THURSDAY, MARCH 30, 1911.

ENTOMOLOGICAL STUDIES AND PROBLEMS.

The Hope Reports. Vol. vii., 1908–10. Edited by Prof. Edward B. Poulton, F.R.S. (Oxford: Printed for private circulation by Horace Hart, 1910.)

THIS seventh volume of "Hope Reports" contains publications that have appeared between June, 1908, and June, 1910. It contains a mass of interesting material testifying to active interest taken in entomological studies and problems. The volume opens with an account of Dr. F. A. Dixey's patient and exhaustive investigation into the scent-distributing plume scales of the Pierine butterflies. These plume scales, when present, are found only in the male, and are confined to the upper surface of the wings, sometimes scattered over the general surface of both fore and hind wings, sometimes confined to special areas. An odoriferous secreted substance volatilises, and passing through the scales diffuses, giving an odour characteristic of the species of butterfly. Dr. Dixey passes in review many Pierine butterflies, and describes the structural characters and the various forms and distribution of the scent-scales, and suggests as a result of his research that the scent-scales have a diagnostic value for specific and certainly for generic distinctions. Further, the occurrence and the character of the scales can afford subsidiary evidence to other and more relied-on evidences of affinity.

The never-failing interest in the highly involved phenomenon of protective mimicry is a subject in which British workers—Oxford holding a deservedly foremost place—have won a world reputation, and this explains, and receives justification in, a series of memoirs in this volume of "Hope Reports." Prof. Poulton describes material from Durban, experimentally obtained by Mr. G. F. Leigh from the three mimetic female forms of *Papilio dardanus*, Brown, subspecies *cenea*, Stoll. In dealing with hereditary relationships of the several female forms, evidence is afforded that the proportion of mimetic forms in a locality is due partly to the proportion of, and partly to the relative conspicuousness of, their particular models, and the way is suggested in which the details of mimetic patterns have become adjusted to those of the models. A second paper, by Prof. Poulton, on the mimetic North American species of the genus Limenitis and their models, is followed by "Some Bionomic Notes on British East African Butterflies," by the Rev. K. St. Aubyn Rogers, who, in a long paper, illustrated by four plates, gives many original observations bearing on mimicry and its problems. J. C. Moulton follows with an illustrated account (five plates) of some of the principal mimetic (Müllerian) combinations of tropical American butterflies, and Dr. G. B. Longstaff, in a memoir full of observation, gives many bionomic notes on butterflies from different parts of the world.

In all the above memoirs there is much new information, and additional experimental and observational evidence in favour of Batesian and Müllerian mimicry.

The protective mimicry theory can only justify itself if there be proof that the mimics receive protection from insectivorous enemies, and in this connection attention may be directed to memoir No. 8 of these "Hope Reports," where Mr. Guy A. K. Marshall, in "Birds as a Factor in the Production of Mimetic Resemblance among Butterflies," deals with the debated question of appetite for butterflies among birds. Mr. Marshall gives here a very satisfying and most helpful review, in fifty-three pages, of such appetite and attack, summarising the evidence from world's records.

In memoir 9, "An Account of Some Experiments on the Edibility of Certain Lepidopterous Larvæ," Mr. Eltringham, in experiments where various larvæ were offered to lizards, obtained interesting results with caterpillars of *Boarmia rhomboidaria*. These caterpillars are well known to have a very marked resemblance to ivy twigs, and when motionless may easily be mistaken for twigs. One would have expected that this caterpillar, on being discovered, would prove palatable, whereas these *Boarmia rhomboidaria* caterpillars, fed on ivy, proved most distasteful to lizards. The same caterpillars, however, fed on apple for some days, were taken most willingly by the same lizards.

The systematic side of entomology is represented in the "Reports" by a series of memoirs on the Orthoptera. Three of these are on the Blattidæ by an expert in this family, viz. Mr. R. Shelford, who also writes on "Two Remarkable forms of Mantid Oothecæ." Dr. Hancock, of Chicago, describes Tetriginæ in the Oxford University Museum, and Dr. Achille Griffini, of Genoa, has three papers on the material at Oxford of Gryllacris, a genus of Locustidæ.

Mr. A. H. Hamm describes the courtship of some Empid species, supplementing previous observations by Howlett. The Empidæ, or dance-flies, are predaceous flies, found under trees or among shrubs and by streams. The females of some species were observed to circle round in slow flight, and then to be joined by a male. This male, provided with prey (some previously caught fly), singled out a female, and on the two flies settling for copulation, the prey is found to have been transferred to the female. When the insects, male and female, were netted on the wing before settling, the prey was also found in the net. The female sucks the prey during copulation. Mr. Colman J. Wainwright describes *Setulia grisea*, a Tachinid new to Britain, and then follow notes on the Lepidoptera of the Dale collection in the University of Oxford Museum, by Mr. J. J. Walker; notes on the British dragonflies of the Dale collection, by Mr. W. J. Lucas; and a supplementary list of Coleoptera of the Oxford district, by Mr. J. J. Walker. There is further a series of extracts from the *Proceedings* of the Entomological Society of London, which include numerous interesting bionomic observations.

These memoirs and the reports of the Hope Pro-

fessor of Zoology represent a body of useful and interesting scientific work on which Oxford University can be heartily congratulated. The excellent work done is honourable also to the science of entomology. The laws of life generally apply equally to the lower forms as to the higher, the general problems of heredity, variation, environment, &c., all receive illustration in the insect world, and such studies and observations as are recorded in these "Hope Reports" make a wide appeal to all zoologists and students of biological problems.

CYZICUS.

Cyzicus: Being some Account of the History and Antiquities of that City and of the District Adjacent. By F. W. Hasluck. (Cambridge Archæological and Ethnological Series.) Pp. xii+326; sketch maps. (Cambridge: University Press, 1910.) Price 10*s.* net.

MR. F. W. HASLUCK, the assistant-director of the British School at Athens, is an archæologist whose knowledge of the bypaths of travel in the Levant is extensive and peculiar. His work, too, has lain among the bypaths of antiquity rather than on its main routes. One of the pleasures of the "Annual of the British School at Athens" for some years past has been the reading of the assistant-director's articles on Frankish Greece and the Ægean Isles in mediæval days. Mr. Hasluck has devoted most of his time to the lands still under Turkish sway, and the present book is a description of what is known of a certain district of Bithynia, of which the centre was the ancient and famous city of Cyzicus.

The author modestly says that his book "lays little claim to be considered as more than a compilation, checked, where possible, by original research." It is more than this, and the original research has been so fruitful and is so genially described that we may wish, perhaps, that Mr. Hasluck had given us only his original research and had left the compilation part out. The book would not have been much smaller, and it would have been more interesting. However, this was not the plan and intention of the book, and no doubt the material derived by Mr. Hasluck from Wiegand and other recent authorities on this part of Asia Minor will be useful to English readers. Wiegand's drawings of the Roman bridge at Sultan Chair, reproduced by Mr. Hasluck, should be of interest to architects. It is a fine and dignified design, worthy of modern adaptation.

The book, part original and part compilation, then, is a very exhaustive monograph on Cyzicus and its district, followed by a very complete bibliography. Mr. Hasluck treats first of topography, in which the results of his own journeys are included, and various new identifications of ancient sites are made. Then he passes to the history, religion, and ancient government of Cyzicus, followed by a very useful index of inscriptions. Mr. Hasluck's photographs are good, and it is a pity there are not more of them. The plans are mostly from Wiegand.

Mr. Hasluck traces the history of Cyzicus from its foundation to the present day, when its site is a waste of meagre and uninteresting ruins, and only the name Bal-kiz preserves the ancient Παλαιὰ Κύζικος In Turkish, *Bal-kiz* means "Honey-Maid," so naturally the Moslem mind identified this *Bal-kiz* with Balkis, the Queen of Sheba, who visited Suleiman the Wise; and the ruined Roman amphitheatre, turned into a castle in Frankish days, was for the Turks Balkis Serai, "the Palace of Balkis." This is one of the many curious little bypaths into which Mr. Hasluck leads us.

The only criticism one has to make is that Mr. Hasluck is too much inclined to rely upon classical authority for his early dates. He accepts the traditional date (756 B.C.) for the foundation of Cyzicus, although there are serious grounds for thinking that this, like all the generally accepted dates of the founding of the oldest Greek colonies, is too early. The traditional year of the second colonisation, 675 B.C., is a more probable date for the first. After all, these dates rest on no more trustworthy grounds than do the Greek dates for the kings of Lydia, which are known to be all wrong. It is odd to find Mr. Hasluck quoting the Eusebian date for Ardys, which is nearly a century and a half too high. Surely, nowadays, we should quote the certain date, known from the contemporary Assyrian records, which place the reign of his father Gyges between 675 and 650. If the "second" founding (which one may think was probably the first and only founding) took place in 675, it can hardly have been due, as Mr. Hasluck considers, to the friendliness of Gyges to Greek colonisation, as in 675 he had hardly been any time upon the throne. However this may be, it is in any case certain that Ardys became king about 650, and Eusebius is really too doubtful an authority even to be mentioned.

In the chapter on religion we find an instance of the same indifference to the results of Oriental research in an adhesion to the old fable of the Sinopean origin of the god Serapis, who is accepted by Mr. Hasluck as originally a native deity of northern Asia Minor (p. 227). Letronne long ago explained the genesis of this story, first circulated by Plutarch and then copied by Tacitus. Sarapis was a purely Egyptian deity, Asar-Hapi, Osiris-Apis, represented at Alexandria in a Greek Zeus-form. The seat of his cult at Memphis seems to have been called *Si-n-Hapi*, "Place-of-Apis," *Sinopion* in Greek. Hence the Sinope story.

However, Mr. Hasluck may be excused for not knowing this fact, notwithstanding that attention was directed to it in an article (by the late Mr. P. D. Scott-Moncrieff) on Plutarch's "De Iside et Osiride," which lately appeared in the "Journal of Hellenic Studies." Classical archæologists should, no doubt, be a little more open than they often are to the reception of Egyptological and other Oriental knowledge; but they cannot be expected to be always aware that some time-honoured Greek belief or other about Oriental matters has long been exploded.

The point is a very minor one in this book, and has

only been expatiated on here in order to point a moral. On his main subject Mr. Hasluck is absolutely trustworthy, and has produced a book which is a credit to himself, to the British School at Athens, and to the University of Cambridge.

H. R. HALL.

RADIOTELEGRAPHY.

Jahrbuch der drahtlosen Telegraphie und Telephonie. Band iii., Hefts 1–6. Pp. 1–634. (Leipzig: Johann Ambrosius Barth, 1909–10.)

FOR those who wish to keep pace with the rapid theoretical and practical progress that is being made in wireless telegraphy, this Jahrbuch is almost indispensable. It contains full accounts of many important researches, abstracts of others, and each number gives a very complete bibliography of the literature on the subject, also a brief account of recent patents.

Glancing through the pages of the present volume, we are impressed with the great improvements that have been made in quantitative measurements. The phenomena dealt with are exceedingly complicated, and as a time interval of one-millionth of a second is long, the inertia of ordinary matter makes it mechanically impossible to follow the rapid changes that take place in an oscillating circuit. Fortunately, the inertia of a kathode stream is practically negligible, and the Braun tube is, in consequence of this, very frequently used in researches on electrical oscillations. This instrument has been utilised by Vollmer in an elaborate investigation of the Poulsen arc (pp. 117–74, 213–50), and by Roschansky in a shorter series of experiments on spark gap resistance (pp. 21–57). From both papers it is evident that much remains to be done before a satisfactory *quantitative* theoretical explanation of the behaviour of arcs and sparks can be given.

There are several papers on the mathematical theory of coupled circuits. Mackü criticises the work of Cohen, discusses the theory of the Fischer method for examining the two waves in coupled oscillators, and gives some approximation formulæ of his own. Berthenod compares direct and inductive coupling mathematically, a problem of particular interest at the present moment.

The problem of long-distance transmission has brought forth many mathematical discussions of the diffraction of electromagnetic waves; one by H. Poincaré appears in the present volume. But it is doubtful whether diffraction plays a very important part; a highly conducting layer of air in the upper regions of the atmosphere would probably be a much more important factor. Very little has so far been published regarding long-distance transmission. Surely a large number of valuable statistics must have been gathered during the past few years at powerful wireless telegraph stations, like Marconi's transatlantic stations, the publication of which would be of the greatest theoretical and practical interest.

Only three papers appear from English men of science—one by Lodge and Muirhead on "The general principles of syntonic wireless telegraphy"; a second by Fleming, "Some quantitative measurements in radiotelegraphy"; and a third by N. Campbell on "The æther."

Wireless telegraphy seems to be very much neglected by the technical colleges in this country; which is most regrettable, as probably in no other branch of engineering is it so essential that an original investigator should have such a very thorough grasp of the fundamental principles of physics.

MODERN ENGINEERING ACHIEVEMENTS.

Engineering of To-day. By T. W. Corbin. Pp. xvi+367. (London: Seeley and Co., Ltd., 1911.) Price 5*s.* net.

THE author of this book has set himself the task of giving a popular account of the present developments of engineering science, illustrating his text with diagrams and photographs, and, although he has not attempted to make any rash forecasts, yet he has indicated the directions in which future developments are likely to occur.

The first few chapters are devoted to the various sources of power; the steam engine, the gas engine, and hydraulic motors, are all in turn dealt with; then follows a chapter on how this power is transmitted, special attention being devoted to electrical methods. The author next treats of the materials used by the engineer, and modern methods of manufacture. In describing the cantilever system of bridge construction, it is a pity that the author did not adopt the elegant illustration given by the late Sir Benjamin Baker in the course of a popular lecture on the design of the great structure across the Firth of Forth. Ship construction is explained somewhat fully, and a clear account is given of the structural design of most of the leading types of passenger and cargo boats; to ships of war a special chapter is devoted, and, as an illustration of the most modern type of battleship, the author has selected the *Minas Geraes*, recently built by the firm of Sir W. G. Armstrong, Whitworth and Co. for the Brazilian Government. Submarine work and submarine diving form the subject of another chapter.

A short account is given of the filtration of water prior to its distribution to the consumer, but no mention is made of the system of mechanical filtration, which has recently been extensively adopted. As an illustration of a great water scheme, the author has selected the Coolgardie water supply, probably the most daring scheme ever conceived, and one which has proved entirely successful.

Three excellent chapters are those devoted to railways and their work; a description is given of the construction of a modern express locomotive, and details as to the signalling appliances which have to be adopted in order to secure the safety of trains on lines crowded with traffic.

That the book is quite up to date is proved by the

chapter entitled "The Conquest of the Air," in which accounts are given of the latest types of dirigible balloons and of aëroplanes.

In the concluding chapter the author attempts to discuss the engineering of to-morrow. He rightly points out that for many years to come the energies of the engineer will be directed mainly towards the problem of the "utilisation of waste materials and waste forces." The author suggests that in the utilisation of the heat and energy given out by the sun a solution may be found for the difficulty which will arise when the world's coal supply is exhausted. All such proposals are, however, still mere ideas.

The author of this book set himself a difficult task, and he has accomplished it in a satisfactory manner.

T. H. B.

TECHNICAL MYCOLOGY.

Technical Mycology: The Utilisation of Micro-Organisms in the Arts and Manufactures: A Practical Handbook on Fermentation and Fermentative Processes for the Use of Brewers and Distillers, Analysts, Technical and Agricultural Chemists, Pharmacists, and all interested in the Industries dependent on Fermentation. By Prof. F. Lafar. Translated by Charles T. C. Salter. Vol. ii., "Eumycetic Fermentation." Part ii. Pp. x+191–748. (London: C. Griffin and Co., Ltd., 1910.) Price 18*s.* net.

THOSE who worked with the first volume, and the first part of the second volume of Lafer's "Technical Mycology," have waited, with some little impatience, for the appearance of the second part of the latter volume. We have waited our seven years, but have, at last, been rewarded by a work that will be of considerable value to those who are working at eumycetic fermentation, the consideration of which is continued by Prof. Lafar and by a number of experts, each of whom has undertaken to treat a part of this question.

In an introductory section Prof. Lafar himself takes up the general question of yeast nutrition and yeast culture, and brings his subject well up to date. An interesting chapter on variability and heredity in Saccharomycetes may have a much wider bearing than in its application to brewing. Our author points out the importance of the presence of certain mineral foodstuffs, and indicates the possible sources of organic foodstuffs, laying special stress on the sources of nitrogen and on the oxygen requirements of the yeast cell. Here, in connection with Hansen's experiments, he indicates the most favourable conditions for cell reproduction, and the oxygen requirements for both cell-reproduction and respiration. Then follows a description of the effect of copper and its salts, inorganic acids and salts, organic stimulants and poisons, and of alcohol itself upon the yeast cells. Some part of this is repeated by Albert Klöcker, of Copenhagen, who, treating the matter from a somewhat different point of view, gives a very good account of the life-history and variability of the Saccharomycetes, and describes fundamental researches into the life-history of these organisms, temporary variations, and the production of sporing and non-sporing forms, and the development and maintenance of these varieties under various definite conditions. Klöcker also contributes an interesting and full classification of the families Saccharomycetaceæ and Schizosaccharomycetaceæ, which will probably be an accepted classification for some time to come.

In a chapter on the morphology and subdivision of the family Aspergillaceæ, Prof. Carl Wehmer gives an account of the saccharification of starch, acid fermentation, formation of alcohol, and the degradation of proteids and their derivatives by the members of this family. Special articles are also contributed by Prof. G. Lindau on "*Cladosporium herbarum* and *Dematium pullulans*"; by Dr. H. Will on "The Torulaceæ, Pink Yeasts and Black Yeasts"; by Prof. Richard Meissner on "Mycoderma or 'Mother of Vinegar'"; by Prof. H. Müller-Thurgau on "The History, Morphology, and Fermentation phenomena of *Saccharomyces apiculatus*"; by Dr. H. Wichmann on the Monillæ and Oidia; and, in the section devoted to enzymes and enzyme actions of yeast, by Dr. Rudolf Rapp on "Alcoholase," by Dr. Arminius Bau on "The Chemistry of Alcoholic Fermentation and on the Enzymes Decomposing the various Sugars"; whilst Dr. Lafar and Dr. M. Hahn close the work with a chapter on "Endotryptase and Philothion."

The new method of treatment, though it takes away somewhat from the continuity of the story, has many advantages in so far that each part is treated by a special authority, and has thus been brought more fully up to date than would have been possible had Dr. Lafar attempted to cover the whole ground single-handed

The subject-matter of the latter part of the work, dealing with enzymes and enzyme actions of yeast, has passed through such rapid transformation within quite recent years, and is still being so highly developed that it would be impossible for any single writer to keep pace with the enormous numbers of publications that have appeared, and to summarise at all adequately the work thus presented to botanists and chemists. How difficult this would have been may be gathered from the bibliography given at the end of the book, a bibliography which covers more than 130 pages, each page containing from twenty to forty titles of papers. In this volume is contained a very full index of the whole work, without which the reader will have some difficulty in gaining access to the material contained in the earlier published volume and part. The translator has done his share of the work well; the illustrations are good, and the general appearance of the book corresponds very closely to that of the earlier issues. The completed work is far more valuable than it is in the individual parts, and we strongly advise those who take an interest in the technical subjects dealt with in this part to read it, and then keep it for reference alongside the others.

COLLOID CHEMISTRY.

An Introduction to the Chemistry of the Colloids. A Compendium of Colloidal Chemistry for Students, Teachers, and Works Managers. By Dr. V. Pöschl. Translated from the second, enlarged, German edition by Dr. H. H. Hodgson. Pp. iv+114. (London: C. Griffin and Co., Ltd., 1910.) Price 3*s.* 6*d.* net.

THIS short work is well described in its title as a compendium of colloidal chemistry. Struck by the growing importance of this branch of chemical science, the author has endeavoured to provide a brief summary of the chief characteristic properties and modes of preparation of colloids, as well as to indicate some of the more important phenomena in the production of which colloidal substances are concerned.

The chemical methods for the preparation of colloidal solutions of the hydroxides, sulphides, and metals are described in some detail, together with the properties of the resulting hydrosols, special attention being paid to gold and silver, the study of which has done so much to advance our knowledge of the colloids. The electrical methods, due to Bredig, for the production of metallic hydrosols are also well described, whereas the precipitation methods by which colloidal solutions of sodium and barium salts have been obtained are not mentioned.

The character of the work is incompatible with much discussion of the numerous knotty points which must inevitably arise in any account of the various theories of the colloidal state, but a clear description of these theories is given, great stress being laid on the positive evidence afforded by the ultramicroscope that colloidal solutions are not homogeneous. Attention is also directed to the important fact that many substances, a list of which is given, are known both in the crystalline and colloidal forms, and that the colloidal state is not necessarily a property only of substances possessed of a large molecule and complex chemical constitution, but may also be associated with quite simple substances, the nature of solvent, or, as it is better termed, the dispersion medium, being frequently the deciding factor.

Perhaps too little stress is laid on the electrochemical relations of colloids, and the important subject of the mutual precipitation of colloids of opposite electrical sign is dismissed in a single line.

The concluding sections on the importance of colloidal chemistry in various branches of chemistry and in other sciences indicate very clearly how much assistance these are deriving from the realisation of the fact that many familiar phenomena can only be adequately understood in the light of our knowledge of the colloids.

On the whole, it may be said that the purpose of the author in compiling this account of the colloids has been fully realised, and that the reader will gain a good idea of many of the points of interest connected with this difficult and important subject.

A. HARDEN.

OUR BOOK SHELF.

An Introduction to the Study of Metallurgy. By Sir W. C. Roberts-Austen, K.C.B., F.R.S. Sixth edition, revised and enlarged by F. W. Harbord. Pp. xv+478. (London: Charles Griffin and Co., Ltd., 1910.) Price 18*s.* net.

THE appearance of a new edition of Sir William Roberts-Austen's "Introduction to the Study of Metallurgy," which has been out of print for some time, is to be heartily welcomed, as no other book adequately fills its place in metallurgical literature. Since its first publication there have been vast advances in pyrometry, metallography, and in metallurgical processes, advances which were only partially dealt with in succeeding editions. In this the sixth edition special attention has been given to the results of recent research and metallurgical progress; the chapter on pyrometry has been rewritten, a new chapter on metallography has been prepared, and in the chapter on furnaces, descriptions and illustrations of typical modern furnaces and appliances have been introduced to replace those which are no longer in general use. This chapter also contains an extremely useful account of the construction, modes of working, and uses of the three chief types of electric smelting furnaces.

A valuable addition, the thermal treatment of certain industrial alloys, has been made to chapter iv., which in previous editions was confined almost entirely to the thermal treatment of steel.

The book is intended to give a systematic course of study in the fundamental principles on which metallurgical processes are based, and the success of their various operations depend; and for this it is admirably adapted. It will be conceded by all that without this knowledge the difficulties and irregularities which arise in metallurgical practice can be, if at all, but imperfectly contended with.

The information which is given on the subjects dealt with, although necessarily brief in some cases, is set forth with remarkable clearness, and is thoroughly trustworthy and up to date.

The new edition is an excellent piece of work, and Mr. Harbord deserves the congratulations of metallurgists for having brought this valuable text-book into touch with the times. It is indispensable not only to students, but to all who are engaged in practical metallurgical work. W. G.

Untersuchungen über die Zoogeographie der Karpathen. (Unter besonderer Berücksichtigung der Coleopteren.) By Karl Holdhaus and F. Deubel. Pp. vi+202, and map. (Jena: Gustav Fischer, 1910.) Price 8 marks.

IN this important and carefully written work Prof. Holdhaus analyses chiefly the Coleoptera of the Carpathians, with special reference to the influence of the Glacial period on the Alpine fauna of Europe. We may perhaps quote a few words from his introduction to make his starting point clear, though possibly the case is a little overstated, in view of the circumpolar fauna and flora:—"During the Glacial period all life was annihilated in northern Europe. The animals at present inhabiting north Europe are post-Glacial immigrants. The remarkable impoverishment and monotony of the northern fauna—especially the absence of a typical mountain fauna in Fenno-Scandia—seems inexplicable except from this point of view. In central and southern Europe the influence of the Glacial period is chiefly visible in the mountain fauna."

