THURSDAY, NOVEMBER 26, 1908.

EXTINCT FRENCH BIRDS AND AMERICAN TORTOISES.

Les Oiseaux des Phosphorites du Quercy. By C. Gaillard. Annales de l'Université de Lyon, nouv. série: I., Sciences, Medicine, Fascicule xxiii. Pp. 1–178; plates i–viii. (Lyon: A. Rey et Cie.; Paris: J. B. Baillière et Fils, 1908.)

The Fossil Turtles of North America. By O. Perry Hay. Pp. iv+568; plates i–cxiii. (Washington: Carnegie Institute, 1908.)

WHEN working at the vertebrate remains from the phosphorite beds of Central France, the late Dr. Filhol made over the whole collection of bird-bones from these deposits in his possession to his colleague Prof. Milne-Edwards, by whom they were described and named in a memoir communicated to the second Ornithological Congress held at Budapest in 1891. Almost at the same time the present writer was engaged on a catalogue of the fossil birds in the British Museum, and as this was published a few months earlier than the report of the congress, his names antedate those of his French colleague. With these works as a starting-point, Dr. Gaillard has for several years past been endeavouring to amplify and consolidate our knowledge of the bird fauna of the phosphorites, and the memoir now before us is the result of his labours. Not only has a very large number of actual specimens passed through his hands, but he has obtained plaster-casts of the phosphorite bird-bones from almost all the museums in Europe, thus enabling him to carry out his task in a manner which would otherwise have been impossible.

Unfortunately, all the bird-remains from the French phosphorites occur in the form of isolated and frequently imperfect bones, so that it is in many cases a matter of extreme difficulty to associate bones of one part of the skeleton with species or genera passed on those from another portion. In this matter the author appears, however, to have been wonderfully successful.

As the result of his labours, Dr. Gaillard is enabled to identify more than forty species of birds from the phosphorites, which are referable to five-and-twenty genera. Although these represent only a small percentage of the bird-fauna of that epoch, they are sufficient to indicate its extremely interesting character. The main interest is concentrated on two points:—first, the indications of affinity between groups now more or less widely sundered; and, secondly, the remarkable evidence of the mingling of what are at present exclusively African with exclusively South American types. It should be added that, with very few exceptions, the genera are extinct.

As regards the first point, it must suffice to mention that the genus described as Strigogyps appears to present structural resemblance to the owls, on the one hand, and to the vultures (and the diurnal birds-of-prey generally) on the other.

In connection with the second point, it is most noteworthy that while secretary-birds, sandgrouse, the game-birds of the genus Palæocryptonyx, and rollers and turacos (Geranopterus and Dynamopterus) give to the fauna a notably African and Indo-Malay facies, on the other hand, a number of types, such as Plesiocathartes (a relative of the condors), Orthocnemus, Elaphrocnemus, Filholornis, and Archætrogon (which respectively resemble the chajas, the hoatzin, the guans, and the trogons) present an equally marked approximation to the modern avifauna of South America. Such resemblances form one more link in the chain connecting the Tertiary fauna of Africa with that of South America, and the varied materials of which the links in that chain are respectively constructed render it difficult (despite the persistent efforts that have been made to explain away the force of the evidence) to give any satisfactory explanation of the resemblance other than a former land-connection between the two continents across the Atlantic. For his labours Dr. Gaillard merits the thanks of all naturalists.

To an English ear the title of the second of the two memoirs quoted at the head of this review scarcely gives an adequate idea of its contents, as in this country we are accustomed to restrict the term turtle to the reptile so well known at City feasts and its immediate relatives, whereas on the other side of the Atlantic it seems to be taken to include tortoises and terrapins. In yet another respect this bulky quarto volume is more than it seems, since it contains, in addition to its proper subject, an excellent dissertation on the structure, taxonomy, and distribution of the Chelonia. In this respect it may be noticed that the author adopts the suggestion made several years ago by the present writer as to Chelyidæ (instead of Chelydidæ) being the proper form of the family name derived from Chelys.

