professors, students, and staff of the Imperial College, the King said:—

"The concentration of various associated colleges into one institution, which was effected by our Order in Council of July, 1907, has always seemed to me to be an admirable scheme for the furtherance of scientific instruction, which my dear father had so much at heart; and the names which appeared in the first list of the members of the governing body were sufficient in themselves to give the college a very high status in the educational world.

"The purposes of the college, as stated in the charter, are to give the highest specialised instruction and to provide the fullest equipment for advanced teaching and research in various branches of science, especially in its application to industry. In recent years the supreme importance of higher scientific education has, I am happy to say, been fully recognised in England; and as time goes on I feel more and more convinced that the prosperity, even the very safety and existence, of our country depend on the quality of the scientific and technical training of those who are to guide and control our industries. The rapid

growth of knowledge makes it necessary for the teacher of any branch of applied science to be a specialist of a high order, and the most accomplished specialist cannot impart the full advantage of his knowledge without that complete provision of apparatus for research and instruction which this college will supply.

"The college has already given admirable results, and we may well look for a steady increase in the number of students and in the efficiency of the instruction provided.

"The thanks of the country are due to those public-spirited donors through whose generosity a large portion of the funds have been provided for this great work, and I join in your appreciation of their munificence. I think it is especially fitting that the great discoveries of the late Sir Henry Bessemer, to which the remarkable development of the engineering industries in the last half-century is largely due, should be commemorated by the equipment of the new laboratories of this institution."

UNIVERSITY OF BIRMINGHAM.

On July 7 the King and Queen, accompanied by the Princess Victoria, performed the opening ceremony of the new buildings of the Birmingham University. Inasmuch as the founding of the University on the initiative of Mr. Chamberlain has been effected almost entirely by means of money subscribed by the inhabitants of the Birmingham district, the occasion was appropriately made to partake largely of the nature of a civic function.

The characteristic note of the proceedings may perhaps best be given by some quotations from the King's speeches. In replying to the address from the Corporation, after warmly commending the public spirit of the citizens, His Majesty said:—"Great schemes such as that for providing your city with pure water have been undertaken in the past, and have been brought to a successful issue; but none is worthier of support or more far-reaching in its scope than the establishment and extension of the great University in which you have taken so important a part." Later, in reply to an address from the Chamber of Commerce expressing the recognition by the commercial and mercantile classes of the value of the advancement of higher education, his Majesty said:—"I am glad to learn that the commercial community have been faithful and generous supporters of the University. I feel assured that your expectations of advantages to be derived from the Faculty of Commerce in training the future captains of industry will be realised."

After a luncheon at the Council House, their Majesties drove, through roads lined with enthusiastic spectators, to the new buildings at Bournbrook, a distance of about three miles. The opening ceremony took place in the great hall of the University, which was occupied largely by members of the University and representatives of other educational bodies.

The University address was read by Sir Oliver Lodge, and the following characteristic passage may be quoted:—"Guided by our Chancellor, whose inability to be present on this memorable occasion we deeply regret, we have made no attempt to give an appearance of finality to our present undertaking. Rather do we regard it as capable of indefinite expansion. Whilst the field of scientific research is ever widening, and its discoveries demand yearly a fresh application to the facts of life, the claims of the humaner studies become none the less imperative; and in both these branches of human activity, which can only flourish side by side, we realise the need of continual development. But we believe that the work which we have begun, upon which this day your Majesties set the seal of your Royal approbation, can confidently be entrusted to the generosity and to the devoted service of the generations that are to come."

His Majesty, in replying, after paying a tribute to the Chancellor, proceeded:—"For the wonderful progress of higher education in the country we have largely to thank the great universities established in our principal cities. No nobler object for munificence can be found than the provision for the necessary equipment for such education; an equipment which, in view of the diverse and elaborate requirements of the modern schools of instruction, must be costly; but without which these schemes, however carefully designed, will prove fruitless. Such institutions as this are of paramount importance in enabling students to obtain in their native city instruction in science and technology, in art and mathematics, which in former days they were compelled to seek in places far distant from their homes, at an expense which in some instances they could ill afford. The universities also foster a wholesome rivalry, and encourage the growth of the highest form of public spirit. A man educated at this University will be a better citizen of Birmingham, and a better subject of the Empire."

At the close of the opening ceremony, their Majesties inspected a part of the departments of civil and electrical engineering.

THE SCIENCE COLLECTIONS AT SOUTH KENSINGTON.

THE question of the worthy housing of the science collections at South Kensington has been brought before the Government on several occasions during the last thirty years or so. The object of a deputation which waited upon Mr. Runciman at the Board of Education on Tuesday was again to endeavour to obtain an assurance that the Government will provide the money for the building of a museum in which the science collections can be exhibited as satisfactorily as are those of art. The deputation included distinguished representatives of the leading scientific societies and institutions, and the memorial which was presented was signed by the president and officers of the Royal Society, all its living past-presidents, and 128 of its Fellows distinguished in physical science; the Chancellors of the Universities of Cambridge, London, Glasgow, and St. Andrews; the Vice-Chancellors of the British universities; the presidents of scientific societies and institutions; professors of chemistry, physics, mathematics, astronomy, and engineering in all the British universities, university colleges, and principal technical schools and polytechnics; the directors of the chief polytechnics in London and in the provinces; and a very large and distinguished body of persons eminent in and interested in British science and desirous of its promotion.

There can be no doubt, therefore, as to the opinion of representatives of physical science upon the urgent need of satisfactory provision for the housing of the science collections. As Sir William Anson said in introducing the deputation, "the museum, which represents the application of science to material, should be placed in the same position as art and natural history by the Government of the country."