Prof. Holdhaus commences by discussing the geological history of the Carpathians, and their climate and vegetation. Then he proceeds to discuss the distribution of the Coleoptera of the Carpathians, and the districts which they inhabit, the age and origin of this fauna, and how far it has been influenced by

the Glacial period, especially as compared with the fauna of the Alps. Another chapter deals with the distribution of mammals, reptiles, amphibia, mollusca, &c., in the Carpathians, followed by lists of Coleoptera (by Holdhaus and Deubel) found in different districts in the Carpathians, with notices of the surroundings. The map illustrates the glaciation of the eastern Alps and Carpathians during the Ice period, and the range of the blind mountain beetles. These beetles are a specially interesting group, of limited range, in the Austrian Alps. Some of them are cave species, while others inhabit the open.

Many interesting subjects are discussed by Prof. Holdhaus, which we have no space to allude to, but he has not forgotten to take account of fossil and amber Coleoptera, and his remarks on what he calls "Massifs de refuge" (districts south of the Alps to which he believes the mountain species retreated during the Glacial period) also seem to deserve special attention.

Mosses and Liverworts. An Introduction to their Study, with Hints as to their Collection and Preservation. By T. H. Russell. New and revised edition. Pp. xvi+211+xiii plates. (London: Sampson, Low, Marston, and Co., Ltd., 1910.) Price 4*s.* 6*d.* net.

THE speedy demand for a second issue of Mr. Russell's book testifies to its value and usefulnes as a guide to the study of mosses and hepatics. The introductory portion is all that can be desired, and the student who conscientiously masters this portion will be in a position to pass on to more advanced books dealing with the same subject. The author lays much stress on the point that he is specially anxious to use simple language, fearing that scientific words might act as a deterrent to the study. With this frequently expressed idea we do not quite agree; the true value of a scientific term consists in the fact that, when once grasped, it stereotypes the particular structure in a single word, whereas a sentence in English may convey but a very vague idea of the structure in question. As an example, the term *archegonium* defines a definite structure, which is said to be "the fruit-bearing organ," which it certainly is not. The species given as examples are well chosen, and cover all the structures peculiar to mosses and hepatics.

The detailed account of habitats, and the stress laid on their importance, are features to be commended, as too frequently the student is encouraged to snatch a fragment from anywhere, put it into a tube containing methylated spirit, and only commence serious study when viewing it under a compound microscope. The chapters on collecting, storing, and the preparation of mounted specimens for microscopic work are very full, and are obviously the outcome of much practical experience.

Thirteen whole plates of excellent figures add much to the value of the book, which can be confidently recommended as a stepping-stone to the study of mosses and hepatics.

The Social Guide, 1911. Edited by Mrs. Hugh Adams and Edith A. Browne. Pp. xxxviii+252. (London: A. and C. Black, 1911.) Price 2*s.* 6*d.* net.

INFORMATION is given in this work of reference not only about occupations for leisure days and hours, but also concerning more serious pursuits. The diary with which the volume begins includes the meetings of the Royal Geographical Society and of the British Association among scientific societies, and the anniversary dinner of the Royal Society. Though it is sometimes a little difficult to understand the principle of selection for the contents of the volume, we notice the activities of the Royal Institution, the Royal Society of Arts, and the Zoological Society are described.

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.*]

A Kinetic Theory of Gravitation.

THE subject of Mr. Brush's article in NATURE of March 23 (p. 129) is certainly of profound interest, and will continue to be so until the problem as to the nature of gravitation is solved. Meanwhile, a few questions raised are comparatively simple. Anyone asked, Where lies the energy of a raised weight? must surely reply, "In the æther," *i.e.* in the medium, whatever it is, that is driving the weight down towards the earth. A critic who either doubts or asserts this will not be confused—as Mr. Brush suggests he will be—by the suggestion that the weight might be raised so high as to reach the neutral point between earth and moon—a suggestion which carries with it the tacit questions, "Where is the energy now?" and "What has become of the work done?"—for this case is no more troublesome than the case of a weight raised and hung on a hook. Something—some opposition force—sustains the weight, *i.e.* opposes the pull of the earth, and it matters little whether the opponent be a shelf beneath it or the moon above it. The important thing to understand is the nature of the downward propelling force—indeed, of both the upward and the downward force—in either case.

The question whether the energy of a raised weight is potential or kinetic is of little or no importance. The energy is certainly potential, according to our definition of potential. So is the energy of a strained spring: for there also the atoms are separated against their mutual (cohesive) attraction, and there again the energy really resides in the æther. But that all energy may turn out to be ultimately kinetic—when we come to understand what elastic stress fundamentally is—that proposition is not negatived in the least.

Mr. Brush proposes a shadow theory of gravitation, a modification of Le Sage's theory except that the pressure is supposed due to the non-syntonic impact of waves travelling in all directions, instead of to a bombardment of utterly minute particles flying at random. There is nothing new in a shadow theory, and all such theories are faced with the difficulty of plausibly explaining the absence of noticeable screening—a difficulty which is bound to reduce them to acquiescence in an approximation.

The contribution which Mr. Brush makes to the discussion is the suggestion that the supposed gravitational æther-waves are the result of accumulated thermal radiation from all past and present suns, the wave-lengths having automatically increased during their long storage.

To this view several objections might be urged—one of them being that in that case the constant of gravitation would be secularly increasing; another, that it should be greater in a hot enclosure, say the interior of a sun, than elsewhere; but a more salient obstacle is raised by the inquiry as to which is cause and which is effect. How did the bodies get hot and so radiate? Was not their heat perhaps due to their having clashed together with gravitational energy itself derived from the æther?

The fact is that every question concerning *origin* involves us always in insuperable puzzles, and that is just the main difficulty about gravitation. An atom of matter, by its very existence, sets up a fixed stress in the æther, varying directly as the mass and inversely as the distance—that is only another way of stating the law of gravitation; we are trying to understand the nature and cause of that stress. It appears to be one of the fundamental properties of matter, and until we can understand what is meant by the generation or destruction of an atom—*i.e.* of an electron if that is the fundamental unit—we are hardly likely to understand its gravitational influence more than any other of its fundamental properties—including, perhaps, existence itself.

Let this not be understood as a negative prediction or estimate of impossibility—such predictions are always absurd; it may be that when the structure of an electron

is understood, we shall see that an "even-powered" stress in the surrounding æther is necessarily involved. What I do feel instinctively is that *this* is the direction for discovery, that what is needed is something internal and intrinsic, and that all attempts to explain gravitation as due to the action of some external agency, whether flying particles or impinging waves, are doomed to failure; for all these speculations regard the atom as a foreign substance—a sort of "grit" in the æther—driven hither and thither by forces alien to itself. When, some day, we understand the real relation between matter and æther, I venture to predict that we shall perceive something more satisfying than that. OLIVER LODGE.

University of Birmingham, March 25.

Visual Sensations from the Alternating Magnetic Field.

THERE is no necessity to look to suggestion or other abstruse causes to account for this phenomenon. The electric currents induced in the head are quite sufficient to produce the effect.

As I pointed out in a letter to *The Electrician* on April 22, 1910, electrodeless currents in the body produced by electromagnetic induction from a coil carrying so-called high-frequency currents have been in use in medical practice for some years.

Employing as primary a coil of wire of many turns, and some 2 feet in diameter, carrying high-frequency currents from the discharges of a large battery of Leyden jars, and using as secondary the body and the two arms bent so as to form a circle, sufficient current can be induced in the circuit formed by the arms and body to light a miniature incandescent lamp connected between the two hands, or a sufficient difference of potential can be produced between the two hands to cause small sparks to pass visibly between them when they are held near together.

It is easy to produce the visual flickering effect by passing through the head the current from an ordinary continuous-current magneto generator, such as is supplied with the Evershed ohm-meter. One terminal of the generator should be held in one hand, while a wire from the other terminal should be held in the other hand in contact with a small piece of wet sponge, and the latter pressed lightly on one side of the head just behind the eye. If the generator handle is then slowly turned (and it is wise to turn it slowly to avoid unpleasant results) the flickering effect will at once become very noticeable, and as the frequency of the flicker increases with the speed of revolution, it apparently is connected with pulsations in the current due to the slow revolutions and the few segments on the commutator. The current through the head must be very small, as the bulk of that generated goes from hand to hand through the arms and body.

I first noticed this phenomenon some fifteen years ago when treating myself electrically for neuralgia, but I fancy that the effects of electric currents on vision have been known much longer than that.

Passing electric currents through the head in certain directions also produces a metallic taste in the mouth.

A. A. CAMPBELL SWINTON.

66 Victoria Street, Westminster, March 24.

The Angular Speed of Rotation of a Long-enduring Prominence.

THANKS to the note contained in the "Astronomical Column" of NATURE of March 9, my attention has been directed to the very interesting article under the above heading in the January issue of the *Astrophysical Journal*.

The prominence Mr. Evershed describes is the same as that under consideration in my letter contained in NATURE of February 23, and of which disc-spectroheliograms were given in the issue of February 2 in connection with the reproduction of M. Deslandres' address of June 12, 1910. The Meudon spectroheliograms add thus a plate to the series enumerated by Mr. Evershed on p. 3 (*Astrophysical Journal*, No. 1, vol. xxxiii.), and an additional date is further added by the spectroheliogram taken at Meudon on April 15, 1910. Both are beautifully reproduced in the fine memoir forming vol. iv. of the *Annales* of the Obs. d'Astr. Physique de Paris, of which M. Deslandres is the author.

The Meudon spectroheliograms seem greatly superior to those accompanying Mr. Evershed's article in the *Astrophysical Journal*, undoubtedly on account of the excellent and original instrumental combination resorted to by M. Deslandres, which aims at *the absolute isolation of the central rays* K_3 *of calcium or of* Hα *of hydrogen*. Comparing the Meudon spectroheliogram of March 21 with what Mr. Evershed says (p. 5) as regards the appearance of the dark formation under discussion, one cannot help being struck by the seeming divergence of the evidence. Mr. Evershed says:—"On March 21 it reappears as a *vague* and *ill-defined* dark mass." Further, he states on March 25 that "the northern arm can indeed be faintly traced for a much greater distance in a vast circular sweep towards the eastern limb." Reverting, now, to the Meudon spectroheliogram of March 21, the dark mass is seen of quite immense breadth longitudinally, no fewer than 5 degrees, is pronouncedly distinct in its entire vast extent also latitudinally, shows well-defined western and eastern contours, both convex towards the west, and also shows the narrow extension towards the N.N.E. quite distinctly. This great difference of what the Kodaikánal plate for March 21 shows as compared with the plate taken on the same day at Meudon, creates in my mind a doubt as to the actuality of what Mr. Evershed suggests on p. 6, viz. the disappearance in its entirety of the dark formation between March 25 and 26.

With due deference to the able observer, I venture to say that possibly inaccurate relative setting of first and second slits, along with insufficient dispersive power or other optical inferiority to the Meudon spectroheliograph, has not allowed the Kodaikánal plates to be so sharp and rich in detail as the Meudon plates. This is further suggested by the striking absence on the Kodaikánal plates of many conspicuous dark calcium flocculi, which during those days infested the sun's disc all over, yet, of course, there is the possibility of their temporary absence; but, on the other hand, on each of the successive appearances of the large prominence on the east or west limbs, the formation exhibited the striking feature of a dark, flat cloud hovering over the bright prominence-range along its entire latitudinal extent, as described in my letter, suggesting, therefore, continuity rather than intermittent or "puffing" action. The Meudon plate taken on April 15 clearly shows the re-entry into the disc of the dark formation, with a more acute apex directed towards the west than during the previous transit, and the N.N.E. directed arm is not yet absent as it is on the Kodaikánal plate of April 18.

Incidentally, another exceptional feature of the sun's disc should be mentioned which was strikingly on view during April and May, 1910, viz. the fine circumpolar wreath of dark flocculi in the south. A formation of this kind goes a long way towards explaining the previously puzzling experience of observing for many days in succession prominences at apparently the same position-angles in comparatively low latitudes. These prominences are, as a rule, of the quiescent, brushy, and rather dull type. ALBERT ALFRED BUSS.

"Barrowdale," 22 Egerton Road, Chorlton-cum-Hardy, Manchester, March 19.

The Flow of Thin Liquid Films.

IN the very interesting letter by Mr. W. G. Royal-Dawson in NATURE of March 23 on the above subject, the peculiar character of the stream-lines round a moving air bubble compared with those round a fixed solid obstacle may seem to some to require an explanation. As the writer of the letter offers none, may I be permitted to state what appears to be the cause of the conflicting currents shown in Fig. 4 of Mr. Royal-Dawson's letter?

It is stated that on pressing the cover-glass the bubble seems to increase in size. From this we may conclude that it is in contact with the glass surfaces top and bottom. It will therefore be more or less anchored. The result of this is that if it is to move it can only do so by the formation of new film on the front, or by the old film which is collecting in the rear from the top and bottom of the bubble moving to the front. As water offers

resistance to the formation of new film, the film-tension in the front will be greater than in the rear, and the film will be dragged from the rear to the front of the bubble, and in its movement will carry the water in contact with it, thus causing the forward current *a*. As the supply of film has to travel in a narrow stream in the middle of the space between the two glasses, it will flow with considerable velocity, as it has to provide film for all the area dragged on by contact with the glass surfaces.

JOHN AITKEN.

Ardenlea, Falkirk, N.B.

Insect Intelligence.

MY friend Prof. Hughes's story about a fox's cleverness in getting rid of his fleas induces me to recount an instance of insect intelligence which I witnessed about fifty years ago at Elmstead in Essex, a place teeming with insect life. There was a narrow border round the wall of my house; on this I noticed one day a large fly of the ichneumon family straddling over and dragging a green caterpillar bigger than itself. I watched it crawling for some thirty or more yards round an angle of the house until it came to a corner protected by a projection of the wall. Here it deposited the caterpillar, and removed one by one a little heap of small stones. This disclosed a cylindrical hole in the ground, into which the fly descended tail first, dragging the caterpillar after it. It then came out, and again went down, apparently stamping the caterpillar close, and may probably at the same time have laid an egg. It then came up, replaced the stones so as to hide the orifice, and flew away.

This probably was only an instance of the mode of proceeding of the whole species, but notice what it involves. The insect must have dug the deep hole and hidden the entrance to it carefully for future use, and it must have remembered its position so as to find it again from whatever quarter where it may have chanced to find its prey.

Graveley, Huntingdon. OSMOND FISHER.

Reflection of Ultra-violet Rays by Snow.

ALLOW me to make the following short statement in the columns of NATURE.

During the past winter we have had frequent snowfalls here in Switzerland, these being followed very often by bright sunshine. I availed myself of these occasions to determine to what extent the spectra of sunlight, reflected by snowfields, reaches into the ultra-violet. To this end I took numerous photographs of the spectrum produced by this reflected light, the angle being 45°. The time of exposure varied from 1 second to 20 seconds, with a slit opening of 0·05 mm. The results showed that this spectrum of reflected sunlight reaches up to 295 $\mu\mu$. The tests were made between 10 and 12 o'clock a.m. at an altitude of 630 metres above the sea-level.

Comparing the results with those of Cornu, we must conclude that the ultra-violet rays are reflected by snowfields almost in their entirety, and hence the powerful action of this light cannot be called into question. It would therefore be advisable at all times, during a period of snow and sunshine, to protect the eyes from the injurious effects of these ultra-violet rays by using glasses which will not permit these rays to pass.

J. v. KOWALSKI.

Université de Fribourg, Institut de Physique,
March 20.

Assil Cotton.

A FORM of cotton has been produced, by selection in the field from superior growths of Mit Afifi, which is said to be a pure strain and similar to the Mit Afifi of twenty years ago. This form is known by the name of "Assil," meaning "of pure original strain."

In order to prevent any misconception occurring that by substituting "Assil" for the present impure Mit Afifi the introduction of a new variety is advocated, it is recommended that this form of cotton be for the present referred to as "Assil Afifi." G. C. DUDGEON.

(Director-General.)

Department of Agriculture, Cairo, March 21.

INSURANCE AGAINST RAIN.

A SCHEME of holiday insurance against rain has been put forward by the Excess Insurance Company, and has been described in considerable detail in *The Times* of March 21 and 22. It applies to the period from May 1 to September 30, at a series of sixty-three sea-coast towns on the south and east of England. It is stated that the daily readings of rain gauges at the towns in question (or in some cases where there is no local observer at a neighbouring town), will be supplied to the company by the town clerks, or "culled from the lists of the Meteorological Office." Four forms of policy are proposed, designated respectively Pluvius A, B, C, and D. Policy A provides for payment for each separate week in which there is rain on more than two days, amounting on each to more than 0·20 in., and the premium is to be one-eighth of the compensation to be paid per week. Policy B provides for payment for every day on which the rainfall exceeds 0·20 in., and the weekly premium is equal to one and a half times the compensation offered per day. Policy C provides for payment for the second and each additional rain-day in a week on which the rainfall exceeds 0·15 in., and the weekly premium is equal to the daily compensation, and Policy D provides for four days, payment being made for every day on which more than 0·20 in. falls, and the premium for the four days is equal to the compensation per day.

The interest of the proposition lies in the fact that the rain for which compensation is to be paid may fall entirely at night and not affect the enjoyment of the holiday at all, and as much compensation will be paid, so far as we can judge, for a thunder-shower of ten minutes' duration yielding just more than 0·20 in. as for a day of uninterrupted rain for twenty-four hours, yielding two or three inches. As there is no necessity laid on the assured to prove damage or even to go near the place where the rain is to be measured, it is apparent that a question may arise as to whether the transaction in certain cases is legitimate insurance or mere gambling. The assured and the company are bound by the terms of the policy to accept the readings of daily rainfall supplied from a specified rain gauge as binding, but no information is given in the articles from which we quote as to the limits of the rainfall day, *e.g.* whether it is to count from 9 a.m. to 9 a.m., as in ordinary records, or from 7 a.m. to 7 a.m., as at the daily reporting stations of the Meteorological Office. No indication is given as to how the records from those stations which read rainfall to three places of decimals are to be interpreted; for instance, one observer records 0·204, where another for the same quantity in the measuring glass records 0·20; the first records 0·206 where the other records 0·21; and when the first records 0·205 the second may read 0·20 or 0·21 with equal truth; but the alternative he chooses would decide the payment or non-payment of perhaps a considerable sum as compensation.

It must also be remembered, as Dr. H. R. Mill points out in *The Times* of March 23, that in summer the rainfall varies very greatly in a short distance, and unless the assured stays very near the rain gauge he may experience totally different weather from that which it records. Here, however, the chance is even of the rainfall being more or less than is recorded—in the one case he may be damaged without compensation, in the other he may be compensated without damage. Dr. Mill considers that there are no data yet elaborated on which a fair basis for an equitable and practicable scheme of insurances against rain risks can be framed.

THE LAND OF THE HITTITES.[1]

PROF. GARSTANG has written an able and informing book on recent archæological exploration and discoveries in Asia Minor. The book is written *à propos* of Prof. Garstang's recent discovery of a Hittite palace at Sakjegeuzi (Sakčegözü), in North Syria, south of the Taurus, near the palace-fortress of Sinjirli, excavated by the Germans some years ago. Prof. Garstang has also visited Boghaz Köi, the site of Khatti, the ancient Hittite capital (lately excavated by Dr. Winckler and Makridi Bey), and other Hittite sites and monuments. The result is the present work, which sums up all that is known on the subjects of the Hittites up to date.

FIG. 1.—Sakje-Geuzi: Royal Hunting Scene. From "The Land of the Hittites."

Naturally, much that Prof. Garstang says about the Hittite monuments is mere repetition of what has already been said by others, except in cases where he is able to add the results of his own personal investigations. And the initial "Chapter on Geography" is perhaps rather tedious. The valuable part of the work consists of chapters iv. and v., the descriptions of Boghaz Köi, Eyuk, Sinjirli, and Sakjegeuzi. Chapter vi. should, we think, have been combined with chapter iii., to form a continuous history of the Anatolian civilisation. The greater part of chapter vi., "the story of the Hittites," is based upon the Babylonian cuneiform tablets discovered by Winckler at Boghaz Köi, which have thrown so unexpected a light on the history of the Hittite kingdom from the time of Shubbiluliuma, the contemporary of the Egyptian Amenhetep III., to that of Arnuanta, who was a contemporary of Meneptah, a period of two centuries (1400–1200 B.C.). The story, as told by Prof. Garstang, is worth reading by those who are not acquainted with Dr. Winckler's original publication in the *Mitteilungen* of the German Orient Society. The tale of Shubbiluliuma's wars and the intrigues which gained his purposes even more effectually than his wars sounds like a bit of mediæval Italian history. He was at the bottom of the revolt which separated Palestine from Egypt when it was seen that the pacifist fanatic Akhenaten would never use force to keep his empire. Shubbiluliuma was a most unphilosophical person; Akhenaten was, we suppose, a philosopher; he had lovely ideas. The philosopher's reign caused unheard-of misery to descend upon his unhappy country, as usual, while the unphilosophical man of action got all he wanted, and, being armed, kept his own goods in peace. *Verb. sap.*

However, they were not always strong men in Khatti, and Arnuanta was probably the last of his race. Overthrown by a great folk-wandering from Europe, his kingdom was destroyed, and as a great empire disappears from history. The small States into which it broke up preserved their Hittite characteristics for some centuries later. The palaces of Sinjirli and Sakjegeuzi belong to this later period, and Assyrian influence is seen to be strong in their art. The buildings of Boghaz Köi and Eyuk, on the contrary, certainly belong to the great period of the kingdom, though they may not, as they stand, be as old as the time of Shubbiluliuma. In their art there is no trace whatever of Assyrian influence. Prof. Garstang's account of them, and of the results of the recent diggings, is very interesting.

The photographs with which the book is illustrated are very good, but are not always exactly appropriate. This is a pity. Prof. Garstang still hankers after exploded "Mongoloid" origins for the Hittites, and even prints photographs of Egyptian representations of them to prove his point (p. 318), which do not prove it at all; while to quote pigtails as a Mongolian trait is unscientific: Frederick the Great and George III. wore pigtails, but were not Mongols. Also, one cannot see anything "Proto-Greek" in the types shown in the companion photograph opposite the same page. What is "Proto-Greek"?

FIG. 2.—Dimerli: a fallen Lion. From "The Land of the Hittites."

Prof. Sayce's introduction is interesting in view of the fact that he and the late Dr. Wright were the pioneers of archæological theory in this field, based on Perrot's admirable description of the monuments. Prof. Sayce is now engaged on the congenial task of deciphering the Hittite hieroglyphics. Prof. Garstang tentatively accepts some of Prof. Sayce's inter-

[1] "The Land of the Hittites: an Account of Recent Explorations and Discoveries in Asia Minor, with Descriptions of the Hittite Monuments." By Prof. John Garstang. Pp. xxiv+415. (London: Constable and Co., 1910.) Price 12s. 9d. net.

pretations, but the historians mostly seem to prefer to wait yet awhile before adopting his system definitely.

We hope that Prof. Garstang will make further discoveries in the Hittite lands, and can wish him no better luck than that he may speedily render his present book obsolete and out of date. H. H.