The study of American fossil chelonians commenced with Leidy in 1851, since which date an almost continuous advance has been made, with a specially large output of work during the last few years. In the present volume no fewer than 266 species are recognised, of which 76 are described for the first time. The author has made a special point of endeavouring to examine, whenever possible, the type-specimens of each species; in some cases these have, however, been irretrievably lost, and in others mislaid.

A special feature of American fossil Chelonia is the number of species belonging to the group termed by the present writer Amphichelydia, of which the typical representative is the British Jurassic genus Pleurosternum. In North America the group is very largely represented by the allied family Bænidæ, which shows greater specialisation in the structure of the vertebræ of the neck and of the bony buttresses connecting the lower with the upper shell. Another very characteristic family of American chelonians is the Cretaceous Toxochelyidæ. The author furnishes some interesting suggestions with regard to the phylogeny of the Chelonia, and likewise discusses their supposed relationship to the Sauropterygia.

Almost the only fault we have to find with the volume is the absence of a good table of contents, or

of a classified synopsis, whereby the serial positions of all the genera and species might be seen at a glance. In all other respects we heartily congratulate Mr. Hay on the completion of such a valuable and heavy piece of palæontological work. R. L.

APPLIED GEOGRAPHY.

Applied Geography. By Dr. J. Scott Keltie. Pp. viii+199. Second edition. (London: G. Philip and Son, Ltd., 1908.) Price 2*s.* 6*d.*

SINCE the appearance of the first edition in 1890, this work has been recognised as an authoritative and coherent statement of human industry and progress from the point of view of geography. The demand for a new edition has provided the opportunity for a thorough revision of the work, involving the addition and consideration of new material now available; and the result is a volume in which the dry bones of what is known as commercial geography are articulated so that their relationship to each other, and to the life of man, can be clearly distinguished.

It is sometimes said that geography is not a science; and in so far as it deals only with the collection of facts there is justification in the remark. No branch of natural knowledge can claim a place in the hierarchy of the sciences until the facts with which it is concerned have been classified, generalised, and shown to lead to productive principles. In the past, geographers themselves have not realised that this is the ultimate aim and intention of scientific investigation, and have mostly been content with the accumulation of facts without attempting to construct an organic system from the material. Few have worked on Baconian principles with the object of discovering by systematic inquiry the true significance of the facts.

That definite principles can be deduced from geographical material is illustrated by many statements in Dr. Keltie's book. Consider, for instance, the relation of rainfall to population and to animal and vegetable commodities. Neglecting the local influence of minerals, manufactures, and transport, it may be said that population is relatively low where the rainfall is deficient or excessive, and high where rainfall favours the growth of grass, grain, and other food products. The density of population in many parts of India is in exact proportion to the rainfall, and the number of sheep that can be grazed per square mile in Australia also varies with the rainfall, being at the rate of twenty-two sheep per square mile for every inch of rain above nine inches. Wheat also shows a similar relationship, the harvest in South Australia being on the average 12·5 bushels per acre for a rainfall of 18·5 in., 10 bushels for 15 in., and 6·5 bushels for 13·5 in. An extra inch of rain in the season would thus represent in South Australia a gain of about 10,000,000*l.* These are examples of geographical principles derived from the coordination of meteorological and economic data by scientific inquiry.

Though Dr. Keltie gives many similar instances of the relation of various factors of climate to the products and commercial value of a country, he omits to mention that the distribution of rainfall through the year is more important than the actual amount. Grass lands require not only an annual rainfall of about thirty inches, but also a distribution of this quantity throughout the year at intervals not exceeding a month. Wheat-growing also depends upon the distribution; and with some varieties can only be successfully carried on where the percentage of winter rains is largely in excess of that for the summer months. Given the meteorological conditions and the character of the soil in any part of the world, it is possible to state what variety of wheat will come to maturity there, or whether the region is unsuited to wheat culture. Here then we have the facts of meteorology, agriculture, botany, and economics, leading to a conclusion of high significance to the human race; and it is only one of many examples of applied geography.