The collections should be in a suitable building, with room for rearrangement and expansion. A site is available at South Kensington if the Government will come forward with the offer of funds for the actual building; but in spite of the memorial and the deputation, Mr. Runciman did not give an assurance that the money will be forthcoming. He was sympathetic, and promised to place the matter before the Prime Minister and the Chancellor of the Exchequer, and with this result we must be satisfied for a while. A useful purpose has certainly been served by bringing the subject into public view. We can now only hope that the Government will rise to the opportunity and offer to the physical sciences, which are closely connected with the industries of this country, the same advantages for its collections as are already possessed by natural history and by art.

From a full report of the deputation in Wednesday's *Times* we make the subjoined extracts.

The memorial presented by Sir Henry Roscoe was as follows:—

"We, the undersigned, being deeply interested in the practice and progress of British science, desire to bring before you the importance of the proper housing of the Science Collections at South Kensington. The permanent buildings now erected provide accommodation for art collections only; to complete the scheme a suitable building for the science collections is a necessity. The formation of a science museum representative of all branches of physical science, both pure and applied, has long engaged the attention both of the Government and of British scientific men. So long ago as 1874 the Duke of Devonshire's Commission on Science strongly recommended the establishment of such

a museum, and in their fourth report the Commissioners state:—'While it is a matter of congratulation that the British Museum contains one of the finest and largest collections in existence illustrative of biological science, it is to be regretted that there is at present no national collection of the instruments used in the investigation of mechanical, chemical, or physical laws, although such collections are of great importance to persons interested in the experimental sciences. We consider that the recent progress in these sciences and the daily increasing demand for knowledge concerning them make it desirable that the national collections should be extended in this direction, so as to meet a great scientific requirement which cannot be provided for in any other way.' Since these words were written a National Science Museum has been established, and the collections in it have been steadily enriched by many important acquisitions. These collections are at present housed in the old buildings at South Kensington known as the Southern Galleries and the Western Galleries. They now include models and copies of historical and modern philosophical apparatus of the greatest value to all interested in the progress of British science, and a large number of machines, instruments, and models of great interest as illustrating the origin and development of our most pregnant British inventions, together with such special collections as the unique series of models illustrating the history of shipbuilding.

"In 1876 the Royal Commissioners of the Exhibition of 1851 offered to the Government of the day a sum of 100,000*l*., together with a site on the Commissioners' ground, for the proper housing of this collection, under the condition that the Government should undertake its maintenance. In 1878 the Commissioners repeated their offer, and in 1879 this was declined by the Government. In 1888 the land to the south of Imperial Institute Road, reaching to that conveyed to the Government in 1864 for the erection of the Natural History Museum, and containing 4½ acres, was sold to the Government for 70,000*l*. This land has now been in part permanently allocated to the main section of the new buildings of the Imperial College of Science and Technology and to the building in course of erection for the Meteorological Office and a post office. The remainder of the site is at present occupied partly by temporary buildings and partly by the old buildings—the "Southern Galleries"—which now afford accommodation for the machinery and naval architecture collections of the Science Museum. This portion of the site, adjoining as it does on the north the Imperial College and on the south the Natural History Museum, is well regarded as an ideal position for the long projected Science Museum, which would complete the magnificent group of museum buildings already erected at South Kensington.

"The cost of acquisitions for the current growth of such a science museum, it may be noted, is far less than that of a corresponding art museum. The value of art products increases rapidly with age, whereas the scientific implements, machinery, and apparatus, interesting from an historical point of view, have rarely any great commercial value. The art collections of the Victoria and Albert Museum are now in possession of splendid buildings. If the buildings provided for the science collections were equally worthy of the interests which they should serve, the objects now in the museum could be exhibited to much greater advantage. Moreover, those *lacunae* which mark sections of recent activity in discovery and invention would be more readily filled than they can be while the obviously temporary character of the accommodation suggests to those who hold objects of interest in the history and advance of science that the authorities have but little appreciation for such things.

"Other countries, notably France and Germany, have recognised the importance of preparing suitable buildings for their National Science Museums. In Paris the Museum of the École des Arts et Métiers has a world-wide renown; and a National German Science Museum is now being built in Munich at the cost of 300,000*l*. England, the mother of so many great inventions that have proved to be pioneers in industrial arts, stands alone in having made no adequate provision for exhibiting and arranging in proper order her unique collections. The undersigned venture to urge upon you that the time has now arrived for action. Land sufficient for the purpose is in the Government's hands, and the Royal Commissioners of '51 if approached by the Government with a definite building scheme would doubtless give it due consideration. The need is great, and the mass of British science workers will hail your favourable decision with gratitude."

In his remarks, Sir Henry Roscoe said that what is needed is a building adequate to the proper exhibition of the present collection, and one worthy of British science. The grant for science purposes is 1800*l*.; that for art 11,260*l*. The fact that with so small a grant the national science collections have reached so important and in many respects so unique a position has been partly due to the fact that the cost of acquisitions for the current growth of such a science museum is far less than that of the corresponding growth of an art museum. Land sufficient for the required purpose is in the hands of the Government, and the Royal Commissioners of 1851, so long ago as 1878, offered to contribute 100,000*l*. towards a building for the Science Museum. Sir Archibald Geikie said that the council of the Royal Society desired him to express its keen sense of the importance of the collections and the need for better housing for re-arrangement and expansion. Sir David Gill said that, confining his remarks principally to the astronomical collection, he was much impressed with its extreme value, as it included apparatus of all periods, from the earliest days down to the present time. Mr. Alexander Siemens, expressing the view of the Institution of Civil Engineers, said that in the interest of students of engineering it is of the utmost importance that the collections should be housed with plenty of space, and should be as complete as possible. Sir Hugh Bell, as president of the Iron and Steel Institute, said his national pride was hurt when he went through the building at South Kensington and saw the collections housed in a place erected about fifty years ago as refreshment-rooms or something of that sort. Paris, Munich, and Berlin are very much in advance of London in that matter. Dr. R. T. Glazebrook, director of the National Physical Laboratory, said that the physical collection at South Kensington is very inadequately housed and quite fails to represent the growth of that science in England. Mr. W. M. Mordey, president of the Institution of Electrical Engineers, said there is at present no adequate representation of their work in this country. Sir William Ramsay said it is practically impossible to gain any notion of the progress of chemistry from a visit to the collection. Sir George Darwin said that in going over the museum he was struck by two or three things—first, the great interest of the collection; secondly, the overcrowding of it; and, thirdly, the extreme deficiency of the buildings in which it is housed.