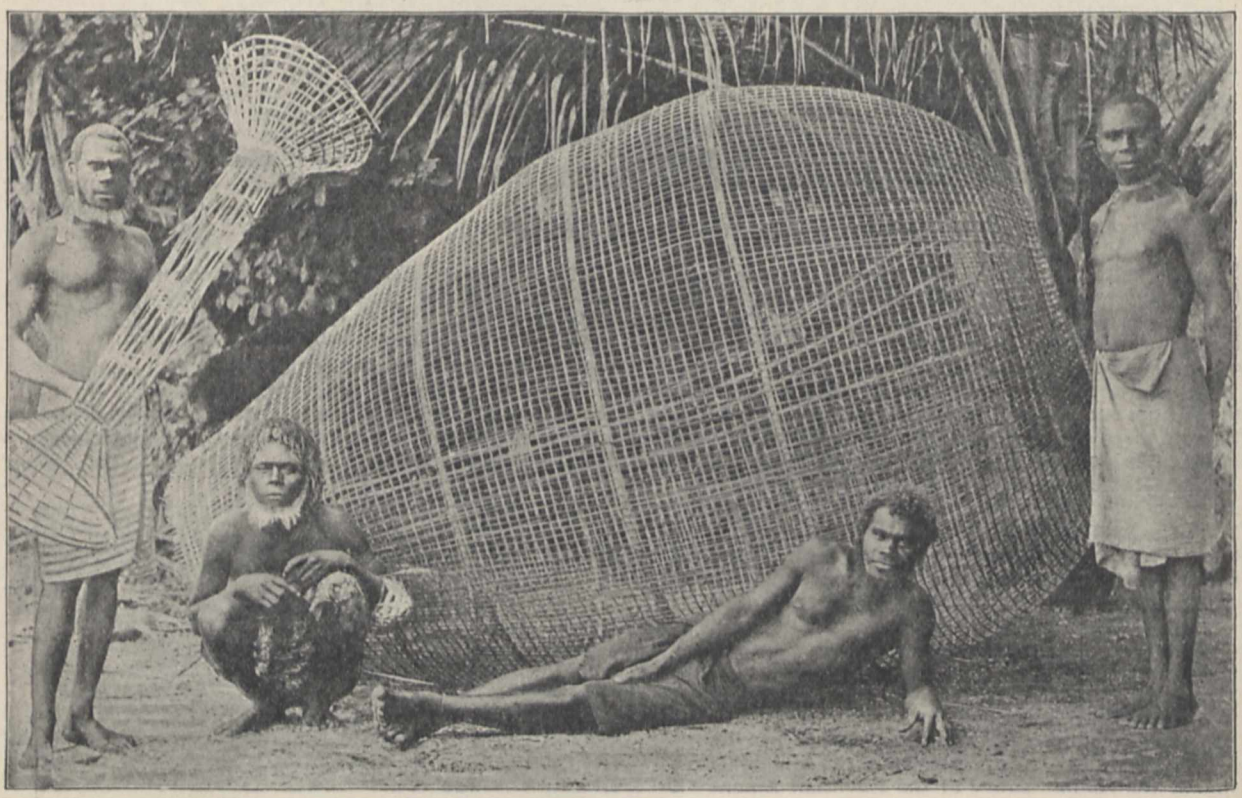
MELANESIANS AND POLYNESIANS.[1]

THE veteran missionary who writes this book lived for more than twenty years on the islands of the Pacific, at the time—a generation ago—when the peoples of the western Pacific were scarcely known, when

". . . Old and New
Weltered upon the border of the world."

Much of his time was spent in New Britain, more in Samoa, and the natives of these places are the people whom he means when he speaks of Melanesians and Polynesians. Dr. Brown has also visited the New Hebrides, Santa Cruz, New Ireland, New Hanover, New Guinea, and the atolls of Ontong, Java, and the Tasman group. In the introduction the author disclaims "pet theories"; nevertheless he gives us (pp. 15–17) the theory as to the origin of the Melanesian and Polynesian races, which he published in the *Journal* of the Anthropological Institute in 1887. Much water has flowed under the bridges since then, and it is at least a pity that Dr. Brown does not discuss (except briefly in the concluding chapter) some of the facts which do not support his views.

A certain looseness of terminology, most pronounced in the pages referred to, also crops up in other parts of the book. Considering especially the most valuable part of the book, that dealing with Melanesia, it is obvious that Dr. Brown has given us a record of what he himself saw or was told during the five years he spent in New Britain, but with the exception to be presently noted he has made no attempt to correlate his own observations with those of other observers, nor does he supplement them by considering the work of others, even when they deal with the very ceremonies he describes. Thus it comes about that the value of one of the most interesting chapters in the book, that dealing with secret societies, is lessened, for though it gives an account of the Duk-duk, no mention is made of Parkinson's work. On the other hand, Dr. Brown has not hesitated to avail himself of information given him by colleagues, or when necessary to seek their assistance. These remarks indicate the scope of the work and its limitations, which will be felt by few except specialists working at the history of the Pacific.



Fish Trap, New Britain. From "Melanesians and Polynesians."

A more detailed examination of the contents of the volume shows that it contains a large amount of new information, not only valuable in itself, but bearing also on work being done at the present time, or which must be done in the near future. There is an extremely interesting account by an eye-witness of the death and cremation of the celebrated Shortland chief Gorai, whose importance may be gauged by the fact recorded by Guppy, that the houses of his wives and children occupied more than an acre of ground.

Several interesting examples of the widely-spread Melanesian custom of burial, accompanied by the removal and preservation of the skull of the deceased, are recorded. On Duke of York Island the body of a chief or person of importance was exposed on a specially built platform until the head could be detached, when it was preserved by the

[1] "Melanesians and Polynesians," their Life-histories described and compared. By George Brown. Pp. xv+451. (London: Macmillan and Co., Ltd., 1910). Price 12s. net.

nearest relative, while the remains were buried in the house. On Ysabel (Solomon Islands) and also in Aneityum (New Hebrides) the body was buried in such a position that the head could be severed from the trunk, which was not itself exposed. At Ysabel the process was accelerated by lighting fires round the exposed head, from which the scorched flesh was easily peeled. At Aneityum female mourners watched the head until the soft tissues had decomposed. A special interest attaches to both these methods, since they contrast with the disposal of the dead by cremation practised in some of the western Solomons and New Ireland, while they agree in principle and in some degree in detail, with the methods of inhumation accompanied by the preservation of the skulls in vogue among the archipelagoes lying off the eastern extremity of New Guinea. These facts support a view held by the reviewer that the inhabitants of the Solomon Islands will be found to be divisible into two ethnic groups, the dividing line falling somewhere in the neighbourhood of the line of political division.

Dr. Brown mentions that on his early journeys in New Britain he was able to buy fowls of a small white breed in large numbers, and he suggests that these were indigenous. The interest of this observation is greatly increased by the fact that in many parts of eastern British New Guinea the natives maintain that thirty or forty years ago they possessed a breed of pure white fowls.

No praise could be too high for the plates with which this book is abundantly illustrated. One picture shows four men of the remote islet Lua Niua (Ontong Java), who speak a language "very closely related to the Samoan." So far as the writer knows this is the first adequate portrait to be published of these Polynesians, stranded long ago in Melanesia, who although they have retained their Polynesian features appear to have come into intimate contact with Melanesians since, as Dr. Brown informs us, they are divided into two exogamous classes. An alternate explanation favoured by Dr. Brown is that they are descended from a group of exogamous castaways from the Ellice group, who, it is assumed, were derived from Samoa at a time when that island was inhabited by a people having an exogamous clan organisation.

Two unfortunate slips occur in the description of the plates. The masks and figures shown in the upper figure facing p. 238 are from New Ireland (not from New Guinea), and the two masks facing p. 316, also attributed to New Guinea, certainly do not come from there. An insufficient index gives an inadequate idea of the real value of the book. C. G. S.

THE BUSINESS SIDE OF A UNIVERSITY.[1]

UP to the present time the development of the American university system has proceeded mainly by the multiplication of universities, and by increase in their endowments. The cost of university education has, however, steadily risen everywhere; and while it has been possible up till now to provide for expansion by increased contributions of funds from outside, it is clear that a limit exists to the possibilities of further increase. It follows that the question as to whether the efficiency of American universities can be increased by a better use of their existing resources is an important question which may become urgent in the future, even if it has not done so in the past.

Under the auspices of the Carnegie Foundation for the Advancement of Teaching, a report has been drawn up on "Academic and Industrial Efficiency." The author, Mr. Morris Llewellyn Cooke, claims to have studied the problem practically exclusively from the point of view of a business man, while freely admitting that there are other aspects of the question not dealt with in his report. In order to collect information, he visited eight universities and colleges, and in every case chose the department of physics for his inquiries, on the ground that the conditions prevailing in this department might be regarded as typical of those prevailing generally in the work of all departments. He notices a certain lack of intensiveness in the work of the colleges, and while admitting that a considerable amount of leisure is wanted for the teaching staff and those engaged in private research, points out that this affords no reason why janitors and gardeners should not carry on their duties out of lecture hours.

On the difficult question of administration, Mr. Cooke expresses fairly definite views. Three methods of administration are possible: firstly, "committee management"; secondly, what he calls the "military type," in which the whole of the direction falls on the shoulders of one man; and thirdly, what Mr. Cooke describes as "functional" management, in which the responsibility is divided amongst a number of individuals, each having complete authority over a limited range of duties. Observing that the system of government by committees does not prevail in the business world, the author objects to this system on the ground that it tends to produce lack of initiative, departmental autonomy, and lack of authority on the part of the heads of departments, especially in the matter of discipline when their decisions are liable to revision at the hands of a board or committee. The functional system is considered to be the best, though the author admits that the other systems are in many cases working well, and better than he would have expected.

Under the heading, "The College Teacher as a Producer," Mr. Cooke refers to the difficulty of increasing the efficiency of professors so long as their duties are so multifarious and varied as they are at present. He is quite astonished at the number of tasks they have to perform. Teaching, research, and administration alone form a group of duties, of which it is difficult for the same individual to combine more than two efficiently. But, in addition, it is becoming increasingly important for the professor to keep himself in touch with what is being done elsewhere, and this involves study of pedagogic methods as well as of the literature of his own subject. Moreover, the committee system, where it exists, makes increasing demands on his time. Yet Mr. Cooke finds professors spending time in taking inventories, keeping track of appropriations, mimeographing examination papers, and handling routine correspondence. "These things," he points out, "are clerical work, and should be handled outside of the teaching field, and not as a part of the teacher's duties." Further on he observes: "The high-priced presidents of our railways, banks, and steel companies would not dream of performing this variety of functions. They would refuse to do so, because they know they could not do them well. This part of raising the efficiency of the college professor will have to be done by building up central agencies for doing much of the work he does now, and for doing it so much better than he possibly can, that he will be glad to relinquish his responsibilities in these respects."

Passing on to the question of "research," the author directs attention to the danger which exists of sacrificing efficiency in other directions, especially in class-teaching, by attaching exaggerated importance to work of a research character. Mr. Cooke is here

[1] "Academic and Industrial Efficiency." A Report to the Carnegie Foundation for the Advancement of Teaching. By M. L. Cooke. Pp. vii+134. (New York City, 1910.)

opening up a question which it will be difficult to discuss adequately without raising controversies of a somewhat heated character, and it is clear that unless the subject be approached with the greatest caution by unprejudiced individuals, an inquiry may do harm instead of doing good. On one aspect of the question little difference of opinion will probably exist. Mr. Cooke directs attention to the case of a professor who felt that his ability lay in the direction of teaching, but who was more or less forced to undertake research owing to pressure from his colleagues. Another authority informed him that it was becoming increasingly difficult to discover profitable lines of research. To those whose main difficulty is to know what can be left uninvestigated and unpublished with the least sacrifice, these remarks must come as a surprise. They may suggest that facilities for research are not bringing relief in the quarters where it is most needed, and that there is something in Mr. Cooke's opinion that research ought to be subject to some kind of control or inspection. But would not such a system, if carried out under existing and not under ideal conditions, have the exactly opposite effect to that which Mr. Cooke desires? The difficulty is that nobody who is not engaged on a piece of original work or research can appreciate its significance and difficulty, and any attempt to assess such work from without would tend to the adoption of a standard of quantity rather than of quality; a premium would be placed on those investigations which were of the most superficial character. In this connection no analogy probably exists in business matters.

Tables are given showing, still for the department of physics, the relative cost and direct expense attributable to research and teaching. For the eight institutions under investigation, research absorbs on the average about one-third of the whole, but the author admits that physics is exceptional. Coming next to the question of economical use of buildings, attention is directed to the small number of hours in which each lecture-room is generally in use, and in this connection the earmarking of lecture-rooms for the exclusive use of one department is deprecated.

The next part of the report deals mainly with proposals for reorganising the administrative side of a college and for better control of its finances. Under the heading of "Functional Activities," the author suggests the establishment or reorganisation of the offices described under the following heads: Superintendent of grounds and buildings; interdepartmental janitor service; purchasing department; stores department; mail handling by a central office; bursar's department; disciplinarian; bureau of publicity; registrar; and bureau of inspection. Under the last heading it is suggested that perhaps the examination system may be found to exercise a useful function, and Mr. Cooke advocates the reintroduction of external examiners for the purpose. Under "Financial Administration" he advocates closer relations between the expenditure on different departments and their corresponding output of work. In a section headed "Physics Departmental Administration" he directs attention to the frequent expenditure of large sums on the purchase of apparatus which are only used for a limited period, and suggests that means should be devised whereby apparatus which have ceased to be useful in one particular college might be made available elsewhere. Under "Student Administration" he instances a few cases of slackness in respect of attendance; this is, of course, a matter that can be easily remedied from within. The rest of the report consists mainly of tables.

The author found everywhere the greatest willingness to cooperate with him in his inquiry, coupled by a keen desire to profit by any suggestions to which that inquiry might lead. No higher praise from a business man to a college professor could be given than his statement: "It would probably be impossible to find a group of men more willing to let one know the full measure of their ideals and of the work done than are the men of the universities." It is clear that if, and so far as, the American universities admit of reforms on the lines suggested, such reforms can and doubtless will be effected from within.

In an English review one is naturally somewhat concerned with the possible effects of Mr. Cooke's report on our own university system, and one cannot but feel a certain apprehension lest such a report falling into the hands of an outsider might be used as a tool for attempting to effect changes from without in a way which certainly would involve a very far-reaching temporary, if not permanent, waste of efficiency.

Now in most of our modern universities and colleges the supreme authority is vested in a council or board of governors consisting mainly of business men, and such a board possesses all the powers of inspection which Mr. Cooke desires to obtain in America. It also, in general, possesses the right of appointing and dismissing any member of the teaching staff, and the safeguards for securing that a professor shall only hold office as long as he continues to prove an efficient teacher are provided for to an extent which probably represents more than Mr. Cooke would consider desirable in his country. The teachers are often called on to furnish such boards with statements as to the progress of work in their departments, and may be called upon to reply to inquiries. In colleges receiving Treasury grants, further inspection on behalf of the Government is also contemplated, and detailed reports have to be furnished as to the work of the colleges and their departments. These reports include statements regarding research and the publication of original work. In regard to the keeping of students' records, different practices necessarily exist in different institutions, but this form of supervision is probably almost universal, and it is certain that in many instances we have got far more than Mr. Cooke would ask for in America.

In regard to the relative expenditure on teaching and research, it is certain that even in a department like physics we cannot furnish figures at all comparing with Mr. Cooke's. A not infrequent experience over here is to find teachers spending a not inconsiderable portion of their small salaries in the purchase of materials for researches conducted in the college laboratories. As regards the apportionment of grants in relation to the work of the departments, we here are usually in the position of having to make a little money go a long way, and the adoption of a standard based on numbers of students has certainly been carried beyond the limit conducive to the greatest efficiency. Last, but not least, there is probably not a college in this country which dispenses with the external examiner or the external examination.

The general conclusion is that the direction in which Mr. Cooke suggests reform tends rather towards assimilating the American university system to the system of most recent development in Great Britain. At the same time it does not necessarily follow that we ought to relax our efforts to move towards the existing American ideal. It may easily happen that the conditions for maximum efficiency are satisfied by some system which is intermediate between the two. While these remarks apply more particularly to such questions as inspection and relative importance of research, it cannot be denied that in the matter of general organisation much the same diversity prevails as Mr. Cooke finds in the United States. At

one centre the committee system is brought to bear on the most trivial details of domestic management; in another case a central authority practically decides even such matters as forfeiture of scholarships in cases of discipline. It may be that these divergences are the result of varying local conditions, but a study of them might well be extended to our universities.

Since the preceding notice was written, we have received a criticism of Mr. Cooke's report by President R. C. Maclaurin, of the Massachussets Institute of Technology, published in *Science*, xxxiii., 838, pp. 101–103 (January 20). Attention is particularly directed to the fact that most of the points raised in the report are not new. "It is full of commonplaces, and there is scarcely a question raised that has not been discussed *ad nauseam* by college professors and other officers. It is not lacking in confidence. One marvels at the temerity even of an 'efficiency engineer' who can lay down the law so definitely as to how to teach physics, how to conduct a recitation, how to carry on research, when most of us who have devoted our whole lives to such problems are far less confident." President Maclaurin specially condemns the "student-hour" standard of efficiency and the proposal for inspection of research, the futility of which has been pointed out above, and he instances his point by the following imaginary dialogue between Newton and the "superintendent of buildings and grounds, or other competent authority."

"*Superintendent:* Your theory of gravitation is hanging fire unduly. The director insists on a finished report, filed in his office, by 9 a.m. Monday next, typewritten, and the main points underlined. Also a careful estimate of the cost of the research per student-hour.

"*Newton:* But there is one difficulty that has been puzzling me for fourteen years, and I am not quite . . .

"*Superintendent* (with snap and vigour): Guess you had better overcome that difficulty by Monday morning or quit."

G. H. BRYAN.

THE MOTIONS OF THE PLANETS JUPITER AND SATURN.

THE January number of the *South African Journal of Science* contains an excellent paper by Mr. R. T. A. Innes on Le Verrier's theory of the motion of the planets Jupiter and Saturn. The title scarcely covers all that is in the paper, for the author concludes with numerical calculations, based upon formulæ developed by himself in the Monthly Notices for 1909, which must constitute a considerable step towards a revision of Le Verrier's theory.

Mr. Innes's chief criticism on Le Verrier is that he has taken 9·7367408 instead of 9·7365514 for the log ratio of the mean distances of Jupiter and Saturn, an error approximately of one part in two thousand.

The error is, however, considerably magnified when its effects upon the series representing the reciprocal of the distance between Jupiter and Saturn are considered, and the author's final conclusion is that the fourth significant figure always, and the third often, is incorrect in Le Verrier's perturbations. The error arose because Le Verrier used the mean distances corresponding in elliptic theory with the mean motions and neglected the systematic effects of the perturbations. Jupiter, for instance, on a distant planet like Neptune, may be approximately considered as coalescing with the sun, making that body heavier by one-thousandth part, and consequently the mean distance of Neptune greater by one part in three thousand.

The mean distance of Saturn needs correction by a greater fraction, nearly one part in two thousand; for when Jupiter is between Saturn and the sun, its attraction amounts to about four parts in a thousand of that of the sun, and the average is thus raised.

Le Verrier's omission is unimportant in all other cases. For the four inner planets the perturbations are so small that the third significant figure is insensible, and for Neptune and Uranus the increment due to Jupiter is practically the same and the ratio inappreciably altered.

We quote, for ready reference, a most valuable table :—

Planet	Log mean distance	
	Elliptic theory	Actual
Mercury ...	9·5878 2168	... 9·5878 2160
Venus ...	9·8593 3781	... 9 8593 3745
Earth ...	0·0000 0001	... 0·0000 0012
Mars ...	0·1828 9703	... 0·1828 9616
Jupiter ...	0·7162 3747	... 0·7162 3339
Saturn ...	0·9794 9655	... 0·9796 7915
Uranus ...	1·2829 0024	... 1·2830 9713
Neptune ...	1·4779 4661	... 1·4781 4316

Some *obiter dicta* in the paper are of great interest. Here is one :—

"So far as merely obtaining an ephemeris goes, it is probable that the method of special perturbations would have given one for 300 years or so with less labour than was involved in either the theories of Hill or Le Verrier."

This sets one thinking why we want the theories. Of course, we want the general results of theory, the first and foremost being that the mean distances are subject to no secular changes. And we want the outline of the theory of long-period inequalities with rough estimates of the numerical coefficients. But an ephemeris of Neptune could be obtained by special perturbations at 512-day intervals (using a power of 2); fifty intervals of 512 days each would cover the period from its discovery to the present day—a month's work.

It is beginning to be recognised that the "theory, good for ages, in which t alone has to be substituted," is incomplete. Le Verrier gave some results for the earth 100,000 years ago, based on his theory. If similar theories existed for the minor planets, we doubt, if we should see Eros falling within the orbit of Mars, the Trojan group being captured by Jupiter, and the zone corresponding to a mean motion double that of Jupiter being cleared of small planets. Possibly these phenomena are due to the secular effects of small causes not at present taken into account. We want, therefore, in the cheapest possible way, to multiply accurate ephemerides for comparison with observation.

THE ANTON DOHRN MEMORIAL FUND.

THE zoological station at Naples occupies a unique position among the biological institutions of the world. It is not only the oldest, the largest, and the best equipped of the biological stations, but it has maintained throughout its existence its thoroughly international character. The founder of this important institution, Dr. Anton Dohrn, died on September 26, 1909, and at the eighth International Zoological Congress, held at Graz during August, 1910, it was decided to raise a fund for an international memorial to commemorate his great achievement.

In case some doubt may be entertained as to the maintenance of the international character of the institution which is now under the management of Prof. Reinhard Dohrn, one of the sons of the distinguished founder, it may be remarked that Prof. von

Graff, the president of the congress, has ascertained that no guarantee has been given for the maintenance of the station by any Government or academy, and that, by the terms of an agreement with the city of Naples, no special rights can be obtained in it by any such body during the period of agreement. Prof. Reinhard Dohrn has assumed the entire responsibility of continuing the work of the station, with the provision that, in the event of his death, the responsibility shall pass to another member of the Dohrn family, and subject to the understanding that the station shall remain a completely international institution, in the benefits of which all countries have the right of participating.

The memorial is to take the form of a portrait in bas-relief, to be placed in the zoological station, and of a fund for promoting the efficiency of the station as an international institution for carrying on research in biology.

The amount collected will be reported in 1913 to the ninth International Congress, which will be asked to formulate the conditions under which the fund shall be handed over to the zoological station. The biologists resident in this country who had signified their sympathy with the proposal to establish the memorial fund, and whose names appear in the international list submitted to the Graz meeting, were invited to attend a meeting which was held in the Natural History Museum, Cromwell Road, S.W., on February 3. As a result of this meeting a number of zoologists, representing the principal centres of research in the British Islands, have been asked to form a sub-committee for the British Empire, in order to assist in the work of the international committee, and of this subcommittee Dr. Sidney F. Harmer, F.R.S., was appointed chairman.

Contributions varying in amount from 5*l.* 5*s.* to 10*s.* 6*d.* have already been paid or promised, and it is hoped that the result of the appeal for subscriptions which is being issued will show that Anton Dohrn's great achievement, the establishment and management of the Stazione Zoologica at Naples, is as fully appreciated here as it is in other parts of the world.

Additional subscriptions may be paid to Prof. S. J. Hickson, F.R.S., of the University of Manchester, who is acting as secretary and treasurer of the British subcommittee. Prof. Hickson will be glad to send a copy of the circular which has been issued to any subscriber whose name has been accidentally omitted in drawing up the list of addresses.

NOTES.

We are asked to state that the annual meeting of the British Science Guild, to be held on Friday, April 7, at the Mansion House, will be opened at 5.0 p.m. instead of 4.0 p.m., as previously announced. The speakers will be:—The Lord Mayor, Viscount Haldane, Sir William White, K.C.B., F.R.S., Sir Albert Spicer, Prof. J. Perry, F.R.S., Dr. R. T. Glazebrook, C.B., F.R.S., Prof. A. D. Waller, F.R.S., and Sir Philip Magnus, M.P.