"From neglect or ignorance of known geographical conditions," says Dr. Keltie, "or from taking no steps to counteract them, the most serious disasters to crops and flocks were of constant occurrence in Australia, though, recently, improvements have been introduced. It is, therefore, the most short-sighted policy imaginable in a young colony to neglect the survey of its territories; public money cannot be better spent than in the maintenance of an efficient survey service, and a carefully selected network of meteorological stations."

Man is, of course, able to modify natural conditions or adapt his demands to them. Irrigation has converted barren land into fertile fields; insanitary and malarious regions have been rendered habitable as the result of biological observation and experiment; and hindrances to commerce have been overcome by engineering enterprise. In this connection, the author says, "By deafforesting here and planting there, we have been able appreciably to modify rainfall, and therefore climate." There is, however, little evidence for this belief. No amount of afforestation or deafforestation will modify the direction or frequency of rain-bearing winds; forests do not, in fact, affect greatly the rainfall of a region, but they assist in conserving the moisture actually received, and when they are destroyed the soil may be washed away or the loss by evaporation and percolation increased.

When referring to the relation of man himself to the resources around him, Dr. Keltie remarks, "Had a different type of man from the Chinese, men like ourselves, possessed that vast territory, how different the results would have been." The explanation of undevelopment is not, to our mind, due so much to the type of man as to the beliefs and traditions accepted by the people. The Chinese are as industrious and ingenious as any Western race, and when they awake to the knowledge that the wisdom of the past is insufficient for the needs of to-day and the future they will make even more substantial advances than Japan has done. Until the study of science had been transferred from books and authority to nature by observers like Paracelsus, Leonardo da Vinci, Galileo, Gilbert, and Gesner, Europe was in the dark ages, and the conclusions of Aristotle, Ptolemy, and other sophists were regarded as the final standard of judgment by which the validity of natural fact or theory

should be tested. Only when independence of observation and thought had been secured by the pioneers of modern science was progress possible. Any race which places the wisdom of its early fathers above the work of its sons, which regards past knowledge as sufficient for future salvation, must remain stagnant. Mr. G. G. Chisholm accurately expresses the application of this fact to China in the "International Geography" in the following words:—

"All Chinese institutions concur in impressing on the people respect for authority and the established order. None is more influential in this respect than the system of examination, for all the examinations test merely the knowledge of the ancient Chinese classics first systematised by Confucius, and give no encouragement to the spirit of independent inquiry."

It would be easy to select numerous other points from Dr. Keltie's book for description or comment. The six chapters in the volume deal respectively with general considerations, geography applied to commerce, the geography of Africa in its bearings on the development of the continent, the British Empire, some common commodities, and the unstaked or unexplored parts of the earth. Each chapter is rich in information, and the style of the whole work is far removed from that of books in general on commercial geography. Our only regret is that a book which embodies so many facts of importance should be published without an index.

QUAIN'S ANATOMY.

Quain's Elements of Anatomy. Edited by Prof. E. A. Schäfer, F.R.S., Prof. J. Symington, F.R.S., and Dr. T. H. Bryce. In four vols. Vol. i., Embryology. Eleventh edition, by T. H. Bryce. Pp. viii+275. Price 10*s.* 6*d.* net. Vol. iii., Neurology. By Prof. E. A. Schäfer, F.R.S., and Prof. J. Symington, F.R.S. Part i., containing the General Structure of the Nervous System and the Structure of the Brain and Spinal Cord. Price 15*s.* (London: Longmans, Green and Co., 1908.)

WHEN in 1828 Jones Quain, "Lecturer in the Medical School, Aldersgate Street," published, as a modest volume, the first edition of his "Elements of Anatomy," he could scarcely have hoped that eighty years later it would still remain the standard work of its kind in the English language, and that it would take and keep a place as a cosmopolitan text-book; and yet if the truth must be told, very little of Quain remains in the work which now passes under his name. In the original edition a chapter of some 4000 words told the story of the development of the human body; now, in the eleventh edition, embryology requires a special editor and a special volume containing more than 100,000 words and considerably more than 300 illustrations.