Mr. Runciman, in the course of his reply, said:—The memorial which has been presented to the Board of Education and to me on the subject of this museum is one of the most weighty memorials that I think has ever been received by any Minister. We not only provide, or intend to provide, an exhibition for the exposition and demonstration of the principles of science, but we provide illustrations of the applications of science and arts to industry, including models and actual examples of outstanding inventions which are of historical importance, and, as Sir Henry Roscoe has said, are absolutely irreplaceable. We have the greatest desire to maintain historical industrial processes, and we have special collections, such as those in which I myself am enormously interested—namely, naval architecture, models of machines, and astronomical instruments. The whole of these are of priceless value. But I quite recognise that they are in many respects incomplete; and I am also impressed with the fact, as indeed everybody is who knows the building in which that collection is housed, that the housing has a great deal to do with the collection in the buildings in their present state. I recognise that the collection, even at the present day, is dreadfully overcrowded. The best illustration of that lies in the fact that in the cases now erected in the museum we have found it necessary to provide for what may be called a basement exhibition. When one passes through the exhibition one sees a considerable number of persons kneeling down on the floor in order to see what is in the basement of these cases. Anyone who is responsible for the museum can hardly avoid being ashamed of that condition of things. It is true that some parts of the galleries were put up as temporary buildings. They were part of the exhibition, I think, of 1862, and it is remarkable that they have lasted

so long. The whole difficulty is the very prosaic difficulty, I fear, of money and land. The South Kensington area, which now contains some of the most remarkable collections and some of the most valuable buildings in the world, has been very rapidly occupied. We cannot go south because of the Natural History Museum, and we are blocked on the north by the Imperial Institute, the Royal College of Science, and some of the other buildings, and I cannot at the moment see in what direction it will be possible for us to expand. The magnificent work which has been done in the direction of art on the other side of the road certainly sets the pace, and I recognise with you that it is pressingly necessary that we should have a new building for our great science collection at the earliest possible date. The question of funds is affected to some extent by the hint thrown out by Sir Henry Roscoe of assistance from the 1851 Commissioners. I cannot imagine any better work to which the Commissioners could devote their funds than in giving assistance in the construction of new buildings. For the moment I will say no more than that I will transmit to my colleagues and lay before the Cabinet, the Prime Minister, and the Chancellor of the Exchequer the very valuable statement which you made, and I will use my own personal influence, for whatever it may be worth, to impress on them the necessities of the case.

ESKDALEMUIR OBSERVATORY.[1]

WE have received the annual report of the observatory department of the National Physical Laboratory for the year 1908, which is noteworthy as being the first report issued since the establishment of the new magnetic and meteorological observatory at Eskdalemuir. Readers of NATURE will be aware that the advent of electric tramways to the neighbourhood of the observatory at Kew has greatly interfered with magnetic work there. The new establishment in Dumfriesshire is far removed from all industrial undertakings, and will thus be free from disturbing effects due to artificial causes.

So far as Eskdalemuir is concerned, the past year has been one of installation and experiment, and the report contains no results of observations. The superintendent, Mr. G. W. Walker, went into residence on May 11, 1908, and was followed shortly after by his staff, comprising observer, computer, mechanic, and mechanic's assistant. The first instruments to be set up were the Elliot unifilar magnetometer and the Dover dip circle, which were given to the laboratory by Sir Arthur Rücker. They are the instruments which were used by the donor and Prof. Thorpe in their magnetic survey of the British Isles in 1890. The first absolute measurements of horizontal force, declination, and inclination were made on May 29, and were continued for eight weeks, when some changes became necessary. Observations, made three times a week, were resumed in October, and have since formed part of the routine work of the observatory. The final determination of the azimuth of the fixed mark awaits the completion of the arrangements for the time signal.

The recording apparatus consists of a set of Eschenhagen magnetographs and a set of Kew pattern magnetographs made for the observatory by Mr. P. Adie. The former belong to the Admiralty, and are those used at the *Discovery's* winter quarters in 1902–4. Owing to damp, the magnetic house could not be used immediately, and the instruments had to be accommodated elsewhere. The Eschenhagen recorders were set up temporarily in the seismograph room. The Adie instruments were accommodated in the general laboratory, but the warping of the wooden supports has made satisfactory compensation for temperature changes impossible, and the point will have to be taken up again when the instruments are removed to their permanent positions.

For seismological work a twin-boom Milne seismograph is in use. Regular records have been obtained since September 24. Provision has also been made for carrying on the work of a meteorological observatory or station of the first order. The photographic barograph and wet- and dry-bulb thermograph have been lent by the Meteorological Office. They are the identical instruments which were formerly in use at Fort William Observatory, the base station of Ben Nevis. A Dines pressure-tube anemometer, a Beckley autographic rain-gauge, a Campbell-Stokes sunshine recorder, and barograph and thermograph of Richard pattern complete the outfit of ordinary meteorological instruments. Provision has, of course, been made for the usual control readings and for eye observations of weather phenomena. An Ångström compensation pyrheliometer has also been set up, and preparation has been made for recording the atmospheric electrical potential.