The Bakerian lecture of the Royal Society will be delivered by the Hon. R. J. Strutt, F.R.S., on Thursday next, April 6, on the subject of "A Chemically Active Modification of Nitrogen produced by the Electric Discharge." The lecture will be illustrated by experiments.

At the anniversary meeting of the Royal Irish Academy on March 16 the following were elected honorary members in the section of science:—Hendrik Antoon Lorentz, Berlin; Max Planck, Berlin; Right Hon. Sir Henry Enfield Roscoe, London; and Charles Sprague Sargent, Cambridge, Mass., U.S.A.

The proposal to establish a museum for London comes at a moment when the subject is better understood than at any other time. Museum work has taken its place in educational requirements, and local history has been shown to be of supreme importance in the development of good citizenship. Of all localities, London is the outstanding city in Britain possessing a history of unique importance. The site of London has been occupied by man since Palæolithic times, through Neolithic times to the historic period when, as a Celtic stronghold, it first became the settlement of a community. As a Roman city, it possesses the finest remains of Roman antiquities in all Britain. Anglo-Saxon, Danish, and later periods are represented by fine series of objects. Remains of beautiful Tudor architecture have been excavated and preserved by the London County Council, which has also preserved and stored every object of interest discovered during its numerous works; the City Corporation has assiduously collected for many years objects discovered in the city, and there are many local collections of considerable interest, both public and private. All this means that there exists already the materials for a London museum from prehistoric to modern times, and it is matter for intense gratification that Mr. Harcourt, when First Commissioner of Works, should have set his hand to this great project and should have carried it through with the aid of a munificent private benefactor. That London should have its own museum of material history as well as its published records is all to the good, though it is late in the day. It is fortunate that the delay in the accomplishment is accompanied by a goodly storehouse of objects awaiting exhibition in a properly organised museum.

Lord Curzon of Kedleston has consented to allow himself to be nominated by the council of the Royal Geographical Society as president of the society in succession to Major Leonard Darwin, who will retire at the anniversary meeting on May 22, after occupying the presidential chair for three years. The annual dinner of the society will be held this year in the Great Hall of the Hotel Cecil on May 26.

A Reuter message from Paris on March 25 states that M. Sommer, the aviator, has made a flight at Mouzon in a biplane with twelve passengers on board, the total weight being 1439 lb.

By direction of the London County Council, a tablet has been affixed to No. 32 Soho Square (the National Hospital for Diseases of the Heart), where for many years lived Sir Joseph Banks, who for forty-one years—from 1778 to 1820—was president of the Royal Society.

The meetings of the Institution of Naval Architects will be held at the Royal Society of Arts on April 5–7. In consequence of the death of the late president of the institution, Earl Cawdor, the annual dinner will not be held this year. On April 5 the presentation of the institution premium to Mr. T. B. Abell will be made.

A brass tablet to the memory of the late Mr. Cox has been placed in the Hackney Town Hall. The tablet, which was provided by residents in Hackney, bears the words:—"In honour of Harry William Charles Cox, consulting electrician, who died at Hackney July 9, 1910. He contracted a malignant disease while perfecting apparatus for adapting the X-rays to the relief of human suffering."

The Bessemer gold medal of the Iron and Steel Institute will this year be awarded to Prof. Henri Le Chatelier, the eminent French metallurgist, in recognition of his

great services in the advancement of metallurgical science. The presentation will be made by the Duke of Devonshire, president of the institute, at the annual general meeting to be held in London in May. The Andrew Carnegie gold medal for 1910 will also be awarded at the same meeting, the recipient being M. Felix Robin, Paris.

THE death is announced of Prof. Kekule von Stradonitz, the Berlin archæologist. He was born at Darmstadt in 1839, and took his degree at Berlin in 1861. He then travelled for several years in the Mediterranean, studying Greek and Greco-Roman antiquities. In some monographs on the Theseion in Athens, and on one of the groups in the Villa Ludovisi, he first developed his methods of research. Early in the 'seventies of last century he was appointed to a professorship at Bonn University, and while here he published two important works, one on Tanagra figures and the other on ancient terra-cottas. In 1887 he was appointed director of the sculptures in the Royal Museums, and later to the professorship of classical archæology, and he held both posts until his death.

A PAPER was read before the Society of Antiquaries on March 23 by Messrs. H. E. Balch and D. R. Troup on the exploration of a late Celtic and Romano-British cave-dwelling at Wookey Hole, Somerset. This is close to the Hyæna Den, explored by Prof. Boyd Dawkins fifty years ago. Beneath a small accumulation of surface material was the Roman deposit, containing coins ranging from Vespasian to Valentinian II. Below this, relics of the domestic life of the cave-dwellers were unearthed—a silver earring with the left frontal bone of a girl, and a large series of iron articles. Charred grain and pulse, together with burnt acorns, throw light upon the limited agriculture of the period. The human remains present a problem, and it is practically certain that the persistent occurrence of these along with waste food-bones indicates cannibalism. The excavations are in progress, and will, it may be hoped, throw further light upon these interesting discoveries.

NATURALISTS throughout the world have an opportunity of showing their appreciation of the labours, and regard for the personality, of the late Dr. Anton Dohrn, by contributing to the international memorial fund referred to elsewhere in this issue. It is proposed to place a portrait of Dohrn in bas relief in the Zoological Station which he founded at Naples, and to establish a fund which will ensure the continued efficiency of the station as an international laboratory of biological research. No memorial to Dohrn could have more worthy or appropriate objects, and we hope that naturalists in the British Empire will give a ready and generous response to the subcommittee's appeal for contributions to it. Subscriptions may be sent to Prof. S. J. Hickson, F.R.S., University of Manchester.

THE report of the advisory committee for the Tropical Diseases Research Fund for 1910 has recently been issued, and contains matter of considerable interest. The fund administered in 1910 amounted to 3245*l.*, and is derived from contributions by the Imperial Government, the Government of India, and various Dominion and Colonial Governments, and is expended on grants to the London and Liverpool Schools of Tropical Medicine, and the Universities of London and Cambridge. Reports are included on the work being done and on the manner in which the grants have been expended. Dr. Wenyon records observations on a malady, "Oriental sore," in Bagdad, and some evidence is adduced that the disease is conveyed by a mosquito, a Stegomyia, sp. Dr. Castellani, of Colombo, records cases of bronchitis in Ceylon caused by an Oidium fungus.

THE seventh International Congress against Tuberculosis is to be held in Rome on September 24–30 next. The English section is being organised by the National Association for the Prevention of Consumption and other Forms of Tuberculosis, 20 Hanover Square, W. All the universities and principal towns in the United Kingdom have been invited to send delegates. An executive committee has been formed for the purpose of arousing interest in the congress in this country, and for collecting suitable material in connection with the subject. Dr. J. J. Perkins will act as honorary secretary of this committee. A representative national committee has also been formed, and many distinguished persons have joined it. The congress next September will be divided into three principal sections to deal with the following subjects:—(*a*) etiology and epidemiology of tuberculosis; (*b*) pathology and therapeutics (medical and surgical) of tuberculosis; (*c*) social defence against tuberculosis.

THE sixty-fourth annual meeting of the Palæontographical Society was held in the Geological Society's rooms at Burlington House on March 24, Dr. Henry Woodward, F.R.S., president, in the chair. The annual report referred to the approaching completion of the monographs of Carboniferous Palæoniscid Fishes, English Chalk Fishes, Cretaceous Lamellibranchs, and British Graptolites. The volume for the year included not only instalments of these works, but also a small, complete monograph of British Carboniferous Arachnida, by Mr. R. I. Pocock. Small monographs of special groups of fossils appeared to be acceptable to the members. The Carnegie Trust for the Universities of Scotland had given to the society the plates illustrating the Carboniferous Palæoniscidæ described by Dr. Traquair. Mr. H. Dewey, Mr. Upfield Green, Dr. A. W. Rowe, and Dr. A. Strahan were elected new members of council. Dr. Henry Woodward was re-elected president, and Dr. G. J. Hinde and Dr. A. S. Woodward were re-elected treasurer and secretary respectively.

WE have received a copy of the third edition of the little book on the Brent Valley Bird Sanctuary, by Mr. Wilfred Mark Webb, the chairman of the Sanctuary Committee and honorary secretary of the Selborne Society. It contains a very fully illustrated account of what has been done in an enclosure of nineteen acres which comes into the London postal district, and those who wish to induce the feathered visitors to their gardens to stay and nest as the spring comes on may obtain from it a number of hints. The price of the book is 7*d.* post free (or in paper boards 1*s.* 1*d.*), and it can be obtained from the secretary of the Selborne Society at 42 Bloomsbury Square. The whole of the sixpence or shilling received goes towards the upkeep of the sanctuary.

MR. T. SHEPPARD, curator of the Hull Museum, in his last quarterly report announces the discovery of a series of Neolithic workshops near Bridlington, the scene of the fabrications of the notorious "Flint Jack," which were suggested by the importance of earlier discoveries in this neighbourhood. The material used by these prehistoric craftsmen was chiefly the black flint found in boulders occurring in the glacial clays and gravels ultimately derived from the bed of the North Sea or from its eastern coasts. Mr. Sheppard has now found a vast number of cores, spoilt flakes or "wasters," and flint-knives under the Bridlington cliffs. One worker seems to have made

a speciality of the pink flints, and some specimens resembling the "pygmy" type have been recognised. The finds now announced include oval or pear-shaped scrapers, a second type possibly used for straightening arrow and spear shafts, and a curved implement, which is believed to have been used as a sickle. These implements are now ready for examination by archæologists in the Hull Museum.

In vol. ii., part iii., of Records of the Albany Museum, Mr. J. Hewitt gives a descriptive account of the South African Batrachia, with supplemental notes on the distribution of the various species.

The American Naturalist for March contains two articles on the "genotype" theory of heredity, the one, by Prof. W. Johannsen, dealing with the conception as a whole, while the second, by Prof. E. M. East, treats the hypothesis in connection with hybridisation. After stating that the genotype theory may prove insufficient, or even erroneous, the former author observes that heredity may be defined as the presence of identical genes in ancestors and descendants, or, as Mageen says, in full accordance with this definition:—"The word heredity stands for those properties of the germ-cells that find their expression in the developing and developed organism."

To the *Verhandlungen schweiz. naturfor. Gesellschaft* for 1910 Dr. F. Sarasin contributes a note on the fauna of the Galapagos Islands, in which particular attention is directed to the flightless cormorant, *Nannopterum harrisi*, and the penguin, *Spheniscus mendiculus*; the latter, which is by far the most northern member of its kind, being regarded as a relict of a former extension of the southern ice. The author supports Baur's view as to the continental origin of the Galapagos group, and suggests that its union with the mainland lasted until North and South America were themselves connected by land, but at a period when there was a temporary sundering by means of an arm of the sea, thereby permitting the influx into the Galapagos area of forms from the Carribean coast and the Antilles.

To Mr. J. D. Hamlyn, the well-known animal importer, we are indebted for a copy of a circular containing reference to additional reports in regard to the African "water-elephant." When in French Congo, in 1905, Mr. Hamlyn came across a Panguin hunter who gave an account of a large water-animal inhabiting a lake in the Fernan Faz (Fernand Vaz) district, unvisited by any white man, and not far distant from the coast. It was described as intermediate in size between a hippopotamus and an elephant, with a thick, hairy hide, but no tusks. These animals spend most of their time in the water, and can stay beneath the surface for considerable periods; they are dangerous to approach, and are never hunted by the natives. It may be added that rumours are current of an apparently similar animal inhabiting lakes in northern Rhodesia, and known to Europeans as "water-rhinoceroses," and that in the first edition of the "Encyclopædia of Sport" Colonel F. T. Pollok, in the article Tapir, stated that he had actually seen one or two of these animals below the Congo, and referred to mention of them in 1894 by Captain H. Bailey in "Travel and Adventures in the Congo Free State."

To the *Verhandlungen schweiz. naturfor. Gesellschaft* for 1910, vol. i., Dr. H. Stehlin contributes observations on the evolution and dental development of various ungulates from the lower Tertiary *Bohnerz* of Switzerland. As we proceed from the lower to the higher stages of this formation, a progressive increase in the size of the different species of various groups, accompanied by an increasing dental specialisation, is very noticeable. *Dichodon ruetimeyeri*, for instance, passes, as regards size, through *cartieri* into *subtilis*, with a gradual increase in the length of the crowns of the first three premolars, and the conversion of the fourth of that series from a triangular into a quadricolumnar tooth; and a progression in the matter of general size and the complexity of the fourth upper premolar is observed in species of the genera Lophiotherium and Palæotherium. In the concluding portion of the paper the author points out that there is evidence of free communication between the Old World and North America during the early Eocene, after which there was a sundering of the two continents, while union was once more resumed in the Oligocene. Africa during the Eocene seems to have had no direct communication with Europe, the relationship between the European early Tertiary lemuroids and the modern lemurs of Africa being capable of explanation by means of a land-connection by way of Asia.

The February number of *The Quarterly Journal of Microscopical Science* (vol. lvi., part ii.) consists chiefly of a long memoir, by Prof. F. H. Edgeworth, on the morphology of the cranial muscles in some vertebrates. In this paper Prof. Edgeworth discusses the very difficult and intricate problem of the segmentation of the vertebrate head. He points out that the probable phylogenetic relationships of the various vertebrate groups are determined by the total morphological evidence available, and that the cranial muscles form one item only of such evidence. The interpretation of this evidence is, moreover, rendered very difficult by secondary modifications which have arisen during phylogeny, such as secondary innervation, convergent evolution and degeneration, and in arriving at any conclusion it is necessary to take into account the development as well as the adult structure. The conclusion at which the author actually arrives is that the morphology of the cranial muscles is in favour of an amphibian ancestry of mammals. This result, however, is only reached by considering the sauropsidan features of the cranial muscles as secondary phenomena, and it appears to us that it can hardly be reconciled with the evidence derived from other embryological characters, and, above all, from the geological record.

In describing a collection of Tertiary insects from the lacustrine deposits of British Columbia, in the second volume of Contributions to Canadian Palæontology, Mr. Anton Handlirsch directs attention to the prevalence of certain groups of flies, especially those of the bibionid section, which appear to have formed the chief element in the insect fauna. These are represented exclusively by the genus Penthetria, which at the present day includes, throughout the world, scarcely more species than those in the collection forming the subject of the paper. While the number of fossil Canadian species is estimated at about thirty-five, the existing forms of Penthetria are thirty-six, the allied genus Bibio including ninety-five. "The occurrence of so disproportionately large a number of penthetrias in the Tertiary of British Columbia contemporaneously with the absence of Bibio indicates that the beds in question belong to the early Tertiary, and are at least Oligocene in age. The supposition is obvious that the genus Bibio originated in the East, probably in Europe, and later found its way into North America." It is added that the occurrence of Penthetria and certain other genera indicates that British Columbia enjoyed a warm climate in the Oligocene.

SOME interesting abnormalities in the flowers of Œnothera are recorded by Dr. R. R. Gates in the twentieth report of the Missouri Botanical Garden. The transformation of the sepals into green leaf-like organs, known as virescence or frondescence, and general modification of the floral organs, appeared in several species, notably in *Œnothera multiflora*. Polymery, or an increase in the number of parts, was manifested in certain hybrids of *O. Lamarckiana*; a curious feature was the occurrence of trimerous flowers side by side with a tetramerous and a heptamerous flower. In some cases there were evident signs of coalescence of two flowers, or synanthy.

NATURAL cross-fertilisation among plants in India forms the subject of the latest botanical issue (vol. iii., No. 6) of the Memoirs of the Department of Agriculture in India, compiled by Mr. and Mrs. A. Howard and Mr. A. Rahman Khan. It is noted that natural crossing among wheat plants, which is very rare in England, but is somewhat more frequent in the drier climates of Europe and North America, becomes more common under the much drier conditions prevailing at Lyallpur. The conclusion follows that wheat breeding in the canal colonies of the Punjab will necessitate the exercise of special precautions. Among the various observations recorded as examples of variation due to natural crossing are colour variations in *Lathyrus sativus*, change of form in tobacco plants, and petal modifications in the opium poppy.

ABOUT four years ago a first catalogue of fifteen pieces of apparatus designed by Prof. W. F. Ganong to serve as instruments for precise measurements in vegetable physiology was issued by the Bausch and Lomb Optical Co., Thavies Inn, Holborn Circus. Those instruments included demonstration clinostat, portable clamp stand, normal light screen, respirometer, leaf-clasp, and bell-jar support. A short supplement to the former catalogue has recently been published, in which new instruments in the form of two space markers and a demonstration auxograph are described. The more useful space marker for root-growth measurements consists essentially of a wheel fitted with a ribbed rubber rim, the ribs being spaced 2 mm. apart. The auxograph is a continuous recording instrument, in which the adjustment of the connection between the growing organ of the plant and the recording pen and other details are carefully devised.

THE survey of the Philippine Islands has advanced steadily since it was undertaken by the Coast and Geodetic Survey of the United States ten years ago. A considerable length of coast-line has been accurately located by triangulation, and a belt of country along it has been surveyed topographically. The hydrographic survey of the waters between the numerous islands has also been vigorously pushed on, 120 charts having already appeared. A map showing the present state of the work appears in the January number of *The National Geographic Magazine*.

THE first number of the Technical Review of the Venezuelan Ministry of Public Works mainly consists of official decrees and regulations, but a small amount of information relating to the country appears in the form of communications from commissions entrusted with exploration of eastern and western Venezuela. The geographical positions of sixteen places in the district of Lara were astronomically determined, and a few notes on the geology and meteorology are added. Similar data are furnished from the country to the southward, and the meteorological observations taken at the Observatory of Cajigal in 1908 are included.

A SUMMARY of the state of the ice in the Arctic sea during the summer of 1910 has been published by the Danish Meteorological Institute. The White Sea was open early, and in the Barentz Sea also the winter ice broke up in May, though the polar ice remained dense. Round Spitsbergen conditions were severe, but in the Greenland Sea, on the other hand, they were normal, and the coasts of Iceland were almost free from ice, though in April and May it was not far from the north-west of the island. The opinion is expressed that there will probably be much ice this spring in the Barentz Sea and to the south of Spitsbergen, while normal conditions are anticipated in Davis Strait, Baffins Bay, and to the east of Newfoundland.

MR. H. J. MACKINDER, M.P., lectured on Monday, March 27, before the Royal Geographical Society on the subject of "The New Geography, its Aims and Methods," wherein he reviewed the present outlook of the geographer in this country and compared it with that of four-and-twenty years ago, when he last discussed the scope of geography before the society. After stating that the geographer in his maps sees the earth's surface and its form, that he studies its history, and appreciates the influence of this upon man, his distribution, development, and history, the lecturer went on to demonstrate that with such an outlook geography became an independent subject of study, teaching, and research. By means of a few selected instances the influence of the physical character of a district on its human history was shown, and the ineffectiveness of historical study without a clear perception of the physical controls was insisted upon. Education on such comprehensive lines may be trusted to give a width of outlook and a power of visualising the relations of a number of factors which must give added power in any branch of knowledge. Research can find ample scope in investigating the effect of the relations between the various physical and human factors, thus furnishing a firm basis for the generalisations of the geographer; and for those whose interest is directed to special branches of the subject, the critical examination of problems arising in them affords opportunities for every geographer so long as he bears in mind its relation to the subject as a whole, and would not restrict the subject to the limits of that portion in which his interest lies.

THE Transactions of the Geological Society of South Africa include (vol. xiii., 1910, pp. 65–92, Plates ii.–ix.) an interesting paper, by Mr. C. B. Horwood, on the carbon found in the banket of the Rand. Mr. Horwood holds that there is some close connection between the presence of the carbon and that of the gold. He holds that the carbon has been deposited, at least in its present position, by secondary action, and that the carbon was probably introduced as a hydrocarbon. He quotes, with apparent approval, Mr. Coste's view that petroleum has a solfataric volcanic origin. Mr. Horwood holds that the carbon at the Rietfontein Mine is usually an indication of the presence of visible gold, and that "where carbon is present good gold values may confidently be expected." According to his account, it appears that it is only occasionally that carbon can be detected in the pay-reefs, and that it is only on the Rietfontein and the Randfontein Mines on the Rand that sufficient carbon occurs to be a characteristic feature of the banket. Carbon is apparently most abundant in the abandoned Buffelsdoorn Mine, which, however, is at Klerksdorp, and not on the Rand. Mr. Horwood's valuable analyses throw doubt on his view that the carbon has been the precipitant of the gold owing to

the very sparse occurrence of the carbon and the lack of agreement between the amounts of carbon and gold. Thus, according to Mr. Horwood's table of analyses of samples from the West Reef dyke of the North Randfontein Mine (Appendix D, p. 92), one of the three specimens containing the highest percentages of carbon had the smallest weighable quantity of gold, and of the two specimens with the highest percentage of gold one had only a trace of carbon, and the other was one of the lowest in carbon in the whole series. Mr. Horwood bears fresh testimony to the fact that throughout the Rand good values are almost invariably found when pebbles of a pinkish-brown quartzite occur in the banket.

To the *Sitzungsberichte* of the Vienna Academy of Sciences (July, 1910), Dr. W. Schmidt contributes a lengthy investigation on thunderstorms and squalls, rapid rises of barometric pressure. The work is divided into two parts:—(1) the observations and results of sixteen months' records of the variometer at the Central Meteorological Office at Vienna, especially with reference to the cases of rapid rises mostly caused by squalls, &c.; (2) experimental investigations of the incursion of heavier (colder), under lighter (warmer) air, and its effect on the formation of the squalls. The latter subject constitutes the essential part of the whole investigation, and this inflowing of the cold air, the author states, never takes place in the form of a simple wedge, but the front portion has the shape of an uplifted head (illustrated in the diagrams). "This head, with the currents that it causes, is the core of the squalls and thunderstorms. In these we cannot therefore speak of an actual whirl with horizontal axis." He considers that another theory must be substituted for the old one, which would explain all the phenomena in squalls essentially by the motions which, under the influence of gravity, must take place from the juxtaposition of two layers of air at different temperature.

THE *Zeitschrift für den physikalischen und chemischen Unterricht* issues from time to time special parts dealing with the method of teaching and the philosophy of science. In a part of 120 pages, which has recently appeared, Dr. H. Lüdtke, of the Modern High School (Real-Gymnasium), Altona, gives details of a course on electrical oscillations and the electromagnetic theory of light suitable for the older pupils in modern high schools. It includes construction of a Tesla transformer, experiments to show the repulsion of a metal disc and other mechanical actions of the currents obtained, together with their thermal, optical, chemical, and physiological effects. The portions of the theory of alternating currents necessary for the study of the theory of light are then introduced, and are followed by experiments on electrical oscillations, their interference, diffraction, and polarisation. The course is well thought out, both theoretically and experimentally, and will commend itself to those high-school teachers in this country who have the time and apparatus necessary for the preparation of a course on the subject, and the pupils capable of benefiting from such a course.

A SMALL portable photometer, known as the "Holophane Lumeter," for determining the luminosity of surfaces, has been constructed by Messrs. R. and J. Beck. It measures 8½ by 2¾ by 2¾ inches, and is divided into two chambers, the first of which contains a small electric lamp run from two storage cells. The light from this chamber, the walls of which are painted white, passes through a small opening into the second chamber, which contains the circular photometer screen. The matt-white surface of the screen is viewed through an eye-piece inserted obliquely into the side of the chamber. The surface the luminosity of which is to be determined is seen through an opening in the centre of the screen, and a corresponding one in the end of the chamber. Two sectors, one notched, the other plain, can be moved over the aperture between the two chambers until the brightness of the outer part of the photometer screen is equal to that of the central part. The luminosity of the surface viewed is read on two scales outside the box, over which two pointers connected with the sectors move. One scale reads up to 0·1 and the other to 1·0 candle foot. By means of dark glass screens interposed in the path of the light coming from the surface tested, the readings may be extended up to 100 candle feet. The instrument is standardised by being made to read 1·0 when directed to a white surface 1 foot away from a standard candle.