The new edition is marked by a number of changes, some of them of considerable magnitude. Chief amongst these is the change in the editorial staff, and it will be with very sincere regret that anatomists, not only in England, but in every country, will see that Prof. George Dancer Thane's name no longer appears on the title-page. In width and accuracy of anatomical knowledge, in clearness of statement and draughtsmanship, he has no compeer amongst present-day anatomists. Dr. T. H. Bryce, lecturer in anatomy in Queen Margaret College, Glasgow, has joined the editorial staff, replacing Prof. Schäfer as editor of the volume dealing with embryology. The present edition is to appear in four volumes, of which the volume by Dr. Bryce, containing the embryology, is the first; general and visceral anatomy will constitute a second, the nervous system and sense organs a third, the remaining subjects being grouped together in a fourth volume. It is to be hoped that, as in the last edition, each of these remaining volumes will be issued in separate parts, for big volumes are very inconvenient for reference and use. In the present edition the "general introduction" has been wisely omitted, for it shared the character of nearly all introductory chapters in being unintelligible until the whole contents of the work had been mastered and appreciated by the student. It is also to be hoped that the precedent set by the present volume of referring readers to foreign text-books for the literature of the subjects dealt with is not to be followed in the other volumes, although it must be admitted that Dr. Bryce does supply references to important papers of more recent date.

In preparing a new edition of "Embryology," Dr. Bryce's task was not an easy one, and he has done it well. In the eighteen years which have elapsed since the last edition was published there has been a remarkable extension in every phase of our knowledge of the development of the human body. Especially is this true of the early stages in the development of the human embryo and of its attachment to the uterus. The ova described by Leopold, Peters, Beneke, and Graf v. Spee, represent earlier stages than were known when the last edition was published, and it is not improbable that the specimen described by Drs. Bryce and Teacher since the present edition was ready for publication represents a younger stage of the human embryo than has been hitherto seen. Our conception of the manner in which the ovum becomes embedded in, and attached to, the uterus has undergone a complete revolution. The elaborate changes undergone by the nucleus of the cell, especially those nuclear changes which preceed the formation of genital cells, have been recently investigated by a large army of workers, a line of research, if one may judge from the space here devoted to it, with which Dr. Bryce has a particular sympathy. On the other hand, later stages of development are dealt with very meagrely, and the descriptions of the origin of such organs as the lungs and prostate are far too slight to be of real use. It is strange, too, that a book which is primarily intended for medical men should provide so imperfect an explanation of the many malformations to which the various parts of the human body are liable.

A study of the text makes it very evident that Dr. Bryce has regarded a full and accurate description.

of observed and verified fact as the chief duty of the editor of a work such as Quain, but however much one may applaud his aim it cannot be said that his style is a happy one for descriptive purposes. The following instance may be selected from p. 251, and it is by no means an isolated example :—

"The formation of the vertebral body is brought about as follows: the notochordal sheath becomes prolonged dorso-ventrally into a kind of septum, which extends between the primitive plates and separates the loose mesenchyme, alluded to above, into a right and left moiety; at the same time the superficial layers of the intervening tissue become condensed into a continuous lamella uniting the plates and enclosing the looser tissue on each side of the septum. This enclosed tissue now becomes converted into cartilage. There are necessarily at first two chondrogenetic centres, but soon the septum becomes implicated, and the notochord is enclosed in a continuous cartilaginous ring."

Now the body of a vertebra is a very simple thing, but the reviewer, after reading and re-reading Dr. Bryce's description, has been unable to obtain a mental picture of how it is formed, and most students will find the same difficulty. The first essential of a descriptive text is that it must be clear and simple, and very frequently Dr. Bryce's text has neither of these merits. As regards the interpretation of fact and statement of theory, the editor has rightly assumed an impersonal and non-committal attitude; he leaves the reader free to make his own choice. He has given an impartial representation of the work and theories of most embryologists, with one exception; in describing the origin of primitive sex cells, not a word is mentioned of the arduous and pioneer work of Dr. Beard, of Edinburgh.