At Kew the usual observing and testing work has been continued. Summaries of the magnetic and meteorological work are given in the appendix. The results of measurements of solar radiation with an Ångström pyrheliometer, and of the temperature of the soil at depths of 1 foot and 4 feet, are given for the first time. The examination of the apparatus to be used at Eskdalemuir has formed an important part of the year's work, and we note also that Mr. W. Dubinsky, of the Pavlovsk Observatory, spent some time at Kew for the purpose of making comparisons between the Kew standard magnetometers and barometer and the standards in use in Russia. These comparisons were carried out in accordance with a general scheme for the international comparison of standards approved by the last International Meteorological Conference. The report concludes with the usual summaries of the magnetic results obtained at the observatories at Falmouth and Valencia.

[1] The National Physical Laboratory. Report of the Observatory Department, Richmond, Surrey, and of the Observatory, Eskdalemuir, Langholm, Dumfriesshire, for the Year 1908, with Appendices. Pp. 53. (Teddington, 1909.)

THE IMPERIAL CANCER RESEARCH FUND.

THE annual meeting of the general committee of the Imperial Cancer Research Fund was held on July 9 at Marlborough House, when the Prince of Wales, the president of the organisation, took the chair.

The following are extracts from the report, which was adopted at the meeting:—

During the past year further correspondence took place with the authorities of the International Society for Cancer Research in Berlin, in which it has been suggested that the executive committee should re-consider the attitude hitherto adopted and join the International Society; and offering that the first International Congress should be held in London. The executive committee is of opinion that the decision arrived at is in the best interests of the scientific investigation of cancer, and accordingly it adhered to its position. At a subsequent date a petition was presented by the International Society for Cancer Research in Germany to the King, as patron of the Imperial Cancer Research Fund, asking that the decision might be reviewed, but His Majesty, after considering the facts submitted to him through the Foreign Office, expressed the view that the Imperial Cancer Research Fund has cooperated freely in the past, both with German and other foreign workers, and will continue to do so in the future.

It may be well to recall in this connection the extent to which the Imperial Cancer Research Fund has encouraged the investigations of independent workers both at home and abroad. As is well known, the material for experimental research is difficult and costly to obtain, and is beyond the reach of many who, but for the help given from this fund, would be debarred from participation in this branch of the research. Recognising that such help must be of the first importance, it has been the aim of the general superintendent, Dr. E. F. Bashford, with the entire concurrence of the executive committee, to distribute to all applicants who possess the necessary credentials the material accumulated with much labour and expense.

A satisfactory feature of the past year has been the recognition of the work of the fund by foreign investigators, as is shown by the number of applicants for permission to work under the general superintendent. It has been found impossible to concede all the requests, but gentlemen from Italy, Bukarest, New York, and Munich have been accorded full liberty to pursue their researches in the laboratories supported from the fund, and every facility has been given them. Special arrangements have also been granted to other workers to pursue certain specific investigations, and to certain foreign medical men to study the methods during a short visit to this country.

Reviewing the results of seven years' work on the comparative and experimental investigation of cancer, says the general superintendent in his report, one is struck by the difference between the nature of the problems before us seven years ago and of those now being considered, as well as by the freedom one feels in investigating the problems presented to-day, without the incubus of having to consider them from the standpoints of the many hypotheses now proved to be untenable. I do not think that too much is claimed by asserting that the arduous labour of the past seven years is gradually effecting, and in several respects has actually effected, a complete revolution in many aspects of the cancer problem. But it has done still more in opening up new vistas in biology. Seven years ago no one conceived it possible that portions of the mammalian organism could be kept growing for a period four times the length of life of the whole animal. But to-day the number of different kinds of tissues now being propagated separately make it theoretically possible that the majority of the tissues may be so grown and segregated. In other words, a living animal can be analysed into many of its living component tissues. The finer relations of various kinds of tissues to one another have been revealed by the application of the new methods. The biological alterations which living mammalian cells may undergo suddenly, as well as gradually, under the influence of experimental conditions, can now be studied. These and many other achievements in the field of general biology are the most important practical fruits which have accrued from the experimental study of cancer, upon which they have only indirect bearings. Ultimately they are bound to be of far-reaching general biological importance, although to-day they are merely the weapons that have been forged to attack cancer. Their further development and their utilisation for the solution of purely biological problems will probably precede the solution of many of the problems surrounding the nature and causes of cancer.

While some chance opportunity may yield results of immediate practical moment, the outlook on therapeutics in the meantime is in the direction of preventing dissemination or metastasis. The means of explaining why inoculated cancer can undergo spontaneous cure have been greatly enriched by the acquisition of fresh strains of propagable tumours behaving in a variety of ways in this respect, and presenting all gradations from some growing progressively in every animal inoculated, to others which, while developing for a time in every animal, are ultimately got rid of in all cases by the active resistance which the tumours induce against themselves.

In acknowledging a vote of thanks, the Prince of Wales said, during the course of his remarks:—"When presiding over this committee on previous occasions I have expressed the view that immediate results in regard to the cure of cancer must not be counted upon, but that rather we must look forward to steady and consistent progress in accordance with the experience of all scientific investigation. There can be no doubt, however, that the seven years' work already accomplished by the fund has brought about a complete change in the standpoints from which cancer should be studied. The many and varied lines of research are being pursued with the utmost perseverance, and every development, as it occurs, is followed up with the minutest care. During the past year an important work—the third scientific report—has been issued from our laboratories, and has been received with appreciation by all those at home and abroad who are competent to express opinions on these highly technical researches. This of itself marks a steady and valuable advance, and one of which we have every reason to be satisfied.

SCOTTISH EXPEDITION TO SPITSBERGEN.

DR. WILLIAM S. BRUCE, of the Scottish Oceanographical Laboratory, is conducting another expedition to Prince Charles Foreland and other parts of Spitsbergen. One of the chief objects of the expedition is to complete the survey of Prince Charles Foreland which he began in association with H.S.H. the Prince of Monaco in 1906 and continued in 1907. He will also connect this survey with the mainland of Spitsbergen across Foul Sound, thus joining up the work of H.S.H. the Prince of Monaco, the late Captain Guissez, Captain Bourée, and Captain Isachsen in the north-west of Spitsbergen.