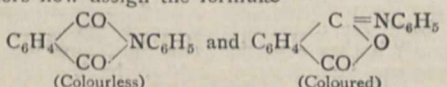
MESSRS. NEWTON AND CO., 3 Fleet Street, have just issued a new price-list of X-ray, high-frequency, and electro-medical apparatus. The X-ray apparatus shows evidence of development in several directions. The "Snook" apparatus consists essentially of a step-up transformer immersed in a tank of oil. The primary receives alternating current from a dynamo, which is worked from the electric supply mains. A simple mechanical high-tension commutator is placed in the secondary circuit, and renders the secondary charge unidirectional. The axis of the commutator is continuous with the axis of the dynamo, and thus perfect synchronism must necessarily result. From a convenient switch table the secondary discharge can be regulated from a very small to a very large one. The introduction of this apparatus has led to modifications and improvements in all other forms of generating apparatus; coils have been constructed with a large amount of metal in the core, and a comparatively thickly wound secondary, so as to be capable of giving large discharges comparable with those obtained from the secondary of the "Snook." Mechanical and electrolytic interrupters have also been developed and enlarged in such a way as to enable large primary currents to pass through them.

No marked development has taken place in X-ray tubes in recent years, but there are several on the market now which are able to stand a heavy secondary discharge, and thus enable skiagrams of the thicker parts of the body to be taken with very short exposures. The accessory apparatus described in Messrs. Newton and Co.'s list referred to above includes certain devices for the protection of the operator. One of these is a lead-lined cabinet in which the observer and one or two others can incarcerate themselves while the X-ray tube is in action. The switchboard is placed in the cabinet. A cabinet of this sort was introduced some years ago by Dr. Albers-Schönberg, of Hamburg. Its utility is confined to cases in which X-ray treatment is to be given, or an X-ray photograph is to be taken, though it is obviously of no use for fluorescent-screen observation, a most important part of diagnostic X-ray work. For protecting the operator during fluorescent-screen operations, Dr. Jordan's adjustable lead-lined screen is illustrated, and also the revolving saddle upon which the patient is seated during the use of this lead-lined screen. Several old patterns of tube stand are still figured in which the X-ray tube is not enclosed in a protective shield or box. Thus on p. 69 two naked X-ray tubes are shown supported by a single jointed clamp. No X-ray tube should ever be used in this unprotected state at the present day, and it would have been better to have omitted such stands from the price-list, as they are a source of danger to those who use them.

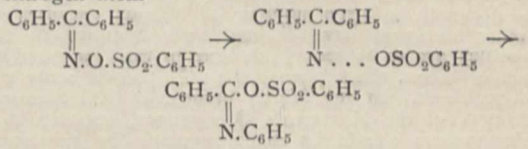
UNDER the title "Chemische Weltliteratur," Dr. Wilhelm Ostwald communicates an article to the current number of the *Zeitschrift für physikalische Chemie* which raises a question of very general interest. He points out that the convention under which all scientific publications are published in one of the three "great" languages (English, French, or German) shows signs of breaking down. Partly through an increased sense of nationality, partly through the difficulty of writing freely in a foreign tongue, numerous valuable publications are now published in Italian, Spanish, Russian, Polish, and other languages. This tendency renders it difficult, if not impossible, for a worker in any given branch of science to learn what has already been done in his own subject. Dr. Ostwald then discusses the possibility of an agreement on an international speech for scientific publications. Owing to the large number of new conceptions and terms, the use of Latin for this purpose is no longer possible, and *Ido*, an improved and developed Esperanto, is suggested as a solution. A general outline of this artificial language is given, and a nomenclature especially adapted to chemistry is sketched out. The subject is one which might well receive attention at international scientific congresses, and if it were possible to arrive at a general agreement, even in one or two isolated sciences only, a real step in the diffusion of science would be made.

WE have received from the publishers, Gebrüder Borntraeger, of Berlin, the first number of a new magazine entitled *Internationale Zeitschrift für Metallographie*. Although published in Berlin and edited by Dr. Guertler in that city, the new journal aims at an international character, and the list of collaborators includes the names of the leading workers in metallography in this country, as well as in Germany, America, Sweden, and Italy. The journal is intended for the publication of papers in German, English, or French dealing with the whole range of metals and alloys, each paper being accompanied by a brief abstract in all three languages. If the new journal can secure the necessary contributions in such a way as to avoid the wide scattering of metallographic papers which now occurs, it will prove extremely useful. It is, however, recognised that British authors who are accustomed to present their work to scientific or technical societies will not be able to abandon these in favour of the magazine; such papers are therefore either to be reprinted in full or to be fully abstracted. The present number of the journal contains introductory matter by the editor, and two papers of some interest, one by Profs. Heyn and Bauer (Berlin) on internal stresses in cold-wrought metal, and the other by Prof. Mathewson (U.S.A.) on sodium-silver alloys. The experiment of establishing an international journal of this kind is an interesting one; if successful, it may lead to similar developments in other branches of science.

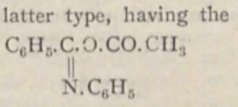
A RECENT issue of the Memoirs of the College of Science and Engineering, Kyoto Imperial University, contains two interesting papers on isomerism of different types. In the first paper, by Prof. Kuhara and Mr. Komatsu, on isomeric phenylphthalimides and some allied compounds, the authors describe a number of pairs of isomeric derivatives of phthalimide. The parent substance is only known in one form, but phenylphthalimide has been obtained in colourless needles melting at 83°–84°, and in yellow rhombic crystals melting at 125°–126°. To these the authors now assign the formulæ



Similar formulæ are assigned to the colourless and yellow isomeric compounds prepared by the interaction of phthalyl chloride with six substituted anilines, and also to the colourless and yellow *p*-methoxy- and *p*-ethoxy-phenylphthalimides prepared some years ago by Piutti and Abati. The isomeric compounds yield identical derivatives when acted upon by the Grignard agent. The second paper, by Prof. Kuhara and Mr. Todo, deals with the Beckmann rearrangement. The authors conclude that the interchange of radicles which takes place, *e.g.*, by the action of benzenesulphonic chloride on benzophenone-oxime is due to the dissociation of an acid radicle from the nitrogen atom



A compound of the latter type, having the formula



has actually been prepared as an unstable yellow oil, and has been shown to pass over at once into benzanilide when acted on by hydrochloric acid.

THE new edition—the third—of Prof. Karl Pearson's "Grammar of Science" is to be issued by Messrs. A. and C. Black in two volumes, the expansion of the text having rendered it too large for one volume. There will be an entirely new chapter dealing with birth-rates, race suicide, and degeneracy. The first volume will be published immediately, and the second volume in the autumn of this year.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR APRIL:—

April 1. 5h. 45m. Venus in conjunction with the Moon (Venus 0° 14′ N.).
9. 7h. Neptune at quadrature to the Sun.
14. 15h. Mercury at greatest elongation east of the Sun (19° 42′ E.).
14. 17h. 6m. Jupiter in conjunction with the Moon (Jupiter 1° 41′ N.).
19. 23h. Uranus at quadrature.
23. 13h. 11m. Mars in conjunction with the Moon (Mars 3° 45′ N.).
24. 20h. Mercury stationary.
28. 10h. 16m. Sun eclipsed, invisible at Greenwich.
28. 14h. 46m. Saturn in conjunction with the Moon (Saturn 2° 17′ S.).
29. 10h. Venus in perihelion.
30. 16h. Jupiter at opposition to the Sun.
30. 18h. Saturn in conjunction with the Sun.

OBSERVATIONS OF THE ZODIACAL LIGHT.—Some interesting observations, illustrated by sketches, of the Zodiacal Light are recorded by Herr Hoffmeister in No. 4484 of the *Astronomische Nachrichten*. The observations were made at Sonneberg, Thüringen, during February and March, 1910, when, it will be remembered, the light was particularly visible during the apparition of comet 1910*a*, which is shown on one of Herr Hoffmeister's sketches (February 3). On this date, at 7h. 10m. (M.E.T.), the summit of the brightest portion of the Light was at $\alpha = 17°$, $\delta = +10°$, and on March 5, at 8h. (M.E.T.), it lay in the position $\alpha = 33{\cdot}5°$, $\delta = +15{\cdot}5°$; Herr Hoffmeister also gives the positions of a number of points marking the northern and southern limits. To provide a scale for the brightness of the various parts of the Light, Herr Hoffmeister selects and names various parts of the Milky Way with which he compared it; this scale, of five steps, should prove useful in making comparisons of the Light from time to time.

THE ADOPTION OF STANDARD TIME IN FRANCE.—To *La Nature* (No. 1970) M. H. Cathenod contributes an interesting illustrated article on the international system of standard time, to which France has now given its support. He outlines the history of its general adoption, the reasons for accepting the Greenwich meridian as the basis of the system, and the reasons for France's hesitation in entering the international agreement earlier. The article is usefully illustrated by a number of sketch-maps, and, in concluding it, M. Cathenod reiterates M. Faye's hope that, in return for the international adoption of the Greenwich meridian as the point of departure, Great Britain will favour the unification of the system of weights and measures by adopting the metrical system.

THE DIFFERENT FORMS OF HALOS AND THEIR OBSERVATION.—Although a large number of famous astronomers and other observers have directed their attention to the halos which are to be seen from time to time surrounding the sun or moon, these phenomena still present some unsolved problems. In the March number of *L'Astronomie* Dr. Besson, of the Montsouris Observatory, suggests that the observations should be made regularly by amateurs, for the phenomena are visible without the help of instruments; but the amateur often lacks the knowledge of what to look for and what is worth recording. To remedy this state of affairs, he gives some excellent descriptions and instructions well illustrated by numerous diagrams.

Two of these diagrams show the solar halo of 22°, the halo of 46°, the upper and lower tangential arcs, the parhelia and anthelia, the oblique arcs and the luminous column and the arcs of Lowitz. Each phenomenon is then described and discussed, so that the observer may know when and where he may expect to see it, and what colours, if any, should attend it. Special notes and a diagram are given for the circumzenithal arcs, which are not so frequently seen, and generally last not longer than five minutes. M. Besson finds that the observations published in late years favour the theory of Bravais as to the appearance of these arcs, a theory which Pernter did not accept. This article is to be followed by another, in which the author will describe some of the rarely seen and abnormal phenomena which attend the apparitions of halos.

NOVA LACERTÆ.—In an article which appears in No. 9, vol. civ., of *The Scientific American*, Prof. S. A. Mitchell gives some very interesting facts concerning the apparition of Nova Lacertæ and the discovery and nature of novæ in general. Since the first recorded nova, that of Hipparchus in the year 134 B.C., only thirty-six new stars have been observed, and of these eighteen have been discovered since 1885; fifteen of these have been first found on photographs, and, of the fifteen, fourteen were discovered at the Harvard College Observatory from plates taken there or at Arequipa.

The photographs of Nova Lacertæ taken by Profs. Barnard and Wolf show that between November 19 and 23, 1910, the light of the star increased 4000-fold. A spectrum secured by Prof. Frost, using the 40-inch refractor at the Yerkes Observatory on January 3, is stated to be exactly analogous to those of Nova Aurigæ and Nova Persei, so that any explanation which accounts for their peculiarities will also explain Nova Lacertæ. Prof. Mitchell discusses, very briefly and generally, the causes which may produce novæ, and shows that the "pressure" theory and the "collision" theory leave much to be explained; he rather favours the passage of a rapidly moving star through a previously unknown nebula. The article is well illustrated, the reproductions including photographs of the Harvard College observatories at Cambridge (Mass.) and at Arequipa.

THE STAR LIST OF THE AMERICAN EPHEMERIS, 1911.—For thirty years (1882–1911) the star list of the American Ephemeris has given ten-day ephemerides for the apparent places of some 378 especially chosen stars, and daily ephemerides for five circumpolar stars. The need of a larger and improved star list for the use of astronomers, engineers, and surveyors prompted the issue, in 1908, of the list of 780 stars for 1909, and the present issue is similar to that except that forty-five more stars have been added. As the Ephemeris for 1912 contains a list identical with the present issue, the publication of a separate Star List will not be continued.

EPHEMERIS FOR WOLF'S COMET.—In No. 4483 of the *Astronomische Nachrichten*, M. Kamensky continues his ephemeris for Wolf's comet, which may return to perihelion in February next. At present the comet is apparently in Aquila, about half-way between δ Aquilæ and η Serpentis, and is moving in a north-easterly direction; its calculated magnitude is about 14.

ANTARCTIC EXPEDITIONS.

THE centre of interest in polar exploration has been shifted, earlier than might have been expected, from the north to the south by the telegram forwarded from Stewart Island from the returning *Terra Nova*. This vessel has carried Captain Scott's expedition to its base successfully in spite of encountering heavy pack-ice in the remarkably low latitude of 65° S., and having to make 380 miles of difficult travelling through it. The telegram includes messages from Captain Scott and from Lieut. Pennell, the officer commanding the *Terra Nova* on her return, and it is in the latter message that the salient point of interest is found, namely, the discovery of the celebrated *Fram*, with Captain Amundsen's expedition aboard, already established in the Bay of Whales, an inlet in the ice-barrier at 165° W. long. It is perhaps early as yet to account for Amundsen's change of plan (for he originally sailed ostensibly with an Arctic journey in view); the interest of the moment is that, assuming his base to be established at the Bay of Whales, he is nearer the Pole by nearly 100 miles than Scott if he elects to strike south in a direct line, and risk discovering a new route up to the polar plateau. If, however, he makes for Shackleton's known route (which Scott, of course, will follow) up the Beardmore glacier, he will have little if any advantage in distance.

Some uncertainty as to Scott's arrangements is caused by the messages. His own states that after leaving him at the base in McMurdo Sound the *Terra Nova* would leave a geological party on Victoria Land, and then proceed to leave an exploring party on King Edward Land. As a fact, it appears that the *Terra Nova* proceeded along the ice-barrier towards King Edward Land first, failed to make a landing at Cape Colbeck, and returned to the Bay of Whales. Here the *Fram* was found, and here two interpretations have been put upon the message:—"The *Fram* is proceeding to Buenos Aires, returning the following season to re-embark Captain Amundsen. Stores were landed and a hut erected two miles from the ship, and the *Terra Nova* afterwards left again for McMurdo Sound."

Some commentators refer the stores and hut to the party from the *Terra Nova*, which seems the more probable on the face of the sentence; others suspect wrong paragraphing, and suppose the stores and hut to belong to Amundsen's party. Later the ship was driven north, and landed the "eastern" party at Cape Adare (Victoria Land), which would suggest that the second group of commentators are right, and leaves it uncertain as to what has become of the geologists. This will doubtless be cleared up when the ship reaches another cable station; in the meantime, it seems reasonable to hope that there will be room in Victoria Land for Scott's party (especially if they are geologists only) and the expedition of Dr. Mawson, who has expressed some doubt as to the inviolability of his province.

Scott, Amundsen, and Mawson (who will have as commander Captain J. K. Davis, late of the *Nimrod*) do not exhaust the list of those already attacking or intending to attack the problems of the south. A Japanese expedition under Lieut. N. Shirase, having little in common with European equipment beyond a characteristic determination, was reported to have left for the south at the end of last year. Nor is it certain that an American expedition has been given up, in spite of Commander Peary's determination not to lead it, for it is stated that his captain, Bartlett, is ready to take his place.

It may be added that already Scott's expedition has added something to scientific knowledge, for those returning on the *Terra Nova* have carried the north coast of Victoria Land (by distant sights) some 150 miles beyond its previously known extension, and the interesting feature of an open sea immediately south of the Balleny Islands was encountered.

THE USE OF RADIO-ACTIVE SUBSTANCES IN THERAPEUTICS.

THE *British Medical Journal* for February 4 contains a report of an address delivered before the Berlin Medical Society on January 18 by Prof. Wilhelm His, of the University of Berlin, on "The Treatment of Gout and Rheumatism by Radium." Prof. His was led to make the investigations upon which the address was founded by the consideration that radium, or at all events some of its derivatives, formed a constituent of certain natural curative springs, the action of which on gout and rheumatism is undoubted, though medical men have not been able to explain it satisfactorily. It soon became evident that both radium and radium emanation were capable of producing cures, which were especially remarkable in the case of gout and of the various rheumatic affections. The results obtained were reported by the lecturer about a year ago to the German Balneological Society. Since then his experience has considerably extended.

The patients dealt with include 100 cases of chronic rheumatism and 28 of uric acid gout. Of the former, 47 were improved, 29 considerably improved, 5 nearly cured, while 19 were uninfluenced by the treatment. The most interesting of the cases were those in which limbs rendered useless by the disease were almost completely restored by the treatment, which was continued for periods of three months or longer. In gout, the results were much more striking. Twenty-eight patients were kept under treatment and under observation for a considerable period. Of these, 4 remained unaffected, while in 24 a marked improvement in the condition was achieved. Some of the patients have remained free from symptoms for a year after the termination of the treatment.

The most remarkable effect is noted in the behaviour of the uric acid in the blood. Under the influence of radium emanation, the blood loses its uric acid within a few weeks. This was observed in 15 cases out of 18. On the other hand, the uric acid persisted in the blood of 3 patients even after a severe course of treatment. On two occasions actual deposits of uric acid under the skin of the ear (so-called "tophi") were seen to disappear during the treatment. The clinical improvement did not always run parallel with the uric acid content of the blood. Thus very marked improvement was obtained in a patient by energetic treatment, though the blood continued to contain uric acid. In another patient no uric acid was present in the blood either at the beginning or the end of the treatment, although he had gouty nodules all over his body.

When water containing radium is drunk, part of the emanation is taken up in the inspired air, and another part is absorbed from the stomach and intestine. Emanation behaves like every other gas which is not a normal constituent of the body. It is excreted to a very slight extent through the kidneys, and to a large extent in the expired air. When the treatment is carried out by baths, absorption is only continued so long as the patient remains in the atmosphere laden with emanation from the bath water, and the foreign gas is excreted immediately. On the other hand, when carried out by means of drinking waters, the absorption takes place slowly from the intestine, and the body is being constantly supplied with fresh doses of emanation for three or four hours after a single dose. When the patient is given from three to five doses during the day, emanation can be detected in the expired air at any period of the day.

Radium itself behaves in the body like other heavy metals; that is to say, it is absorbed slowly, and the absorbed quantity is excreted again through the intestine. So long as it is present in the body, small quantities of emanation are continuously developed from it. It is therefore clear that the most active application of emanation is achieved when the individual is breathing an atmosphere which contains a certain quantity of radium emanation. Under these conditions, an equilibrium will rapidly be established between the emanation content of the outer air and that of the blood. This equilibrium will be maintained so long as the body remains in this atmosphere. The emanation content of the blood will reach a level in this way which can only be attained by the drinking of exceptionally large quantities of water containing radium. Experiments have shown that it is usually sufficient for the purpose of obtaining definite curative results, and of ridding the blood of gouty patients of uric acid, to place the patient in an air containing from two to four "making units" per litre for two hours a day. "Emanators" have been constructed on this principle. A stream of oxygen bubbles through a fluid containing a salt of radium and is saturated with emanation. The emanation issuing from the fluid is distributed equally in the air of the room by a ventilator. This method, however, has the disadvantage that it can only be applied when a special emanator is available. A portable inhalation apparatus has also been constructed.

With regard to the mode of action of radium, the most important factor appears to be the property possessed by radium of rendering various ferments of the body more active than usual. This power of activising ferments has been demonstrated in the case of pancreatin, pepsin, lactic acid ferment, diastatic ferments, and autolytic ferments. It is probable that the same is true of numerous other ferment actions in the body, though not for all; for example, it is known that the excretion of sugar by diabetics is not influenced by radium. In the case of gout, this property of radium can be demonstrated in a very clear manner. The disturbance in gout has been shown to depend on a slowing of the purin body metabolism, and not only is the formation and breaking down of uric acid slowed, but the mutual relations of the two processes are altered. In the gouty this is shown by the fact that, on a diet free from purin, though containing nucleic acid, the uric acid formed is not completely excreted within five days, as is the case in healthy persons. After prolonged treatment with emanation, however, the excretion takes place as promptly and completely as in a healthy individual. Gudzent was further able to show that uric acid and its salts are dissociated into carbon dioxide and ammonia under the influence of this action, and he demonstrated in a very ingenious manner that neither radium nor radium emanation produces this dissociation. It is due to radium D. Thus the actions that come into play in the treatment of gout by radium are very varied. In addition to the autolytic action, the action inhibiting inflammation, and that alleviating pain, there is a specific action on the uric acid and its salts, and on the processes regulating the quantity of uric acid in the body.

Another radio-active substance—mesothorium—has been prepared in considerable quantities by Dr. Otto Hahn. As compared with radium, the want of durability of this preparation is amply compensated by the greater ease with which it can be obtained from raw material. It is more than probable that other radio-active substances will be discovered, and will bring the treatment of gout and allied complaints by radio-active substances within the reach of all. A great deal of experiment and observation is still required, more particularly to make sure that no evil results may appear side by side with the undoubted benefit which has already been obtained. A. C. JORDAN.

THE AERO AND MOTOR EXHIBITION.

THIS exhibition opened at Olympia on Friday, March 24, and will continue until Saturday, April 1. A general survey of the flying machines shown indicates that the crank inventor is less conspicuous than has been the case at former exhibitions, and that the British makers have achieved notable progress during the past twelve months both as regards design and workmanship. Most of the machines have evidently been designed and constructed with a view to military requirements. Thus among foreign machines is the Breguet three-section military biplane, one of the favourites with the French War Department. This machine is built almost entirely of steel, thus cutting down the number of parts and the amount of wiring. The spars of the wings consist of large diameter steel tubes, to which the ribs are elastically attached, forming a supple surface which is claimed to give almost entire automatic stability. Another French War Department machine is the Nieuport two-seater monoplane, chiefly remarkable for its high speed—63 miles per hour.

Graham-White has a small biplane on show. This machine has a span of 27 feet and an overall length of 32 feet, and is fitted with a Gnome engine of 50 horse-power driving a four-bladed propeller. On account of the small span and chord, the machine is exceptionally fast, and has been repeatedly flown in gusty winds of velocity up to 35 miles per hour. Aluminium has been entirely dispensed with in the construction, the whole of the fittings and connections being of steel. The machine can be separated into three sections for transport.

The British and Colonial Aëroplane Company, Ltd., exhibit three of their now well-known Bristol machines, a military biplane, a racing biplane and a monoplane. The planes in the biplane type are so shaped—from experimental evidence—that a considerable amount of lifting power is in reserve under normal conditions of flight. The Gnome engine is used by this firm, who are the sole agents for it in Great Britain and the Colonies.

The Sanders Aëroplane Co., of Beccles, Suffolk, and London, exhibit a biplane having some novel features. The extreme tips of the upper planes dip downwards, both upper and lower planes being set at a dihedral angle. There is a biplane elevator in front and a triplane rudder at the rear. Balancing planes are placed between the main planes, and no tail plane is fitted. The peculiar shape of the wings is claimed to give great stability, even in high winds. The main frame of this machine has diagonal braces consisting of flat steel strips. The carriage comprises two skids, and is fitted with two wheels which draw up under the body when released by a trip device, enabling the machine to alight on the skids alone. The outer portions of the main planes are hinged to the central portion, and may be folded inwards for convenience in storage and transport.

Among historical machines shown by the Royal Aëro Club is the Blériot monoplane on which Graham White won the Gordon Bennett Cup at Belmont Park in October, 1910; the Howard Wright biplane with which Sopwith won the Baron de Forest prize of 4000*l.* by a flight of 169 miles, from England to Belgium, in 3½ hours; and the Cody biplane, with which Mr. Cody won the British Michelin Cup. The latter is fitted with a Green four-cylinder engine. The Blériot machines shown in another part of the exhibition are fitted with small skids at the rear in place of the single wheel present in last year's machines.