A large number of new illustrations have been added, many of those by Dr. Bryce, such as Fig. 136, showing a stage in the development of the nerve roots, being of real merit, but on the other hand it must be admitted that the illustrations prepared from photographs of sections of the embryo and fœtus are almost of no value whatsoever, for it is only the expert who can make any use of such sections, and these they have already by the score in their store cupboards. In exercising the rights of a reviewer, perhaps the many merits of this new edition have been sacrificed to an enumeration of what the reviewer regards as demerits, and it is only just to Dr. Bryce to mention in conclusion that the former far outweigh the latter.

In part i. of vol. iii. Profs. Schäfer and Symington have produced a standard work on the structure of the central nervous system. The combination of physiologist and anatomist has had the happiest result, securing at once an authoritative representation of what is known of the finer structure as well as the gross anatomy of the brain and spinal cord. The volume is richly and wisely illustrated, many of the new figures by Prof. Symington being of great merit. One has only to compare it with the corresponding volume of the last edition to realise the extraordinary progress that has been made during the last fifteen years in every part of our knowledge of the brain.

A. K.

NATURAL AND SYNTHETIC CAMPHOR.

La Canfora Italiana. By Prof. Italo Giglioli. Pp. 292. (Rome: Tipografia Nazionale di Giovanni Bertero e. C., 1908.)

THE commercial production of camphor is, at the present time, in a very interesting phase. The true camphor tree, *Cinnamomum camphora*, one of the Lauraceæ, occurs wild in eastern Asia, Formosa and Japan yielding the greater portion of the world's supply. After the Chino-Japanese War, the Japanese, by the acquisition of Formosa, gained the practical control of the total output, and camphor production was made a Government monopoly, first in Formosa, but afterwards in Japan as well. Within a short space of time camphor rose enormously in price, causing serious concern in the industries employing camphor, particularly the manufacture of celluloid, which uses up the greater portion of the world's supply.

This condition of affairs, and the possibility, as a further development, that celluloid manufacture might also become a Japanese monopoly, gave a great impetus to research with the object of preparing camphor artificially or of finding some efficient substitute. The chemists proved equal to the occasion, and camphor was prepared synthetically by using turpentine oil as a raw material, the successive products in one of the processes being the terpene pinene, pinene-hydrochloride, camphene, bornyl acetate, borneol, and finally crude camphor, which, when refined, yields camphor identical in all its properties with the natural product except that it is optically inactive, a difference, however, of no economic importance.

Not only has the synthesis of camphor been successfully accomplished, but the synthetic camphor can be prepared at a sufficiently low price to enable it to be a formidable competitor to the natural product, and it is at present a moot point as to whether the natural or artificial camphor can be produced the more cheaply. Natural camphor in the past was obtained by the destructive method of felling mature trees, cutting up the wood into chips, and subjecting these to distillation. The experiments carried out during recent years at the Royal Botanic Gardens, Ceylon, and elsewhere have shown that this is not essential, and that camphor can be obtained from the young twigs and shoots, and it is possible that by coppicing the plant instead of allowing it to assume its normal tree habit much greater yields can be obtained per acre, and the cost of production considerably reduced. Synthetic camphor, on the other hand, unless other large supplies of suitable hydrocarbons become available, will remain dependent on turpentine oil, which during recent years has shown a tendency to increase in price.

The Japanese monopoly not only encouraged researches aiming at the artificial production of camphor, but also gave a stimulus to the cultivation of the tree in other countries, the work in Ceylon already referred to being a case in point. Prof. Giglioli, in the volume under review, deals with this aspect of the question as regards Italy. Many people, asso-

ciating the camphor tree with its close ally, the cinnamon (*Cinnamomum zeylanicum*), are inclined to regard camphor as a product of tropical, or at any rate distinctly hot, countries. As a matter of fact, it is rather a plant for subtropical and warm temperate regions, and it is noteworthy that Mr. H. N. Ridley, F.R.S., in a recent number of the Agricultural *Bulletin of the Straits Settlements and Federated Malay States*, records that the finest camphor tree he has ever seen outside Japan was one growing near Fowey, in Cornwall. The tree thrives in many parts of Italy, where the average yield of camphor from green leaves is given by Prof. Giglioli as 1·20 per cent., which is very similar to that obtained in Ceylon, and considered sufficient for commercial purposes.