In 1907, Dr. Bruce brought back geological collections which have been described by Dr. G. W. Lee, of H.M. Geological Survey of Scotland, in a paper read to the Royal Physical Society, Edinburgh. These rocks and fossils entirely change previous opinions of the geology of Prince Charles Foreland, which was thought to be Silurian, whereas the rocks of Prince Charles Foreland consist, first, of a series of metamorphic crystalline schists, quartzites, and non-fossiliferous shales and hard grey limestones; secondly, of the fossiliferous limestone, probably permo-Carboniferous; and, thirdly, of grey shales containing the remains of dicotyledonous plants of Tertiary age. This time Dr. Bruce will carry with him a specially strong geological staff, and he hopes to clear up definitely the whole geology of Prince Charles Foreland and the neighbouring coasts of the mainland.

A special study of the botany of the Foreland will be made, Dr. Rudmose Brown carrying on that special part of the work. Dr. Bruce's staff consists of Mr. J. V. Burn Murdoch, who accompanied him to Prince Charles Foreland in 1907; Mr. John Mathieson, of H.M. Ordnance Survey of Scotland, who will take entire charge of the survey work; Dr. R. N. Rudmose Brown, late botanist of the *Scotia*, at present lecturer on geography, Sheffield University; Mr. Ernest A. Miller, who accompanied Dr. Bruce in 1906, and has since been attached to the meteorological and magnetical service of the Argentine Republic, having wintered at Scotia Bay, South Orkneys, during the last year. Mr. H. Hannay and Mr. A. M. Peach are the geologists, and Mr. Alastair Geddes will also accompany the expedition.

Dr. Bruce has chartered the steamer *Conqueror*, which is being specially re-fitted for the purpose, and has selected as master of the ship Captain Francis Napier, who has been kindly lent by Messrs. James Currie and Co., Leith. The expedition will leave Leith on Monday next, July 19, and is expected to be absent about two months.

We understand that this expedition, which will be Dr. Bruce's ninth visit to the polar regions, in no way interferes with his future Antarctic plans.

BIRD NOTES.

TO the May number of *Naturen* Mr. O. J. Lie-Pettersen contributes an account of the life-history of the icterine tree-warbler (*Hypolais icterina* or *H. hypolais*) in Norway, where it is known as the "bastard nattergale." The dates of arrival in the neighbourhood of Bergen during a period of eleven years range from May 16–20 inclusive; birds of the year take their departure about the middle of July, and old birds some weeks later. By the middle of August nearly all have vanished, although an occasional straggler may be seen up to the end of that month, and one specimen was so late as September. Among the trees haunted by this species the hazel is the favourite; nesting takes place at the end of May or early part of June, and the period of incubation is thirteen days.

The April number of the *Emu* contains the minutes of a conference on Government bird-protection in Australia, held at Melbourne in November, 1908. A large number of species and subspecies were recommended for total protection, among these being lyre-birds, coachwhip-birds, emeus, and cassowaries. Owing, however, to the conference being unable to prepare a protection Bill, on account of the relations existing between the Commonwealth and its constituent States, it was eventually decided that the list of species and groups recommended for protection should be submitted to each State for favourable consideration. The urgent need for efficient legislation in this direction is made evident by a statement on another page of the same issue with regard to a recent wholesale slaughter of emeus.

To Mr. L. J. Cole we are indebted for a copy of a paper from the April number of the *Auk* on the importance of "tagging," or marking, birds as a means of studying their movements. It is pointed out by the author that we are still nearly as much in the dark as regards the true

"inwardness" of migration as was the case a century ago, and that practically all our information on this subject is connected with mass-movements, so that we are ignorant of the wanderings of individual birds. The acquisition of a knowledge of such individual movements will, it is urged, aid, not only in the study of the general migration of species, but will assist in analysing the factors connected with migration as a whole. Active measures are being taken to inaugurate a system of bird-marking in the United States.

A similar movement has been started in this country by Mr. H. F. Witherby, the editor of *British Birds*, the details of which will be found in the June issue of that serial. The rings used for marking are extremely light, and do not in any way interfere with the bird's power of flight; each is stamped "Witherby, High Holborn, London," and bears a distinctive number, which in the smaller sizes is stamped inside the ring, and it is hoped that anyone into whose hands should fall a bird so marked will send the bird and the ring, or, if this is not possible, then the particulars of the number on the ring, the species of bird, and the locality and date of capture, to the address given.

Yet another centre for bird-marking is to be established at Aberdeen, as announced in the June number of *British Birds*.

The history of the rise and progress of ornithology in South Africa is presented in concise and popular form by Mr. A. Haagner in Popular Bulletin No. 2 of the South African Ornithologists' Union, recently published at Pretoria.

To No. 1670 of the Proceedings of the U.S. National Museum Mr. E. A. Mearns contributes a paper on new and rare birds from the Philippines, while in No. 1683 of this serial the same author gives a list of birds recently collected in the Philippines, Borneo, and certain other Malay islands.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. E. KNECHT has been appointed professor of technological chemistry in the University of Manchester.

FROM the *Observatory* we learn that Mr. J. Lunt, astrophysical assistant at the Cape Observatory, has been given the honorary degree of D.Sc. by the University of Manchester.

THE annual meeting of the Midland Agricultural and Dairy College will be held on Monday, July 26, when the report on the year's work will be presented. The Duke of Rutland will address the meeting, and present the diplomas and certificates gained during last session.