Many well-known types of engines are exhibited, those most generally in evidence being the Gnome and the Green. The Isaacson engine, made at the Boyne Engine Works, Leeds, at first glance might be mistaken for a Gnome. It has seven radial air-cooled cylinders, which, however, do not revolve. The casing enclosing the crank also contains a two to one reducing gear, so that the propeller, which is coaxial with the crank shaft, rotates at half its speed. The development of this engine will be watched with interest.

THE GLANDS OF RUMINANTS.

IN the issue of the Zoological Society's Proceedings for December, 1910, Mr. R. I. Pocock makes an important addition to our knowledge of the specialised skin-glands of ruminants. The value of this communication lies in the fact that it is largely based on the examination and dissection of animals from the society's menageries, whereas, with the exception of the observations published years ago by Brian Hodgson, much of our previous information appears to have been gleaned from museum specimens, which are obviously ill-suited for a study of this nature. The most common of these glands occur near or between the base of the front surfaces of the hoofs (pedal), on the carpus or "knee," where they form tufts in numerous antelopes, on the tarsus and metatarsus of many members of the deer-tribe, on the face below the eyes (preorbital), and in the groin (inguinal). After a review of the structure of these glands, their occurrence or absence in various genera, and their taxonomic value, the author discusses, firstly, their function, and, secondly, their origin and evolution.

As regards function, Mr. Pocock is of opinion that the limb-glands and hoof-glands are mainly for the purpose of tainting the grass or ground through or on which the animals have passed, or upon which they have lain, thereby serving to indicate to the members of a species the whereabouts and the reposing-places of their fellows, the inguinal glands of sheep and many antelopes corresponding practically, so far as their function is concerned, to the tarsal and metatarsal glands of deer. The preorbital glands, on the other hand, appear to be connected to a considerable extent with the sexual function, although it is possible that they may likewise help in directing the members of a herd to the line taken by those in advance.

In structure the preorbital glands range from a more or less complexly invaginated sac to simple glandulation of the surface of the skin; and it appears that the knee-glands of gazelles and the tarsal and metatarsal glands of deer are of the latter simple type, the glandular area itself being naked in a few deer. The glands in the groin, on the other hand, seem to be intimately connected with the milk-glands, their secretion in some instances having an odour like that of sour-milk. The interdigital, or hoof, glands take the form of invaginated sacs of varying degrees of complexity, and appear to attain their fullest development in the type of foot characterised by a long cleft between the toes in front and of a web connecting them behind, such as is found in deer, sheep, and many antelopes. Such deeply cleft and highly glandular feet must apparently be a source of weakness to bulky animals which move rapidly on hard ground; and there accordingly seems to be a tendency in such species to strengthen the foot by obliterating the cleft, with the more or less complete loss, not only of the interdigital, but of all limb glands. The culmination of this takes place in cattle, which lack glands both on the limbs and on the face.

Apart from the consolidation of the foot and the loss of the interdigital glands, the total absence of glands in the members of the ox and buffalo group may, the author suggests, be accounted for as follows:—

"Large ruminants," he writes, "are much more easily kept in view by members of their own species than small ones; or, if they live in thick bush, are more easily followed by hearing, as they crash away in a state of panic through the vegetation." It is added, however, that these and kindred subjects cannot be fully or definitely explained in the present state of knowledge. R. L.

SOME NEW SOUTH AFRICAN MARINE ANIMALS.[1]

THE volume referred to below contains a report on the material collected during the investigations of the Cape Government, carried out under the direction of Dr. Gilchrist. The larger part of the report is contributed by Prof. R. Bergh in a paper on South African opisthobranchs (with fourteen plates). Prof. Bergh is able to make a large addition to our knowledge of these animals, since only five species have been previously recorded in this region. He describes eight apparently new Aplysias, a Cape Philine, and other new tectibranchs. Many new holohepatic nudibranchs were found, including a second species of Kalinga. Several new cladohepatic nudibranchs are also described, the most interesting of which is placed in a new genus as *Tritonidoxa capensis*. The paper is illustrated by numerous valuable drawings of organs of specific differential value, and there are two coloured plates.

In looking over Bergh's anatomical contributions, one concludes that he must have many valuable drawings of complete systems of organs, as, for example, of the genitalia. There is no doubt that the publication of more of such drawings would be warmly welcomed by students of nudibranch anatomy.

Reviewing the faunas of the coast west and east of the Cape of Good Hope Peninsula, Bergh points out that the former has a more northern character, with occasional tropical nudibranchs, while the latter is more tropical.

Dr. Gilchrist has an interesting contribution on three new forms of hemichordata: a new species of Phoronis, *P. capensis*, the behaviour and habits of which are interestingly and fully described, and a form which differs

[1] "Marine Investigations in South Africa." Vol. v. Pp. 198. From the Transactions of the South African Philosophical Society, vol. xvii. (Cape Town: Published by the Society, 1908.)

from the typical Phoronis in having an involution of the epidermal cells below the œsophageal nerve collar; it has been allotted to a new genus as *Phoronopsis albomaculata*; the third form is a Ptychodera, *P. capensis*, a brief preliminary description of which is given.

In a short paper Miss Lydia Jacubowa describes a new species of Plarocera, *P. gilchristi*.

Dr. Calman contributes an account of a parasitic copepod from *Cephalodiscus gilchristi* from the Cape Seas. An interesting point about this new form is that it is referable to the family Ascidicolidæ as *Zanclopus cephalodisci* (nov. gen. et sp.), and is thus closely allied to forms infesting tunicates. The author points out that as the nearest ally of Zanclopus is a form infesting the echinoderm Antedon, the nature of the parasite in this case does not necessarily have any bearing on the chordate affinities of the host; nevertheless, the point has some value in such discussions.

Mr. F. Gordon Pearcey concludes this volume with a paper on the genus Botellina, with a description of a new species, which is a gigantic arenaceous rhizopod, attaining a height of 1 to 2½ inches.

Vol. vi. of the Marine Investigations will be published in the Annals of the South African Museum.

SOME MODERN METHODS OF ORE-TREATMENT.

AT the twentieth annual general meeting of the Institution of Mining and Metallurgy, held on March 22, the new president, Mr. H. Livingstone Sulman, was inducted into the chair, and delivered an address in which he reviewed some modern methods of ore-treatment. At the outset, attention was directed to the increasing complexity of metallurgical science, and the need for specialisation on the part of those engaged in its practice. Each stage of production for every finished metal demands its own specialised services from the miner, the metallurgist, and the metal worker, and the task of each daily becomes more elaborate in detail.

After paying a passing tribute to the debt owing to the technical chemist and the mechanical engineer, who have enriched metallurgical practice with such a wealth of ingenious and useful apparatus, Mr. Sulman passed on to a general review of the metallurgical industry, its conditions and requirements, incidentally touching on some of the more important processes now in operation in the treatment of various metals. Zinc-fume precipitation of gold solutions, oil-flotation in aiding recovery of gold and tin, electrolytic cyanidation, the use of cyanogen iodide and of bromocyanide, of silica sponge brick and other methods, were briefly noted, and the speaker then dealt with the rapid development that has recently come about in the treatment of "complex" ores, in which blende, more or less ferruginous in character, is in intimate physical association with galena and other minerals. The means by which such ores can be attacked may be divided into two broad classes, proximate or mechanical methods, and ultimate or leaching and smelting processes. Among the former, flotation methods (somewhat indiscriminately termed "oil" and "surface tension" processes) are now largely used, though there is still apparently much to be learned in this department, especially with regard to the underlying physical reactions, and the need for a practical solution of the slime problem. Magnetic separation, electrostatic methods, and centrifugal machines are also among the mechanical devices which are still in vogue. In processes dependent on the prior removal of zinc by distillation, comparatively little progress has been made; but the reproach often levelled against zinc metallurgists of being behindhand and incomplete in their practice is unmerited, since the conditions surrounding the reduction of zinc oxide to metal are peculiar, and the reactions involved are so highly endothermic. A feature of the zinc industry is its limitation to comparatively few smelting centres, a localisation due primarily to the necessity for cheap fuel, the occurrence of the peculiar clays required for retorts, and climatic conditions. Ultimate methods of treating complex ores introduce a variety of processes devised to meet diverse circumstances, and include leaching processes, electrolysis, electric smelting, and other means.

Mr. Sulman also touched on the treatment of copper ores, and in this connection led up to the necessity for the conservation of what the present generation is too apt to regard as "waste" tailings, but which in the future, with more advanced methods, may prove to be sources of considerable profit. This question of profit, present or ultimate, should, of course, be the dominating idea in all metallurgical work, for, as pointed out earlier in the address, whilst the labours of the chemist, the physicist, the engineer, the mechanician, and the electrician are all important in their respective spheres, the accountant must in effect dominate all.

THE ORGANISATION OF TECHNICAL EDUCATION.

AN open meeting of the London Branch of the Association of Teachers in Technical Institutions was held on March 25 at the South-Western Polytechnic. The chairman of the branch, Mr. J. Paley Yorke, presided, and Dr. R. T. Glazebrook, F.R.S., opened a conference on the organisation of technical instruction, especially in connection with the higher branches. Dr. Glazebrook's address was confined mainly to the question of the organisation of some form of technical university in London. As a keynote he quoted, from his recent speech at the Guildhall, three main points to the effect that (*a*) an independent faculty of technology in London University had become a necessity; (*b*) definite value should be given to the technical instruction in each London school of technology; (*c*) the technical faculty should have power to confer degrees under conditions which should be laid down by the faculty. He pointed out the difficulties which lay in the way of establishing an independent university of technology, and affirmed that these need not exist if separate and independent faculties were established in the existing university. Moreover, each faculty could be treated as if it were a university. It could have its own active body of control composed of representative business and professional men of wide views and sound knowledge of and interest in local necessities and conditions. This body would be similar to the controlling bodies of such provincial universities as Birmingham or Leeds. It could have its council to keep in touch with the governing bodies of the various institutions in the faculty, to approve the various courses of instruction, and adjust the degree of "recognition" of the work done in each institution. This council should consist of representatives of employers, employees, and teachers. It could also have its board of studies, composed of teachers of various subjects under the faculty, to arrange the educational courses and examinations. These independent faculties would have to be connected in some way to prevent overlapping. This could be done by means of advisory committees which should advise a board of trustees, which would see that the freedom of the faculties was not abused, adjust any differences, and administer finance.

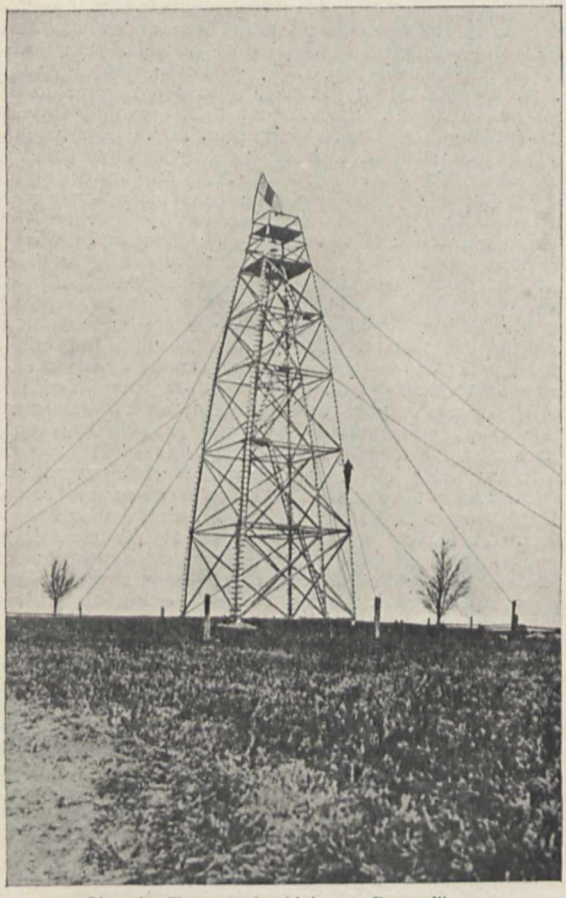
Dr. Glazebrook urged the importance of inter-school courses, and the need of greater facilities to teachers and post-graduate students for carrying out research work at their own institutions, and also at the Imperial College of Science and Technology. Principal Skinner advocated the linking up of the polytechnics to the Imperial College, but did not wish to break connection with the pure science side of the university. His polytechnic was already "thrusting itself into the Imperial College," as Sir Alfred Keogh had urged all polytechnics to do, and was doing inter-collegiate work with it. Mr. J. Wilson emphasised the difficulty of procuring under present conditions that freedom of the faculties which was so necessary. Messrs. H. Ade Clark and W. J. Lineham urged for complete separation on the grounds that sympathy towards technical work was not likely to be forthcoming from the present university. Mr. W. P. Winter urged the adoption of a wider matriculation examination, which would allow a student to qualify without having to take a foreign language. Mr. E. Bates also spoke on behalf of the building trades. Dr. Glazebrook, replying to a vote of thanks, hoped the conference would help to strengthen the evidence which the association had been asked to present to the Royal Commission.

THE DOMINION OBSERVATORY, CANADA.

THE annual reports issued by Dr. King, the chief astronomer, dealing with the work performed at, and by, the Dominion Observatory, are comprehensive volumes worthy of a place on the library shelves of every observatory for the purpose of general reference.

The organisation of a modern astronomical institution is no mean task, and to have the experiments, failures, and successes so clearly set forth as they are in these volumes, for the work is still in progress, is to be counted as one of the important achievements of the Canadian astronomers.

Perhaps the most striking feature of the organisation of astronomical labours in Canada is the manner in which collateral and interdependent researches are brought under the same direction. Dr. King's directorship includes



Observing Tower, 87 feet high, near Bowesville.

seismology, terrestrial magnetism and gravity, astrophysics, meridian work and time service, longitude and latitude observations, spectroscopy and solar physics, with all their subdivisions and ramifications. Such organisation makes for a great saving of time and correspondence; records of one branch are readily available, on the spot, for correlation with those of other branches, and auxiliary researches, such as can be more readily prosecuted in divisions other than that in which the results are actually required, can be readily ordered by the same direction. Unfortunately in this country we, at present, lack such a properly organised institution, although in other countries the opportunity and money to instal them have been found.

The report published in 1910 deals with the work done during the year ending March 31, 1908, and, in 356 pages, includes seven divisional reports, not merely of the work attempted, but the actual results in each division. A few only of the more striking features may be summarised here.

Dr. Klotz is responsible for the geophysical department, and he discusses very thoroughly the working and improvement of the seismographs, &c., and enters into a general discussion of the results. Regarding the suggestion that the boom acts as a delicate barometer, registering the tilting produced by excess or defect of atmospheric pressure, he, as yet, preserves an open mind, although the preliminary discussion of the results, given in detail in the report, indicates a connection between the presence of a "low" over the Gulf of St. Lawrence and the incidence of well-marked microseisms at Ottawa later in the same day. But there are important outstanding differences which call for further investigations.

The magnetic elements, and their variations, are also recorded in full, and the isogonic lines for 1907 are shown on an excellent large map of Canada accompanying the report.

Mr. Plaskett contributes a voluminous and important report on the astrophysical work (pp. 65–273), in which a prominent feature is the investigation of spectroscopic binaries. Those conversant with Mr. Plaskett's published papers will readily understand that a great deal of practical information concerning the apparatus and methods employed makes his report both interesting and useful for reference to those engaged in similar researches. For each star dealt with practically every possible datum is recorded, and the results are carefully summarised and discussed.

Five appendices to Mr. Plaskett's report deal with special researches coming under the head of astrophysics. Of these Mr. Harper contributes two, dealing, respectively, with the orbits of the spectroscopic binaries η Virginis and θ Aquilæ. Mr. Motherwell discusses the measurement of visually double stars, Dr. De Lury gives an account of the determination of the wave-lengths in the spark spectrum of iron-vanadium alloy between $\lambda\lambda$ 3900 and 4900, and Mr. Tobey discusses the photometric observations.

For solar work, the observatory is equipped with a 23-foot plane-grating spectroscope, used with a cœlostat and photographs of the sun, $7\frac{1}{2}$ inches to the solar disc, are taken on every clear day, but during the period covered by the report the solar work was delayed by difficulties in getting the necessary buildings completed.

Mr. Stewart's report on the meridian work and time service also contains many practical hints useful to those engaged in similar work. The observatory controls a number of synchronised public clocks, and the methods of synchronisation are carefully described. Difficulties with the various piers, which cracked under the influence of frost, interfered with the meridian work to some extent, but the account of them affords instructive reading. The primary azimuth-marks are now installed underground, as at the Cape Observatory.

It is interesting to note here the great advantages secured by having a properly equipped workshop attached to the observatory, an institution without which any observatory where a number of instruments are employed in experimental researches is sadly handicapped. At Ottawa—as at Mount Wilson, Mount Hamilton, and many other important observatories—apparatus can be made, or modified, and adapted under the actual supervision of the observer who wishes to use it; and a great deal of time, trouble, and expense often required to instruct the sometimes unadaptable outside mechanician is thereby saved. While there is some satisfaction in constructing an effective piece of apparatus from odd pieces of wood and metal, with the aid of a penknife, the results attained are not, inevitably, always the most satisfactory attainable for the purpose.

The results of the latitude and longitude observations, 1907, are tabulated by Mr. Macara in Appendix 4, and the astronomical stations established up to March 31, 1908, are shown on a large-scale map of the Dominion which accompanies the report. Appendix 6 is a summary of the photographic work, and in the next section Dr. King reprints his paper, from *The Astrophysical Journal*, on the determination of the orbits of spectroscopic binaries.

The geodetic work, whilst primarily utilitarian in character, aspires to take its place among the "great" surveys—for the determination of the earth's figure—and, judging from the results given in Mr. Bigger's most interesting report, it will not be found wanting in pre-

cision. A great deal of work has been performed since its initiation in 1905, despite the fact that the atmospheric conditions in Canada were found to hamper the observations considerably. Very careful investigations of the local, actual conditions have to precede the making of the standard observations. Observing towers—modifications of that designed by Sergeant Beaton—have to be employed, and range in height from 47 to 102 feet; they consist of a tripod upon which the theodolite is mounted, and a scaffold insulating the observer's weight from the instrument. One of these structures, 87 feet high, is illustrated on p. 160, and Mr. Bigger reproduces several other photographs illustrating the method of its erection. The large amount of country already surveyed, and under survey, is shown on the third large map accompanying the report.

In conclusion, it may be stated that the report indicates that astronomy and its allied sciences are being well looked after in the Dominion with an organisation that many workers in the British Isles might well envy, and that, when completed, the Dominion Observatory will properly take its place among the observatories of the world.

W. E. ROLSTON.

A CONSPECTUS OF SCIENCE.

THE annual report of the Board of Regents of the Smithsonian Institution for the year ended June 30, 1909, has been received from Washington. The volume contains the annual report of the secretary, giving an account of the operations and condition of the institution for the year; a report of the executive committee exhibiting the financial affairs of the institution; the proceedings of the Board of Regents; and a general appendix. As in previous years, it is the appendix which gives the volume its unique value. It comprises a selection of scientific and other memoirs of wide interest relating chiefly to the year 1909. Many of these memoirs are translated into English from the languages in which they were written, and thus become much more widely available both in this country and America.

We note among such contributions to the appendix Prof. H. Poincaré's address on the future of mathematics, delivered at the International Congress of Mathematicians in Rome in 1908; Commandant Paul Renard's contribution to the *Revue des Deux Mondes* for November 1, 1909, on what constitutes superiority in an airship; M. L. Marchis' article on the production of low temperatures and refrigeration, in the *Revue générale des Sciences*, March 15, 1909; M. A. de la Baume Pluvinel's paper on solar-radiation researches by Jules César Janssen, from the *Astrophysical Journal*, September, 1908; Dr. Gaubert's essay on the formation, growth, and habit of crystals, which appeared in the *Revue scientifique* of January 15, 1909; M. Maurice Zimmermann's paper from the *Annales de Géographie*, March 15, 1909, on the Antarctic land of Victoria; M. D. Damas' paper on the oceanography of the sea of Greenland, from *La Géographie*, Paris, June 15, 1909; M. Romuald Minkiewicz's contribution to the *Revue générale des Sciences*, February 15, 1909, on the instinct of self-concealment and the choice of colours in the Crustacea; and M. G. Marotel's paper on the relation of mosquitoes, flies, ticks, fleas, and other arthropods to pathology, from the *Annales de la Société d'Agriculture, Sciences et Industrie de Lyon*, 1906.

The appendix also contains several important contributions from British men of science in the form of reprinted addresses. The numerous plates contained in the volume add greatly to its interest.

INSECT AND FUNGOID PESTS.

PROBABLY the most important advances in agricultural and horticultural practice in the present day are in the direction of controlling insect and fungoid pests. Economic considerations generally compel the grower to aim at large crops; in consequence, losses caused by disease may be very heavy. All the conditions of modern cultivation tend to favour the pests; the distribution of seeds and of nursery stock from district to district facilitates the spread of spores and ova, whilst the dense planting and the continuous cropping provide a succession of host plants. Further, the high nitrogenous manuring invariably practised as agriculture and horticulture become more developed seems to increase the susceptibility of the plant to attack. In all countries where agriculture is progressing there is growing up an enormous literature dealing with these pests. A few of the more recent publications only are referred to in this article, but the list does not profess to be complete. Two general methods are in use for combating the pests: natural enemies are encouraged, and, if necessary, introduced into the country, and poisons are applied sufficiently potent to kill the pest, but not the infested plant.

In output of literature the United States easily heads the list. Under the direction of Dr. Howard, the Bureau of Entomology of the Department of Agriculture has accomplished an enormous amount of work of both scientific and technical value. A recent bulletin by H. E. Burke deals with the flat-headed borers (Agrilus), causing damage to forest trees to the extent, it is estimated, of 100,000,000 dollars annually in the States alone. Methods of treatment are now known, and much of the damage can be prevented. The San José scale (*Aspidiotus perniciosus*) is shown by A. L. Quaintance to yield to treatment with petroleum or kerosene washes, or with lime and sulphur washes. "Brown rot" (*Sclerotinia fructigena*) and the plum curculio (*Conotrachelus nenuphar*) are described by W. M. Scott and A. L. Quaintance as causing great injury to peaches and plums respectively, but they can be kept in check by a lime-sulphur wash containing lead arsenate. V. L. Wildermuth writes on the clover-root curculio (*Sitones hispidulus*), which injures clover, although it is probably not a common pest. It is eaten by a number of birds, and, in the larval stage, is attacked by a fungus. W. M. Russell describes a cigar-case bearer (*Coleophora caryaefoliella*) attacking pecari trees; it is not yet abundant, and can probably be kept in check by lead arsenate washes. H. O. Marsh deals with the common Colorado ant (*Formica cinereorufibarbis*), which has fallen under the ban because it protects the melon aphis. It is said to be a common thing to see the ants busily engaged in killing and carrying off the syrphid larvæ which were destroying the aphides. Adults of a lady-bird, *Hippodamia convergens*, the nabid bug, *Reduviolus ferus*, and a species of Chrysopa were also carried away by the ants. The simplest method of extermination seemed to be watering the nests with a weak solution of potassium cyanide.

Not only at the Department of Agriculture, but also at the colleges, are investigations undertaken, and a large number of bulletins are issued. Many of these make no claim to originality, and are mainly of interest to us as showing how the American colleges try to educate the farmers. These bulletins are always well illustrated, pictures being given of typical infested plants and of the pest in its various stages, so that recognition shall be easy. Preventive and curative methods are described where known, and farmers are told where they may apply for further information. Admirable bulletins of this class are sent out by the agricultural experiment stations of the West Virginia University, the Purdue University, the Colorado Agricultural College, and others.

Turning to the British Dominions, good work is being done in India, and is published in the Pusa Memoirs and *The Agricultural Journal of India*. The Transvaal work appears in *The Transvaal Agricultural Journal*. In a recent issue of *The Agricultural Journal of the Cape of Good Hope*, Messrs. Laws and Manning discuss the eradication of ticks on the veld. Of the three methods in vogue, periodical dipping or spraying of the hosts, grass burning, and the enclosing of definite areas for a sufficient length of time to ensure all ticks dying off through the absence of hosts, they consider the dipping or spraying the best, but the other two are also effective. In another article the ostrich wire-worm (*Strongylus douglassii*), a worm found in the proventriculus of the ostrich, is described; the treatment commonly adopted is to give a strong dose of carbolic acid, insufficient, of course, to kill the bird. It is not considered, however, that this treatment is satisfactory, and others are discussed, but none can be depended upon as certain.

The scientific work of the entomological staff of the

West Indies appears in the West Indian Bulletin, and the more technical work in *The Agricultural News*. Mr. F. W. South deals in a recent issue of the Bulletin with the control of scale insects by means of fungoid parasites. The fungi can be introduced in two ways: material containing fructifications may be hung on the tree near to the scale-infested part, or the fructifications may be stirred up with water, which is then sprayed on to the tree. When the spores germinate, the hyphæ grow under the scales and destroy the insects. In every issue of *The Agricultural News* a section is devoted to insect and fungoid pests; the diseases of rubber trees have recently received considerable attention. Some of the islands, as Jamaica and Trinidad, issue their own bulletins, in which the staff publications appear. In the Trinidad bulletin Mr. Rorer deals with pod-rot, canker, and chupon-wilt of cacao in a well-illustrated paper; spraying is shown to be effective, but definite instructions cannot yet be given owing to the absence of local experience of the treatment.

The Circulars and Agricultural Journal of the Royal Botanic Gardens, Ceylon, contain accounts, by T. Petch, of root diseases of Hevea and of *Acacia decurrens*, which is extensively planted as a wind-break in tea plantations and also for green manuring. The brown root disease, caused by *Hymenochaete noxia*, is the commonest root disease of Hevea in Ceylon, although this fungus does less damage than *Fomes semitostus*. *Sphaerostilbe repens* is also recorded, but is as yet not common. Two diseases of Acacia are described, one caused by an agaric, *Armillaria fuscipes*, the other by *Fomes australis*. A remarkable plague of a large snail, *Achatina fulica*, is described by E. E. Green, which swarms in millions in one area of the island. On the whole, it is considered to do more good than harm, as it feeds on animal and human excrement, and does comparatively little damage to the vegetation. Besides the circulars and journal, a series of leaflets are sent out from Ceylon.

Much of the Japanese work is published in the Journal of the College of Agriculture, Tokio, a beautifully illustrated periodical brought out in English and German. Vol. ii., No. 4, contains a paper by Ichiro Miyake on the fungi attacking rice. The list is, the author believes, complete, and as full references and descriptions are given, it must prove extremely valuable to other workers. It is in the true scientific spirit that the Japanese have broken down the barrier of language and issued their scientific publications in languages that can be read in the West.

In addition to the work going on at some of the larger agricultural colleges and departments in Great Britain, the smaller colleges are also studying the pests and diseases that occur in their districts. Mr. G. T. Malthouse recently, in a bulletin issued by the Harper-Adams Agricultural College, dealt with the wart disease of potatoes (*Chrysophlyctis endobiotica*), which has been doing much damage in Shropshire and Staffordshire. Accounts of the various diseases are also circulated as leaflets by the Board of Agriculture, as well as in their Journal.

TECHNICAL INSTRUCTION AND SECONDARY SCHOOLS.[1]

TECHNICAL instruction, in particular, has too long been looked upon as having little relation to the elementary or secondary schools. The schoolmaster has perhaps been too apt to view the technical school or college as an upstart and an interloper, the title of which to the name of an educational institution rests on a very insecure foundation, and the utilitarianism of which gives a somewhat unfair advantage in the competition for students. On the other hand, those engaged in technical work have in some cases looked upon the schoolmaster as an unpractical person, from whose clutches the student should be rescued at the earliest possible moment.

We have, however, now emerged from this stage, and are ready to discuss the relationships of our various schools with a better knowledge of the necessities and limitations of each, and taking as the basis the requirements of the scholar and not the supposed benefit to the school.

[1] An address read to the Annual Congress of the Secondary Schools Association, held at Bradford on February 24, by Prof. Walter M. Gardner.

The scholar's work, from entering the elementary school to the end of his studentship, whenever that may be, should appear to him as an unbroken progress, during which he can see gradually unfolding a definite scheme leading eventually to his life's career. In so far as the various grades of education form a series of detached schemes without proper interrelationship, and to the extent to which the student's time is wasted when he passes from one grade to another by reason of this, to that degree our educational administration is defective, and we, as administrators, are lacking in skill or in our duty to the students and to the public. The solution of this problem proves to be very difficult, and even now the matter hardly receives the attention which it deserves. To provide in a sufficiently economical manner courses throughout the school suited to the different needs and capacities of various scholars is *the* educational problem. At what stage to introduce differentiation, and when to begin specialisation, and at what age a scholar should pass from one school to another—these are important but minor matters incidental to the main problem.

Keeping to the front the thought of the ultimate benefit of the student, and making this the determining factor, many details will settle themselves. Difficulties, of course, at once arise, due to the uncertainty or to differences of opinion as to whether a particular course of action is or is not for the benefit of the scholar. Here ideals will probably at once clash with practicabilities, and, as the head of a technical institution, I am perhaps predisposed to lay stress on the latter.

The problem presents itself to me in this form:—"How can we make the best use of the student's time up to the age when experience shows he will, in all probability, leave school, and what portion of this should be allocated to technical instruction?" Others may state it thus:—"In order to acquire a thoroughly trained intellect and well-stored mind, a student should pass from the elementary school at twelve or thirteen years of age to the secondary school, and should remain at the latter for at least four or five years. He cannot, therefore, enter a technical school under the age of seventeen or eighteen." How are we to reconcile these views?

Whilst it is, of course, true that all of us, men and women alike, and whatever our avocation, are of greater service, are more efficient, if we have received some training which may legitimately be termed "technical," we are not concerned with this general aspect of the subject on this occasion, but with that specialised technical instruction provided in the technical institutions. The students we wish to get in such institutions are those who will pass into the great industries of the country; and in investigating this matter we are at once confronted with the fundamental point that, of a thousand boys who pass through the elementary schools and who ultimately take positions as workmen, foremen, or managers in industrial concerns, probably not more than forty pass through a secondary school, and not more than three or four enter a day technical college. There is, therefore, a problem of enormous magnitude still requiring solution relative to the further instruction of the 950 out of every thousand boys who do not proceed beyond the elementary schools.

Before the advent of steam-driven machinery, when industrial conditions were much simpler, the personal instructions which the boys received under the apprenticeship system sufficed to produce the necessary skill and training, though in a very unequal degree. The personal association of the craftsmaster and the learner cannot, however, be relied upon under modern industrial conditions, and therefore the technical schools are called upon to provide a substitute for the apprenticeship system. Boys leaving the elementary schools are not, however, sufficiently mature to reap the full benefit of the advanced specialised instruction provided in day technical schools, and for these boys, most of whom will eventually become industrial operatives, I strongly advocate the establishment of what are known as trade preparatory schools, with a two years' course comprising, roughly, two-thirds general subjects and one-third handicraft work. The majority of the boys should then go to work and attend evening technical courses, but those who show special promise should be drafted into the day courses of the technical school by means of scholarships. A necessary and

important link is thus formed between the elementary schools and the technical institutions, which link cannot be so efficiently provided by the evening continuation schools.

Such trade preparatory schools in no way interfere with the secondary schools. They simply provide for the further education of those boys who would not, in any event, go forward to the secondary schools. It is, however, obvious that the secondary schools must constitute the main feeder of the higher day technical courses, and it is this aspect of the general question with which we are chiefly concerned this afternoon.

With regard to the relationship between the secondary and technical schools, difficult and thorny questions at once crowd into the mind. At what age should the student pass from the secondary to the technical school? Should this age be the same, whatever the student's future career is likely to be? Should the secondary-school curriculum be the same for students who are going forward to a technical school as for those who are going into commerce or into one of the professions? If not, when should differentiation begin? Should any definite technical training (using the expression in the narrow sense of special training for industrial life) be given in the secondary school?

To not one of these inquiries can a categorical reply be given.

I am not at the present moment at all concerned with Government regulations as to age or curricula, but, looking at the age question purely from the point of view of the student's benefit, one cannot lose sight of the fact that the age at which the student should finally complete his school career depends on the nature of his future occupation; and this fact, coupled with the different requirements of various groups of students, in my opinion points strongly to the desirability, wherever numbers render it practicable, of differentiation in the secondary schools.

This raises the important question as to whether different groups of subjects may be made to yield similar educational results. If this is not so, differentiation must lapse; but many will probably agree that a study of science may be made as useful in developing intellectual capacity and character as an exclusive study of the humanities, and that as liberal an education may be got from literature and science as from entire devotion to languages, living or dead.

While speaking on this matter, I should further like to urge that education and culture, in the truest sense, may be acquired during the study of the processes involved in the transformation of raw materials into useful articles, which is the special business of the technical schools. The fact that present-day factory conditions are not perhaps conducive to the development of culture does not necessarily imply that educational ideals are inherently impossible in a technical school, but, on the other hand, emphasises the necessity of their development.

I argue, therefore, that a student's education, in the strictest sense of the word, is continued during a properly organised technical course, and must entirely dissent from the view that technical instruction is purely utilitarian.

We now come to close quarters with the question of the previous training desirable for students who will enter a technical college after passing through a secondary school.

May I point out in this connection that the value of the training in many secondary schools—speaking now of the information gained rather than the intellectual training—varies greatly according to the students' future work? If a lad is going to be a clerk, it so happens that most of the ordinary school subjects are such as will eventually form his tools in his trade of clerking. Of course, for higher commercial work he requires special instruction, but up to a certain point he receives his technical training incidentally along with the ordinary school training.

In the case of students who will enter the industries this does not hold good to anything approaching the same degree, and if it is possible to place these students on an equality in this respect by modifying the secondary-school curriculum, the gain to the technical schools will be enormous.

What, then, are the possibilities in this direction? With regard to the specialised technical work, I think nothing can be done. The importance of technical instruction being given by men having an intimate knowledge of the particular branch of industry concerned cannot be overrated, and such men are not likely to be found on the staffs of secondary schools, where, in fact, they would be out of place.

Manufacturing operations, and the technical instruction dealing with them, are, however, based on scientific fact, and mainly upon physical, mechanical, and chemical science, and a knowledge of these underlying sciences should precede the technical study of materials and processes. Men highly qualified to teach these sciences are, moreover, normally found on the staffs of secondary schools, and the teaching of physics, mechanics and chemistry, and of mathematics and art, might well be carried much further than is usually the case if it is done by the right men in the right way.

This, in my opinion, is the direction for advance. What we really need in the technical colleges are students with as much sound scientific training as possible—students trained to think for themselves and with the work habit highly developed. By economising time, this would enable us to carry students further forward, to the ultimate benefit of the industries of the country.

The whole matter is one which requires sympathetic consideration from both sides, and only in this way can any real advance be made. The teachers in the secondary and technical schools should be brought closer together, should have a more intimate knowledge of each other's work, and wherever practicable, as in a large city, the curriculum of at least one of the secondary schools should be so arranged as to offer to industrial students the same advantages as are now given in such generous measure to those who are training for commercial life or for the teaching and other professions.

CRYSTALLINE STRUCTURE, MINERAL, CHEMICAL, AND LIQUID.[1]

THE importance of crystallography has been growing so rapidly during recent years that the subject is no longer to be regarded merely as a branch of geology and mineralogy, but has now become a wide and far-reaching subject on its own account, embracing its former parent mineralogy, almost the whole of solid optics, the structure and physical properties, both mechanical and thermal, of solid matter, the structure and character of metals, with most important reference to their preparation for industrial application, and the fundamental groundwork of chemistry. Such a subject can no longer with impunity be relegated to a subsidiary part of a course in geology and mineralogy, but must in future be treated, studied, and taught as a specific branch of natural science. It is of the utmost urgency that all students of chemistry, physics, mineralogy, and metallurgy should be made acquainted with the main facts of the science in order that they may understand their own subjects with clear and broad insight.

It is a remarkable fact that no definition of life has yet been given which will not include a crystal. The virility and longevity of seeds and spores are often found to be quite extraordinary; but the power of crystalline growth goes even further, for it is everlasting. An instance was taken in the first lecture from common sand grains, which, originally quartz crystals in a granitic rock, after passing through every variety of vicissitude for thousands of years, when eventually they come in contact with water containing a little of their substance, silica, in solution, begin to grow again as crystals of quartz. A slide of such sand grains was shown on the screen, having perfect little quartz prisms and pyramids growing out from them.

Some fine examples of the growth of crystals were projected on the screen in polarised and ordinary light, notably of benzoic acid crystallising from the melted condition, of white arsenic crystals growing from the vaporous state, and of potassium bichromate and ammonium chloride growing from solutions of different degrees of supersaturation. Especial emphasis was laid on the fact that slow growth from the slightly supersaturated condition, that which has been so clearly defined

[1] Summary of three lectures delivered at the Royal Institution on February 28, March 7, and March 14, by Dr. A. E. H. Tutton, F.R.S.

by Miers and Ostwald as the "metastable" condition, usually yields well-formed individual crystals suitable for study and measurement, whereas crystallisations from more strongly supersaturated solutions, those in the "labile" condition, invariably take the character of skeletal, tree-like, or acicular forms, very beautiful, but unsuitable for crystal measurement. The extraordinary fact was then referred to that germ-crystals of all common crystalline substances are constantly floating about in the air, and that by falling into metastable solutions of their own or similarly constituted (isomorphous) substances are able to set them crystallising. Indeed, metastable solutions are entirely dependent on such intrusions of germ-crystals, for labile solutions are alone capable of spontaneous crystallisation.

The great diversity of habit of the crystals of the same substance was next discussed, and a striking instance given in the three common forms of calcite, carbonate of lime, namely, the rhombs of Iceland spar, the scalenohedral (pyramidal) dog-tooth spar, and the long prismatic form of calcspar terminated by rhombohedra. Totally dissimilar specimens of all three were exhibited, and others still more remarkable, from the same mine, were projected on the screen, so unlike as to be apparently the crystals of quite different substances. Yet the faces present were geometrically the same, but developed to different extents, in all three, and inclined at angles of precisely the same value. It was shown how this diversity of habit had delayed the discovery of the laws of crystallography, and the historic sequence of events, from the seventeenth century onwards, was briefly outlined, until in 1784 the main laws were enunciated by the Abbe Haüy, especially the great law of the constancy of the angles of the crystals of the same substance.

The natural classification of crystals into seven styles of architecture or crystal systems, according to the geometrical disposition of their faces, was then discussed, and shown to depend on the presence of a greater or less number of planes and axes of symmetry, this external configuration being due to the regular homogeneous character of the internal structure. It was shown that this latter is of the nature of a space-lattice, each unit cell of which is occupied by a chemical molecule. The chemical molecules are thus the regularly arranged bricks of the crystal edifice. Some remarkable examples of crystals of the various seven systems were exhibited, both in the form of natural mineral crystals of large size, and of artificial crystals, some of considerable size and others grown under the microscope, photographs of many such crystals taken in the act of growth being exhibited on the screen.

The grouping of crystal faces in "forms" or sets having an equal value with respect to the symmetry, and the mode of distinguishing the faces by their "indices," symbols of three or four figures (inversely proportional to the lengths of the axes cut off by the face) enclosed within brackets, was explained. The simple or "rational" nature of these indices, the low numbers, 1, 2, 3, and 4 vastly predominating, and being often the only numbers involved, was emphasised, thus demonstrating the important law of rational indices.

It was shown in the second lecture that these external regularities are entirely the consequence of the internal homogeneity and structural symmetry of the molecular arrangement in one or other of the fourteen space-lattices referred to in the first lecture. The remarkable work of Sohncke, Schönflies, von Fedorow, and Barlow was then discussed, whose joint labours had indicated 230 types of homogeneous structure, represented by point-systems, and which include 165 involving the property of mirror-image symmetry and 65 Sohnckian assemblages of points which do not, but clusters of which latter, if each cluster be represented by a single point, give us the 14 space-lattices. The interesting fact was brought out that the space-lattice represents, in all the simpler cases, the arrangement of the molecules, while the detailed point-system represents the plan of distribution of the atoms.

It was also shown how recent work had confirmed the law of Haüy as to the constancy and specific nature of the crystal angles of any one substance, and that in the cases of the isomorphous series of Mitscherlich, composed of analogously constituted compounds, which were at first supposed to be identical in their crystal morphology, the crystals of the different members of the series show small but real differences in their angles, and even greater differences in their other properties. Moreover, the differences conform to a definite law, for they follow the order of progression of the atomic weights of the interchangeable chemical elements which give rise to the series. The dimensions of the structural-unit molecular cells of the space-lattice also conform to this law.

The optical properties of crystals may, in general, be represented by an ellipsoid, the three rectangular axes of which are proportional to the three different refractive indices afforded along those directions, and the position of which varies with the symmetry. Crystals of the rhombic, monoclinic, and triclinic systems have such a triaxial ellipsoid, but it becomes an ellipsoid of revolution for crystals of the tetragonal, hexagonal, and trigonal systems, and a sphere for a cubic crystal. This property thus at once enables us to discriminate between these three groups of crystal systems, which are characterised, respectively, by three indices, two indices, and one index of refraction. The directions of the three axes of the ellipsoid are identical with the crystallographic ones in a rhombic crystal, but only one axis is coincident with a crystal-axis in a monoclinic crystal, and no axes are coincident in a triclinic crystal.

Such an ellipsoid with three unequal rectangular axes must possess two circular sections symmetrically situated, and directions perpendicular to these sections are the well-known optic axes of "biaxial" crystals, more or less comparable to the single axis of no double refraction of "uniaxial" crystals, which are characterised by an ellipsoid of revolution. It is round these two optic axial directions that the well-known spectrum-coloured rings and dark hyperbolic "brushes" are visible in convergent polarised light, thus forming the biaxial analogue of the circular spectrum-rings and black rectangular cross of a uniaxial crystal such as calcite. Many of these phenomena were projected on the screen with the projection polariscope, including the Mitscherlich experiment showing the crossing of the optic axial plane of gypsum as the crystal becomes warmed by the heat rays accompanying the beam of convergent light.

The concluding lecture opened with a description of the remarkable "liquid crystals" discovered by Lehmann, substances of complicated and elongated chain-like chemical constitution, the molecules of which set themselves, by virtue of their inherent directive force, in shapes resembling crystals, which display double refraction and rotate the plane of polarisation. Mobile crystals of para-azoxy-anisol in the form of rotating drops, of the ethyl ester of para-azoxy-benzoic acid, and of para-azoxy-phenetol in the shape of rounded crystals showing interference bands, were exhibited on the screen with the Zeiss projection microscope, and also spherulites of cholesteryl acetate, beautiful star-like apparitions breaking out all over the field, exhibiting colours and a dark cross in polarised light. The mobile crystals were instantly deformed on touching the cover-glass, but as instantly recovered their shape on removing the pressure.

The conclusion arrived at from experiments of this nature was that the molecular directive force of crystallisation, temporarily discarded as unnecessary by the geometricians for the building up of homogeneous structures, is reinstated as a fact which cannot be ignored. There can be no doubt that in these mobile crystals the chemical molecules are constantly arranging themselves in space-lattices, although the substance may be as mobile as water. The fundamental importance of the space-lattice, its formation by the chemical molecules as its structural units, and its influence in determining the crystal system, are thus again strongly emphasised.

It was proved by various optical devices that crystals of quartz exhibiting characteristic little facets on certain right-hand solid angles invariably rotate the plane of polarisation to the right, while other crystals on which these faces are only developed on the left-hand solid angles rotate the polarised rays to the left. It was further proved that this was due to an oppositely right-handed and left-handed helical arrangement of the atoms composing the molecules in the two cases, and that there are equal chances in nature for the formation of either. The re-

markable optical effects of the twinning of right- and left-handed quartz were also demonstrated, culminating in the interesting case of lamination twinning of amethyst; and interesting conclusions were drawn as to the chemical nature of the racemic, pseudo-racemic, and truly inactive varieties of substances showing the optically active forms.

It was made clear during these lectures how important crystallography is to chemistry. This importance has, however, been yet further enhanced by the recent work of Pope and Barlow, who have shown that the fundamental chemical property of valency is intimately connected with crystalline structure; for if we assume, as there is ground for doing, that the atoms present in a crystal may be represented by their spheres of influence arranged in contact, according to the particular type of homogeneous structure displayed, then the volumes of these spheres of influence are proportional in any one compound to the fundamental chemical valency of the atoms. This theory, when taken in conjunction with the lecturer's work on isomorphous series, in which the progression of the crystal properties was shown to follow that of the atomic weights of the interchangeable elements of the same family group forming the series, embraces the whole field of chemistry, the theory of Pope and Barlow relating to the horizontal progression and the generalisation concerning isomorphous series corresponding to the vertical progression of the periodic law of Mendeléeff. The importance of crystallography to chemistry is thus not only paramount, but fundamental.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

IT is announced that Miss Mary Anne Ewart, who died on February 19, left 20,000*l.* to Newnham College, Cambridge, for scholarships for the benefit of women students studying there, and 10,000*l.* to Somerville College, Oxford, for like purposes.

A SHORT time ago announcement was made that the late M. A. Loutreuil had left the sum of 284,000*l.* for the promotion of science in France. Of this amount, 100,000*l.* was bequeathed to the University of Paris upon condition that the provincial universities also should benefit by the annual revenue derived from this sum. A message from Paris, published in *The Times* of March 29, states that a committee consisting of the Vice-Rector of the Sorbonne and a representative of the faculty of science of each of the provincial universities will decide the distribution of the revenue from the legacy, and will communicate its decisions to the council of the University of Paris. According to the terms of the will, the revenue of the gift is to be devoted to the encouragement of scientific studies, the equipment of laboratories, the formation of a library, and the foundation of additional lectureships on scientific subjects.

THE president's address to the members of the Institution of Mechanical Engineers was delivered on March 16. Mr. Ellington considered questions relating to the qualifications for membership; the Institution of Civil Engineers has already attained to a position such that it is difficult for civil engineers who are outside that body to obtain positions of responsibility. That the Institution of Mechanical Engineers is the proper body to secure the same standing for mechanical engineers is undoubted. Mr. Ellington insists on knowledge and experience in both theory and practice of mechanical engineering as essentials for admission, and would favour examinations for entrance to the grade of associate member. The council of the institution has always closely scrutinised the educational training and practical experience of candidates for membership, and properly conducted examinations would provide a desirable standard of entrance into the profession.

THE sum of 1400*l.*, says *Science*, has been received by the University of Michigan from the estate of Emma J. Cole, of Grand Rapids, Michigan, to constitute a scholarship fund for graduate students in botany. From the same source we learn that the regents of the University of Wisconsin have accepted as a trust the sum of 6000*l.* for the establishment and maintenance of a chair to be known as the Carl Schurz memorial professorship. The chair is to be filled by professors from the universities of Germany. The present fund will make it possible to secure a German professor for one semester every second year. President Van Hise has been authorised to open negotiations with German authorities with the view of establishing a system of exchange professors between German universities and the University of Wisconsin. The establishment of the Carl Schurz professorship will be celebrated on March 31. The speakers on that occasion will include the two German exchange professors now in the States, Dr. Max Friedlaender, of the University of Berlin, now at Harvard, and Prof. Ernst Daenell, of the University of Kiel, Kaiser Wilhelm professor at Columbia.