MERELY to mention the titles of four of the six articles contained in the February–March issue of the *Southern Educational Review* is to demonstrate the importance its editor attaches to the education of the negro. These articles are those on "Results of Attempts at the Higher Education of the Negro of the South," "The Essential Requirements of Negro Education," "Negro Rural Schools," and "Relation of the State to the Education of the Negro." The review is published at Chattanooga, Tenn., U.S.A., by the editor, Mr. H. Elmer Bierly.

IT is proposed to establish in connection with the Paris University a system of exchange between French and foreign professors on similar lines to that which has for some time been in vogue between Berlin and America. M. Liard, rector of the university, has made an appeal to the friends of the university to create a fund for the purpose. M. Albert Kahn has placed at the disposal of the rector an annual grant of 30,000 francs for five years. The *Revue scientifique* states that two million francs are necessary for the success of the scheme.

IT is announced by the New York correspondent of the *Times* that Mr. John D. Rockefeller has celebrated his seventieth birthday by giving 2,000,000*l.* to the General Education Board, which he founded in 1907 for the purpose of endowing American colleges and universities. The Board had already received 8,600,000*l.* from him. Some forty institutions of higher education have benefited by this trust, including Harvard and Yale Universities. The correspondent states that the Board's policy is governed by the belief that every city of more than 100,000 inhabitants should possess a college. The annual income of the Board is said to be 200,000*l.*

THE accounts of the London Polytechnics for the year ended July 31, 1908, have been printed by the London County Council. The council's comptroller points out that the total ordinary receipts of these eleven institutions amounted to 212,495*l.*, an increase of 8,543*l.* over the previous year. The council's grants amounted to 80,503*l.*, or 37·88 per cent. of the total receipts. Grants from the Board of Education amounted to 38,229*l.*, or 17·99 per cent.; the sums received from the City Parochial Foundation were 27,704*l.*, or 13·04 per cent., and from City companies, &c., 6,929*l.*, or 3·26 per cent. The total ordinary expenditure on revenue account of all the polytechnics amounted to 211,950*l.*, an increase of 4,431*l.* over the previous year. Taking the results as a whole, so far as ordinary income and expenditure are concerned, there was a surplus of 545*l.* on the institutions, as compared with a deficit of 3,567*l.* in 1906–7. The amount expended on teachers' salaries reached 99,286*l.*, or 47·84 of the total expenditure; other salaries accounted for 25,509*l.*, or 12·30 per cent.; rent, rates, and taxes absorbed 11,586*l.*, or 5·58 per cent.; and apparatus and other educational appliances and furniture cost 18,327*l.*, or 8·83 per cent. of the total expenditure.

TEACHERS at agricultural schools and colleges in this country will be interested in the full and detailed syllabus issued by the Colorado State Agricultural College. The requirements for admission strike an English teacher as severe, and we can only congratulate the Colorado College if it is in a position to insist on the high standard they imply. The student is expected to have a certain acquaintance with English literature, gained by reading specified classics, and to be "familiar with the essential principles of rhetoric," including the following:—"choice of words, structure of sentences and paragraphs, the principles of narration, description, exposition, and argument." History is another essential subject, and the teacher who is preparing pupils for the college is informed that "the mere learning of a text will not give the preparation that the colleges desire. Effort should be made to cultivate the power of handling facts and of drawing proper deductions from data, to develop the faculty of discrimination, to teach the pupils the use of books, and how to extract substance from the printed page." The other subjects—mathematics, chemistry, physics, "other languages"—are to be taught in a similar spirit. Students so trained would form admirable raw material, and could have no great difficulty in taking the fullest advantage of the college course.

THE Board of Education has issued [Cd. 4736] its regulations for technical schools, schools of art, and other forms of provision of further education in England and Wales which will come into force on August 1 next. No changes of special importance have been made as compared with those of last year. It is satisfactory to note that the amount of each of the royal exhibitions, &c., tenable at the Royal College of Art and the Imperial College of Science and Technology, South Kensington, has been raised from 50*l.* to 60*l.* per session. The old royal exhibitions and national scholarships tenable at the Imperial College of Science and Technology, have been combined as royal scholarships, the competition for which is to be conducted on the lines hitherto adopted for the award of national scholarships. In place of the former studentships-in-training in science, the Board of Education has established special studentships for teachers of science and technology who are qualified to enter on the third or fourth year of the course provided at the Imperial College. We notice that in future such teachers-in-training are not to be permitted to continue for more than two years in all at the Imperial College, a change which, in view of the need for highly qualified teachers in our provincial schools of science and technology, seems of doubtful wisdom.