THE trustees of the A.K. Travelling Fellowships will shortly elect two fellows. These fellowships, for which both men and women are eligible, are each of the value of 660*l.*, are awarded annually, and, as has been explained in these columns, were established for the purpose of enabling the fellows to travel round the world. The trust is administered at the University of London. The appointments are made by a board of trustees, and candidates are nominated by the Vice-Chancellors of each of the universities of the United Kingdom, the president of the Royal Society, and the president of the British Academy, but the trustees are not required to confine their election to these nominees. The only conditions for candidature are that candidates shall be British subjects and graduates of, or persons who have passed all the examinations required for a degree in, some university of the United Kingdom. An incorrect impression exists that persons to be nominated as candidates must be members of the teaching profession in one of its grades. The founder's object in establishing the fellowships is in no sense to further any special line of research, but to enable intellectual men to enter into personal contact with men and countries they might never have known. The English fellowships are part of a general scheme for the establishment of similar foundations in various countries, and endowments have been made already for this purpose in France, Germany, Japan, and the United States.

THE third annual report of the governing body of the Imperial College of Science and Technology deals with the work for the year ending July 31, 1910, and shows that the activities of the college were much extended during that period. The building extensions were pushed forward, and some are now nearly complete. The workshops of the City and Guilds College have been extended, at a cost of 8000*l.* to the City Guilds Institute, to provide for the development of the course of instruction in railway engineering commenced two years ago. We notice that the Bessemer memorial committee has decided to provide 10,000*l.* to assist in equipping the mining and metallurgical laboratories, and the laboratory so furnished will be called the Bessemer Laboratory, and in it a statue of the late Sir Henry Bessemer will be erected. The governing body has secured the services of leading men of large experience in connection with great industrial concerns of the country, or of men with special knowledge, for the purpose of giving short courses of advanced lectures on such branches of science as press for immediate study. Financial considerations prevented the full and immediate realisation of the department of chemical technology recommended by the Advisory Board concerned with this subject, but a beginning has been made, so far as is practicable, in the existing buildings. Great attention has been given by the governing body to the provision of facilities for the study of the relation of the biological sciences to the industries, and funds have been set aside for the foundation of a chair of plant physiology and pathology, and it is hoped that resources will be forthcoming for its permanent endowment. A complete scheme of scientific instruction and research in aëronautics has been drawn up, and much work has been done in providing facilities for such study. The approved budget for 1910–11 for the Imperial College as a whole estimates a revenue of 59,006*l.*, and an expenditure of 67,374*l.*—a deficit of 8368*l.*, while the estimated effect of capital commitments (buildings, &c.) will be to reduce the unappropriated capital to 100,935*l.*

IN the issue of *Science* for March 10, Prof. Rudolf Tombo, jun., deals with the statistics of students at

German universities. His article on the registration statistics of American universities, to which reference was made in these columns on March 23 (vol. lxxxvi., p. 133), leads to certain interesting comparisons. The twenty-one German universities show an enrolment for the winter semester of 1910–11 of 54,822 students, as against 52,407 students the winter before. During the past five years there has been an increase in registration of no fewer than 12,432 students. The number of women students has grown from 211 five years ago to 2418 in the present session. The number of students studying pure science is 7914 as compared with 7349 in the previous session, in agriculture 2546 as compared with 2085, and forestry 171 as compared with 129. The three largest universities —Berlin, München, and Leipzig—alone enrolled no fewer than 39 per cent. of the total German student body. Berlin remains at the top with an enrolment of 9686 students, as against 9242 last winter. This is followed by the University of München with 6905 students (6537 last year). It will be remembered that for the first time in the history of American universities the 7000 mark was passed in the last winter session, Columbia having a grand total of 7411 students. Six American universities have now more than 5000 students. In Germany, Leipzig is the third most numerously attended university, and has 4900 students. Bonn follows with 3846. Seven others have fewer than 3000 and more than 2000 students, and all but two—Greifswald and Rostock—have more than 1000 students. The figures show that all the universities, with the exception of Erlangen, Würzburg, and Giessen, have increased their attendance, the largest gains having been made by Halle, Kiel, Jena, Tübingen, and Rostock. Since 1909–10 Breslau has been passed by Halle, Göttingen by Freiburg, Heidelberg by Münster, Würzburg and Königsberg by Kiel. In addition to the 54,822 matriculated students, 3528 men and 1772 women are enrolled as auditors, giving a total of 60,122 individuals receiving instruction at the German universities, the largest number in the history of German higher education.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 23.—Sir Archibald Geikie, K.C.B., president, in the chair.—G. N. **Watson**: A theory of asymptotic series.—R. T. **Beatty**: The ionisation of heavy gases by X-rays.—W. **Wilson**: The variation of the ionisation with velocity for the β particles. Rays of different speeds were separated, by means of a magnetic field, from the heterogeneous beam given out by the active deposit from radium. The relative numbers of particles corresponding to the different speeds were determined by measuring the charges gained per second by an insulated copper vessel which was placed in the path of the rays, and was thick enough to absorb them completely. The corresponding ionisations were determined by a separate experiment, and were corrected for scattering of the rays by the walls of the ionisation vessel. The results obtained are as follows:—(1) The ionisation produced per cm. by β particles in free air varies inversely as the square of the velocity, between the limits examined. (2) The ionisation in a thick copper vessel is not connected with the velocity by any simple law, but can be approximately represented by $I=k(c-v)$, where I is the ionisation, v the velocity of the particles, and k and c constants.—C. G. **Douglas** and Dr. J. S. **Haldane**: The causes of absorption of oxygen by the lungs in man.—Prof. Arthur **Schuster**: The influence of planets on the formation of sun-spots. In this investigation the relative position in heliocentric longitude of a planet, and that point of the sun's disc where a spot is first observed, is taken as starting point. Spots first noticed within 60° of the eastern limb were excluded on account of the possibility or probability that these spots were formed in the invisible hemisphere, and only brought into view by the rotation. The total number of spots taken into account was about 4250. Imagine an observer placed on the sun. He might observe within each solar rotation, imagined to be divided into twenty-four hours, a planet rising, reaching a maximum altitude, called "planetary noon," descending and setting. The chief results of the investigation, dealing with the planets Mercury, Venus, and Jupiter, are as follows:—(1) More spots are formed when the planet is above the horizon than during the planetary night. The excess amounts to 4·5 per cent. in the case of Mercury, 6·4 per cent. in the case of Venus, and 1·5 per cent. in the case of Jupiter. The probability that this excess is accidental in the case of Mercury and Venus is about 1 in 7 and 1 in 17 respectively. In the case of Jupiter, the difference is no more than might be expected by the theory of chance. Not much importance is attached to each of these results taken separately, but if the theory of probability be applied to the combined results, an accidental coincidence of the excesses of one hemisphere over the other to the amounts indicated will not happen more than once in 1150 cases. (2) More decided results are obtained if the formation of spots during different parts of the planetary day are investigated. If the distribution were purely accidental, twice as many spots should form during the eight hours after the planet has risen as in the four hours before it sets. It is found, on the contrary, that during the latter interval the number of spots bears a proportion of 0·344, 0·349, and 0·347 respectively to the whole instead of 0·333, the planets always being taken in order of distance from the sun. The average excess here amounts to about 5 per cent. (3) The effect of the planets when compared in detail exhibits remarkable similarities. At an observing station on the sun, a strong minimum of spot formation is found to exist shortly before the planet rises; this is followed by a decided maximum in all three cases one hour after the rise. This is succeeded by a drop in activity, leading to a minimum, which occurs sooner with Mercury and Venus than with Jupiter, but this distinction may be accidental. The most remarkable feature in all three cases is the rapid rise from a secondary minimum, one hour after the planetary noon, to a pronounced maximum two hours later. This is followed by a drop lasting until the hour before the planet sets. The action after that and during the greater part of the planetary night is irregular, and might disappear if a larger quantity of material were available. The probability that all three planets should show their greatest activity at the same hour to the extent shown by the figures is 1 part in 130 million. The probability of the corresponding minimum in the planetary morning is not much less, so that taking the coincidence of both these factors into account, we may exclude the possibility of an accidental coincidence.

Royal Astronomical Society, March 10.—Mr. F. W. Dyson, F.R.S., president, in the chair.—Mr. Stratton gave an account of a paper by the late Mr. Bryan **Cookson**, a research on the aberration constant and the variation of latitude by means of the floating zenith telescope. The paper was left unfinished owing to the illness and death of the author, and had been completed and prepared for publication by Messrs. Hinks and Stratton. Their principal work had been to renew the search for systematic errors, and to prepare for press an account of the investigation. Sir David Gill spoke of the value of the constant of aberration obtained by Mr. Cookson. In reference to unexplained discordances, he suggested the possibility of a displacement of the zenith from meteorological causes.—Mr. Eddington gave a short account of a paper by Dr. W. **de Sitter** on the bearing of the principle of relativity in gravitational astronomy. It was assumed that mass or inertia had an electrical origin, and it had been shown that the motion of matter relatively to the æther is impossible, the author being of opinion that the æther hypothesis might be abandoned.—Mr. **Davidson** showed photographs of Jupiter's satellite VIII., taken at the Helwân Observatory, Egypt, when the planet was too far south for observation at Greenwich. There was a certain residual when compared with theory which might disappear if we assumed a small error in the tabular orbit. —Prof. **Turner** read a paper on the determination of the positions of reference stars and fundamental stars by photographic processes. He compared the superseding of visual by photographic observations to the substitution of the telescope for the old "sight" instruments, which Hevelius and Halley considered the most accurate. Sir David Gill pointed out difficulties and recommended caution, and the Astronomer Royal considered that photography could not render observations with the transit instrument unnecessary, though moving wires might be

superseded by photographic methods.—Mr. Reynolds showed photographs of Halley's comet taken by Mr. **Knox Shaw** at the Helwân Observatory, and pointed out that when the comet was near the sun the tail seemed formed from the envelopes round the nucleus, leaving a dark streak in the centre. When farther from the sun the dark streak was replaced by a bright one, the tail appearing to spring from the nucleus itself.

Linnean Society, March 16.—Dr. D. H. Scott, F.R.S., president, in the chair.—Mrs. D. H. **Scott**: New species of the fossil genus Traquairia.—R. S. **Adamson**: An ecological study of a Cambridgeshire woodland.

CAMBRIDGE.

Philosophical Society, March 13.—Sir George Darwin, K.C.B., F.R.S., president, in the chair.—Sir J. J. **Thomson**: Exhibition of photographs of Kanal Strahlen.—F. E. E. **Lamplough**: (1) Freezing point and depression of freezing point of sodium chloride. The depressions of freezing points of certain fused salts were measured by the platinum resistance thermometer. In the case of sodium chloride, the molecular depressions of the freezing point for most salts examined were nearly the same; that of sodium bromide, however, was half as great as the depression generally expected. In the case of calcium chloride as solvent, no regular results were obtained. Some unsuccessful attempts to measure directly the rate of migration of a coloured ion in fused silver nitrate, which led to the above research, were described. (2) A simple form of electric resistance furnace. A resistance furnace which may be easily set up, and is useful for many operations, such as the determination of freezing points, points of recalescence, and for slow cooling, annealing, &c., was described.—J. A. **Crowther**: Some experiments on scattered Röntgen radiation. Experiments have been made to investigate further the unsymmetrical distribution of scattered radiation already described by the author. The distribution has been shown to be unaffected by strong electric and magnetic fields. Experiments made near the primary beam have failed to detect any direct diffusion or irregular refraction of the primary beam itself.—H. E. **Watson**: Regularities in the spectrum of neon. The spectrum of neon, as previously measured by the author, has been examined with the view of finding some connection between the wave-lengths of the lines composing it. The existence of a number of triplets and quadruplets with constant oscillation frequency differences has been discovered, these being such that if A is the oscillation frequency of the first line, those of the other members are approximately A+1070, A+1429, and A+1847. In the case of the triplets, the second line is absent. These regularities apply only to the brightest lines of the spectrum, which fall naturally into three groups of diminishing intensity. The first group contains two very bright lines, three quadruplets, and three triplets; the second, two very bright lines, three quadruplets, and four triplets; and the third, two bright lines, three quadruplets, and five or six triplets. This type of regularity is not like that of helium, but is very similar to that part of the argon spectrum investigated by Rydberg. The investigation of the other lines is being continued.—J. C. **Chapman**: Fatigue and persistence effects in the production of secondary Röntgen rays. In these experiments a radiator was fully excited by X-rays, and its power of emitting secondary radiation was compared by a method only allowing 1/60oth second for recovery from any fatigue which might exist, with that of a radiator of the same material not previously excited. The results with zinc, copper, and aluminium fail to show that any such fatigue is present. In addition, there is no measurable persistence in the production of secondary radiation from aluminium 1/850oth second after the removal of the exciting beam.—J. E. **Purvis**: The absorption spectra of the vapours of some sulphur compounds. The substances examined were diethyl trithiocarbonate, diethyl thionthiocarbonate, diethyl monothio-oxalate and dipropyl dithio-oxalate. It was found that (1) each of the vapours exhibited a large absorption band in the ultra-violet regions of the spectrum; (2) each band was comparable with the band found in the alcoholic solutions, except as regards position; (3) there was no series of narrow bands produced as a result of the freer vibrations; and (4) the general absorption was shifted towards the less refrangible regions as the temperature and pressure were increased. A discussion of these results from a consideration of the orientation of the atoms as a closed ring.—J. C. **Chapman** and E. D. **Guest**: The intensity of secondary homogeneous Röntgen radiation from compounds. The results of these experiments indicate that the same intensity of secondary homogeneous radiation is produced whether the metal which gives rise to it is combined or not, or whatever its compound.

PARIS.

Academy of Sciences, March 20.—M. Armand Gautier in the chair.—M. **Schloesing,** sen.: The mother liquors from the salt marshes. A study of the mother liquors in the salt works of Goulette, in Tunis.—E. L. **Bouvier**: The decapod Crustacea collected by the *Princesse Alice* during the voyage of 1910. For the bathypelagic fauna described, the modification of the Richard wire, due to M. Bourée, has been found to be of great service.—M. Hilbert was elected a correspondant for the section of geometry in the place of M. Dedekind, elected foreign associate.—Sigismond **Janiszewski**: Continuities irreducible between two points.—René **Garnier**: Differential equations with fixed critical points and hypergeometric functions of higher order.—G. **Reboul** and E. Grégoire **de Bollemont**: The transport of particles of certain metals under the action of heat. If a sheet of platinum is placed at a short distance from a sheet of copper, and both heated to about 800° C., a black deposit is seen to be formed on the platinum. This was proved to consist for the most part of copper oxide. The magnitude of the deposit under varying conditions has been studied.—Samuel **Lifchitz**: Displacement of particles in the Brownian movement with the aid of very rapid sound vibrations.—E. **Caudrelier**: Researches on the constitution of the electric spark. The initial state of ionisation of the gap in certain cases has an influence on the discharge of transformers, but the action is very complex.—M. **Guilleminot**: The yield in secondary rays of X-rays of different quality.—A. and L. **Lumière** and A. **Seyewetz**: Differentiation by means of chemical development of the latent images obtained with emulsions of silver chloride and bromide. The special developer used contained sodium quinone-sulphonate and sodium sulphite in water. With this solution a latent image obtained in a gelatinochloride emulsion could be developed in some minutes, whilst no trace appeared in a gelatinobromide emulsion, even strongly over-exposed.—G. **Urbain** and C. **Scal**: Monovariant systems which admit of a gaseous phase.—Marcel **Dubard**: The genus Planchonella, its affinities and geographical distribution.—L. **Lindet**: The elective power of plant cells towards dextrose and levulose. Experiments on the behaviour of fungi towards dextrose and levulose confirm the results previously obtained with beetroot. Levulose is specially concerned with tissue formation, whilst dextrose is more decomposable and more easily split up by fermentation or burnt by respiration.—G. **André**: The conservation of saline materials in an annual plant; the distribution of the dry substance, total ash, and nitrogen.—M. **Marcille**: The mode of action of sulphur utilised for destroying oïdium. The author's experiments show that neither the volatilisation of sulphur nor its oxidation can be regarded as having any appreciable effect on the fungus. Sulphur appears to act upon oïdium solely by reason of the sulphuric acid which it contains ready formed.—M. **Mazé**: The influence of mineral substances which accumulate in the organs as assimilation residues upon the development of the plant. The absorption of colloidal organic materials by the roots.—Mme. Z. **Gruzewska**: Some characteristic properties of amylase and amylopectine.—M. **Tsvett**: A new plant colouring matter, thuyorhodine. The analysis of the winter pigment of Thuya has shown that there is no modification of the α and β chlorophyllines, but that there is a new red colouring matter formed, for which the name thuyorhodine is proposed. The method of extraction and properties of this substance are given in detail.—C. **Delezenne** and Mlle. S. **Ledert**: The action of cobra venom upon the serum of the horse. Its relations with hæmolysis. The experiments described lead to the conclusion that snake venom acts as a catalytic agent or a species of diastase capable of liberating at the expense of certain materials in the blood serum a substance endowed with true hæmolytic properties; this catalytic action is considerably limited

by the presence of blood corpuscles.—MM. **Doyon**, A. **Morel**, and A. **Policard**: Passage of the anti-coagulating nucleo-proteid of the liver into the blood. Comparative action of atropine according to the mode of penetration.—J. **Le Goff**: The mortality through diabetes in Paris and in the department of the Seine. In thirty years the number of deaths caused by diabetes has quadrupled. This may be due to a relative increase in the number of cases or to a higher rate of mortality per 1000 cases. The possible causes of this increase are discussed.—Jules **Courmont** and A. **Rochain**: Immunisation through the intestine. Antityphoid vaccination. These researches were carried out on the goat, guinea-pig, rabbit, and on man. No inconvenience results to the human subject by the use of this method.—Mme. **Fabre** and A. **Zimmern** and G. **Fabre**: The action of a continuous current on the diadermic penetration of radio-active substances.—MM. **Haret, Danne,** and **Jaboin**: A new method for the introduction of radium into the tissues. The radium ions are introduced into the organism by the electrolysis of a solution of a pure radium salt.—L. **Bruntz** and L. **Spillmann**: The origin of cancers of the skin.—G. **Guilbert**: The storm of March 13, 1911.—A. **Baldit**: Observations on the electric charges of the rain in 1910 at Puy-en-Velay.

DIARY OF SOCIETIES.

THURSDAY, MARCH 30.

ROYAL SOCIETY, at 4.30.—The Chemical Dynamics of Serum Reactions: Captain A. G. McKendrick.—Preliminary Note on a Method of Measuring Colour Sensations by Intermittent Light, with Description of an Unfinished Apparatus for the Purpose: Dr. G. J. Burch. F.R.S.—On Variation and Adaptation in Bacteria, illustrated by Observations upon Streptococci; with special reference to the Value of Fermentation Tests as applied to these Organisms: E. W. A. Walker.—On the Inter-relations of Genetic Factors: W. Bateson, F.R.S., and Prof. R. C. Punnett.—A Case of Gametic Coupling in Pisum: P. de Vilmorin and W. Bateson, F.R.S.—On Gametic Coupling and Repulsion in *Primula sinensis*: R. P. Gregory.

ROYAL INSTITUTION, at 3.—Surface Combustion and its Industrial Applications: Prof. W. A. Bone, F.R.S.

FRIDAY, MARCH 31.

ROYAL INSTITUTION, at 9.—Travelling at High Speeds on the Surface of the Earth and above it: Prof. H. S. Hele-Shaw, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Uses of Chemistry in Engineering: J. Swinburne, F.R.S.

SATURDAY, APRIL 1.

ROYAL INSTITUTION, at 3.—Radiant Energy and Matter: Sir J. J. Thomson, F.R.S.

MONDAY, APRIL 3.

SOCIETY OF ENGINEERS, at 7.30.—The Administrative Aspect of Water Conservancy: W. R. Baldwin-Wiseman.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Measurement of High Temperatures: C. T. Heycock, F.R.S.—Gum from the Bombax Malabaricum: P. P. Phillips.

ARISTOTELIAN SOCIETY, at 8.—The Place of Psychology in Philosophy: Dr. Wm. Brown.

VICTORIA INSTITUTE, at 4.30.—Indications of a Scheme in the Universe: Rev. Canon Girdlestone.

TUESDAY, APRIL 4.

ROYAL INSTITUTION, at 3.—Explorations of Ancient Desert Sites in Central Asia: Dr. M. A. Stein.

ZOOLOGICAL SOCIETY, at 8.30.—Demonstration of Nematode Parasites obtained from Animals in the Gardens: Dr. R. T. Leiper.—Contributions to the Anatomy and Systematic Arrangement of the Cestoidea. No. I. On some Mammalian Tapeworms: F. E. Beddard, F.R.S.—On the Natural History of Whalebone Whales: J. A. Mörch.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Improvement of Highways to meet Modern Conditions of Traffic: J. W. Smith.—Recent Development in Road-traffic, Road-construction and Maintenance: H. P. Maybury.

ROYAL SOCIETY OF ARTS, at 4.30.—The Commonwealth of Australia: Capt. R. Muirhead Collins.

WEDNESDAY, APRIL 5.

ENTOMOLOGICAL SOCIETY, at 8.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Analytical and Microscopical Examination of Compound Liquorice Powder: G. E. Scott-Smith and J. Evans.—(1) Note on Almond and Apricot Kernel Oils; (2) Constants of Chicken and Turkey Fats: Raymond Ross and J. Race.—(1) Note on Gerber's "Neusal" Milk Test; (2) Note on Abnormal Cotton Cakes: J. Golding.—A Further Contribution to the Question of Turpentine Substitutes: J. H. Coste and L. Myddelton Nash.

INSTITUTION OF NAVAL ARCHITECTS, at 11.30 a.m.—The Problem of Size in Battleships: Prof. J. J. Welch.—Twelve Months' Experience with Geared Turbines in the Cargo Steamer *Vespasian*: Hon. C. A. Parsons and R. J. Walker.—The National Experimental Tank and its Equipment: G. S. Baker.

GEOLOGICAL SOCIETY, at 8.—Trilobites from the Paradoxides Beds of Comley (Shropshire), with Notes on some of the Associated Brachiopoda (by Dr. Charles Alfred Matley): E. S. Cobbold—The Stratigraphy and Tectonics of the Permian of Durham (Northern Area): Dr. D. Woolacott.

ROYAL SOCIETY OF ARTS, at 8.—Wheels, Ancient and Modern and their Manufacture: H. L. Heathcote.

THURSDAY, APRIL 6.

ROYAL SOCIETY, at 4.30.—*Bakerian Lecture*: A Chemically-active Modification of Nitrogen produced by the Electric Discharge: Hon. R. J. Strutt, F.R.S.

ROYAL INSTITUTION, at 3.—Surface Combustion and its Industrial Applications: Prof. W. A. Bone, F.R.S.

LINNEAN SOCIETY, at 8.—On the Brown Seaweeds of the Salt Marsh: Miss S. M. Baker.—On the Genus Salicornia: Dr. C. E. Moss (History, Synonymy, and Phylogeny), E. J. Salisbury (Characters of the Species), and Dr. Ethel de Fraine (Anatomy).

RÖNTGEN SOCIETY (King's College), at 8.15.—Secondary Rays: Prof. Barkla.—An Improvement in High Tension Discharge Apparatus: Prof. Wilson.

INSTITUTION OF NAVAL ARCHITECTS, at 11.30 a.m.—Diesel Engines for Sea-going Vessels: J. T. Milton.—The Influence of Longitudinal Distribution of Weight on the Bending Moments of Ships among Waves: F. H. Alexander.—Considerations affecting Local Strength Calculations of Ships: J. Montgomerie.—At 7.30: The Acceleration in Front of a Propeller: R. E. Froude.—An Investigation into the Stresses in a Screw Propeller Blade: Engineer-Lieutenant A. Turner.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Wireless Telegraphy Working in Relation to Interferences and Perturbations: J. E. Taylor.

FRIDAY, APRIL 7.

ROYAL INSTITUTION, at 9.—A New Method of Chemical Analysis: Sir J. J. Thomson, F.R.S.

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