THE new laboratories of St. Paul's School, built to celebrate the quatercentenary of the foundation, were opened on Wednesday, July 8, by Lord Curzon. In his address, Lord Curzon said he noticed how the school had kept pace with the spirit and reforms of the day, how during the last hundred years its numbers had increased from 153 to 600; how the modern side had grown to equal the older side in numbers and importance; and he told how great had been the achievement of the school under the late high master, Dr. Walker, one of the great school-masters of the nineteenth century. Lord Curzon went on to say that we lived in an age of self-depreciation, of a too great self-depreciation. Foreign critics were always coming to our public schools to learn how, having their superior equipment and their excellent organisation, they might obtain also "that training in character, that sense of moral responsibility, that spirit of civic patriotism, that ordered sense of personal liberty which were among the chief and most honourable characteristics of our public school system." So while content to learn from others we were not to forfeit that in our educational system which had done so much in the civic government of the country and the empire. The Bishop of Manchester referred to the conditions, so different from those obtaining now, under which he had learnt at St. Paul's School; yet he had learnt there that most valuable of lessons, to think. The high master, Dr. Hillard, said that St. Paul's had taken its full share in all those changes in educational method which began with Arnold's life at Rugby.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, June 16.—Prof. W. J. Sollas, F.R.S., president, in the chair.—The Carboniferous Limestone of County Clare: James A. **Douglas.** The district forms the westernmost limit of the central Carboniferous Limestone plain of Ireland. The area, for the purposes of description, is divided into two main districts. The northern region is formed by an elevated plateau of Viséan Limestone, which rises on the north and east in terraced cliffs, but to the south-west dips below the "Coal-measure" series. The surface is of bare rock, devoid of vegetation. The southern district is not formed of limestone; the high ground on the east is of Old Red Sandstone and Silurian rocks, that on the west of Coal-measures. The older formations appear as two anticlinal flexures, forming the mountains of Slieve Aughty and Slieve Bernagh. The margin of the syncline is formed by Tournaisian shales and limestone, while the Viséan limestones occupy the core. The limestone fauna show that the Geological Survey boundary between the Upper and Lower Limestones corresponds with the transition from a Tournaisian to a Viséan fauna, and the Middle Limestone contains a fauna distinct from that of the Upper, although they are not separable on lithological grounds. The Old Red Sandstone is succeeded by a series of sandy shales containing brachiopods characteristic of the Cleistopora zone; at the base are found modioliform lamellibranchs. The Zaphrentis zone is well developed. The most remarkable portion of the whole sequence is included in the Syringothyris zone. These beds show evidence of deposition in shallow water. The fauna is compared with that of the Waulsortian phase of Belgium. The incoming of a Viséan fauna is well marked at the base of the Seminula zone; in the middle of this zone occurs an important bed of oolitic limestone, with abundant gasteropods. The Dibunophyllum zone attains a thickness equal to that of the Midland area.—The Howgill Fells and their topography: J. E. **Marr**, F.R.S., and W. G. **Fearnsides.** The Howgill Fells form a monoclinal block, from which the Carboniferous rocks have been denuded. The northern slope probably corresponds with the sloping plane of unconformity between the Carboniferous rocks and Lower Palæozoic strata. On the south the slope to the Rawthey is along a block-fault. The chief drainage was originally north and south from the watershed at the summit of the block. The tract was glaciated by its own ice, but "foreign" ice was conterminous with the local ice on all sides. The rocks are, from the point of view of erosive effects, nearly homogeneous. The chief erosive effects of glaciation were the truncation of spurs, the formation of conchoidal scoops in the concavities of the valleys, a general widening of the valleys, and but slight deepening. A feature of interest is the contrast in this small area between these glaciated valleys and others of **V**-shaped cross-section, which are typical water-carved valleys unaffected by glacial erosion.—A new species of Sthenurus: L. **Glauert.**—Some reptilian remains from the Trias of Lossiemouth: D. M. S. **Watson.** The fore-limb of *Ornithosuchus woodwardi* is shown in a specimen in the Manchester Museum. Ornithosuchus is restored as an animal walking on all fours, with the head carried rather low. The proportions are identical with those of Ætosaurus. A description is given of the skeleton of a very small reptile, interesting as recalling Ætosaurus in its armour.—Some reptilian tracks from the Trias of Runcorn (Cheshire): D. M. S. **Watson.** Four types of tracks which occur on the slab of sandstone from Weston Point, described in 1840 by Dr. Black, are discussed in this paper. It is suggested that some of these prints may quite well belong to such thecodonts as Ornithosuchus.—The anatomy of *Lepidophloios laricinus*, Sternb.: D. M. S. **Watson.**

Linnean Society, June 17.—Sir Frank Crisp, vice-president, in the chair.—The growth of a species of Battarea: J. G. Otto **Tepper.**—The deposits in the Indian Ocean: Sir John **Murray.**—The *Sealark* Penaeidea, Stenopidea, and Reptantia: L. A. **Borradaile.**—The *Sealark* Lepidoptera: T. B. **Fletcher.**—Report on the Porifera collected by Mr. C. Crossland in the Red Sea, part i., Calcarea: R. W. H. **Row.**—The African species of Triumfetta, Linn.: T. A. **Sprague** and J. **Hutchinson.**—New species of Malesian and Philippine ferns: Dr. H. **Christ.**—The acaulescent species of Malvastrum, A. Gray: A. W. **Hill.**

DUBLIN.

Royal Dublin Society, June 22.—Dr. J. M. Purser in the chair.—The fossil hare of the ossiferous fissures of Ightham, Kent, and on the recent hares of the *Lepus variabilis* group: M. A. C. **Hinton.** The paper describes the fossil remains of *Lepus variabilis*, Pall., obtained from the rock fissures at Ightham, and deals with the osteology of the recent and fossil hares of the *L. variabilis* group. The Pleistocene hare of England is referred to a new subspecies, *L. variabilis anglicus*, which is to be regarded as the immediate ancestor of *L. variabilis hibernicus*, its relationship with the existing Scotch form not being so close. The subspecies *anglicus* and *hibernicus* are shown to be the most primitive members of the *variabilis* group. The most important conclusion reached is that, contrary to the prevalent view, the *variabilis* group of hares has originated in temperate latitudes, and not in the high north.—The value of benzidine for the detection of minute traces of blood: Prof. E. J. **McWeeney.** The author began by explaining the chemical nature of benzidine, which is a di-*p*-diamino diphenyl. This substance, when dissolved in acetic acid and brought into contact with blood in presence of H_2O_2, at once undergoes oxidation with formation of a brilliant blue colour. The reaction is in principle the same as that with guaiacol, the old-fashioned Van Deen's or Schönbein's guaiacum test. The colour base from guaiacol differs from the benzidine colour-base in the same way as an amine (aniline) differs from a phenol, or an aurine from a rosaniline dye. The test is ten-fold more delicate than that with guaiacum, and detects blood in solution as weak as 1/500,000; but for medico-legal purposes it is preferable to bring particles of the suspected matter into contact with the reagent, when each granule, if blood, at once strikes a most brilliant blue. The reaction can be observed under the microscope. The test worked well with blood-stains many years' old, and seemed to be independent of the nature of the substratum. Controls, and a time limit of about a minute, were essential, and the sensitiveness of each batch of benzidine had to be worked out beforehand. Of all the substances tested, none gave the typical blue colour so speedily as blood, save fresh vegetables and fruit, which at once struck an intense blue, at first limited to the fibro-vascular bundles. Boiling deprived them of this power, owing to the destruction of the oxydase, whereas blood solutions gave the blue reaction at once after five minutes' boiling. The author recommended this test to the attention of medical jurists.

PARIS.

Academy of Sciences, July 5.—M. Émile Picard in the chair.—Some new trialkylacetophenones and the trialkylacetic acids derived from them: A. **Haller** and Édouard **Bauer**. It has been shown in a preceding communication that dialkylacetophenones can be converted into trialkylacetophenones by treatment with an alkyl iodide in benzene solution in presence of sodium amide. These trisubstituted ketones, when further heated with sodium amide in toluene give a nearly quantitative yield of the amide of the trialkylacetic acid, together with benzene. In the present paper alkyl groups of high molecular weight are introduced. It has been found that on treatment with sodium amide these trialkyl ketones always give the fatty amide, the expected change into benzamide and the trialkylmethane not being effected. The preparation and properties of several new ketones are described.—The tectonic relations of the island of Elba with Corsica, and the situation of the latter in the Alpine chain: Pierre **Termier**.—The new *Recueil* of levellings of Russian railways as a basis for the hypsometry of the country: J. de **Schokalsky**.—Central Asiatic Russia and the level of the lake basins: J. de **Schokalsky**. There is evidence that the levels of the Siberian lakes are slowly rising. This is connected with the fact that the annual rainfall for the last twenty years has been slowly increasing. It is possible that there are alternate dry and wet periods in Siberia, and that at the present time the wet period has passed its maximum.—M. J. C. **Kapteyn** was elected a correspondant in the section of astronomy.—Occultations of stars observed at the Observatory of Lyons with the Brunner 16-cm. equatorial during the eclipse of the moon of June 3: J. **Guillaume**.—The summation of Dirichlet's series: Marcel **Riesz**.—The singular integrals of certain algebraical differential equations: B. **Gambier**.—Linear differential equations and uniform transcendentals of the second order: René **Garnier**.—Some inequalities having a bearing on the theory of elastic vibrations and electrical vibrations: A. **Korn**.—The conductivity of a gas at atmospheric pressure under the influence of a high alternating voltage: A. **Chassy**. The conductivity of a gas increases continuously with the voltage, and it is only for the highest voltages well above the critical voltage that the capacity of the gas condenser is the same as that which would be obtained if the gas were replaced by a liquid conductor. It is possible that under these conditions the gas is a true conductor and follows Ohm's law.—The radio-activity of potassium salts: Émile **Henriot** and G. **Vavon**. The minute radio-activity shown by potassium salts would appear to be a property of the potassium atom, since all attempts to concentrate the radio-activity by a series of fractionations failed. This confirms the results of Campbell and MacLellan. The rays have been identified with the β rays.—Tautomeric changes elucidated by means of the magnetic rotatory power: P. Th. **Muller** and M. **Thouvenot**. A differential method was employed to increase the sensitiveness of the measurements. Experiments were made with methyl cyanacetate and its sodium salt and with acetoacetic ester and its sodium derivative. The results indicate a change in the internal structure when the molecule passes into the sodium derivative.—The chlorides of silicon: A. **Besson** and L. **Fournier**. The evolution of hydrogen from silicochloroform under the action of the silent discharge has been confirmed by working in a current of hydrogen chloride gas.—A new method for the isolation of terbine: G. **Urbain**.—The oxidation of aldehydes by silver oxide: Marcel **Delépine** and Pierre **Bonnet**. The aldehyde in aqueous solution is mixed directly with silver nitrate, and baryta solution added in a proportion sufficient to set free the silver oxide and neutralise the organic acid formed. Various applications of the method are given, the yields being very high, usually more than 90 per cent. of the theoretical.—The hydrolysis of proteid materials by means of hydrofluoric acid; some new results: L. **Hugounenq** and A. **Morel**. By varying the strength of the hydrofluoric acid used for the hydrolysis the reaction can be stopped at definite stages. The process is especially advantageous for the isolation of the simple peptides.—Study of the principal layers of the alkaline rocks of the French Soudan: G. **Garde**.—The elaboration of the materials containing phosphorus and saline substances in the leaves of living plants: G. **André**.—Two new carbohydrates extracted from asparagus: Georges **Tanret**. These have the composition $(C_6H_{10}O_5)_n$, where n is about 15. Details of the method of isolation and properties of these carbohydrates are given.—The *rôle* of the fluorescent bacilli of Flügge in plant pathology: Ed. **Griffon**.—The biometrical study of the seeds of *Vitis vinifera*: P. **Seyot**.—The supposed utilisation of atmospheric nitrogen by certain special hairs of plants: François **Kövessi**. The development of plant hairs is independent of the presence of atmospheric nitrogen, and there is no evidence that these organs have specialised absorptive powers for nitrogen.—Seeds killed by anæsthetics retain their diastatic properties: Jean **Apsit** and Edmond **Gain**. Grains of wheat, the germinating power of which had been destroyed by treatment with ether, retained both their diastatic and peroxydiastatic properties.—The sensation of relief: A. **Quidor**.—The presence of attractive spheres and of centrosomes in the cells resulting from the parthenogenetic segmentation of the fowl's egg, and on the characters of these formations: A. **Lécaillon**.—The caves of Lacave (Lot): Armand **Viré**.—The morphological zones of western Switzerland: E. **Romer**.—The earthquakes of June 11 and 23: Alfred **Angot**.—An attempt to guard against hail: M. de **Beauchamp**.—New observations on earth currents between stations differing greatly in height: B. **Brunhes** and P. **David**.

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