Prof. Giglioli enters fully into the history of camphor, its cultivation in various parts of the world, describes the mode of extraction and preparation of the product, shows by chemical and industrial tests that camphor of good quality can be produced in Italy, and is of opinion that a successful industry there is quite feasible. Finally, it is worth noting that the book has as footnotes and in a special appendix very full bibliographic references to all aspects of the subject. W. G. FREEMAN.

POPULAR GARDENING.

Garden Rockery: How to Make, Plant, and Manage it. By F. G. Heath. Pp. vi+173. (London: George Routledge and Sons, Ltd., 1908.) Price 1*s*.

THE object of this popularly-written book is frankly stated by the author in the preface as "to show the worn and worried man, or woman, of business how to obtain a maximum of enjoyment with a minimum of preliminary attention and consideration." It appears to be an attempt to induce those who have but little time, or inclination, for gardening, to take up a branch of that art which in our opinion demands sympathetic treatment and constant ungrudging attention to small details of cultivation.

We sympathise with any efforts that are made to popularise gardening, but it is to be feared that the contempt for high cultivation expressed in many of the author's remarks is scarcely likely to be helpful to those who may be desirous of maintaining their rockeries in a condition that will afford most pleasure to their owners. Eden may, or may not, have "yielded food and fruit not, at any rate, inferior in quality to that of our own times," but whatever may be the truth in regard to such a statement, we feel sure that, with very few exceptions, the fruits of the earth, as we know them, are much improved by cultivation, including in this term the processes of cross-breeding and selection of varieties. But the author declaims against the "vicious practice" of developing single into double flowers, or of making the naturally white flower blue, red or yellow.

"Nature's variations in form and colour," he says, "are endless, and should suffice for the most exacting horticultural taste, without the display of cunning efforts to alter her wise disposition of form and colour."

All this, it would appear, has little to do with the making or planting of rockeries, but this book discusses such questions before asking in the third chapter "What is Rockery?" Subsequent chapters give directions as to what materials to use in the formation of a rockery, and describe how rocks are generally seen in a state of nature, whether of volcanic origin or the result of the "weathering" of exposed rocks.

A list of British ferns is given, and some of the commoner flowering plants that may be cultivated on rockeries, and the text is relieved with forty-five illustrations which have been reproduced from photographs. There are several mis-spellings in the lists, and whilst many of the terminations of the specific names appear to have been purposely brought into conformity with the recommendations of the Vienna Conference, there is no consistency in this matter.

In one of these lists *Linaria cymbalaria* is described as growing 3 inches high, but upon a rockery it is surely more useful for this species to *trail* 24 inches. The author speaks of *Primula vulgaris* as the *wild* plant, and suggests that it is the progenitor of such species as *P. farinosa, P. scotica, P. floribunda, P. auricula*, and others, but these plants are just as *wild* as *P. vulgaris*, and we are unable to discover the evidence upon which the author bases his deduction. Of *Linnaea borealis* (mis-spelt *Linnea*) the author timidly states that it is believed this plant was named after Linnæus, because it was understood to be a favourite plant of his! The plant was undoubtedly named by Gronovius, not only after the great botanist, but at his request.

FLOREAT CANADA!

Canada's Fertile Northland. Evidence heard before a Select Committee of the Senate of Canada, 1906–7. Edited by Captain E. J. Chambers. Pp. 140; with illustrations and a volume of maps. (Ottawa: Government Printing Bureau, 1908.)

WITH characteristic foresight, the Government of Canada has collected such information as is available regarding the possibilities of the northern regions of the dominion as a field for immigration. The title of these cloth-bound volumes is attractive, and certainly optimistic. The evidence of those who know the country, given with simple directness, does not emphasise its fertility, and it soon becomes obvious that a large part of the 1,637,559 square miles discussed has emerged so recently from the Glacial epoch that soils have only just begun to form. It is fair to add that a very large part remains unsurveyed and unprospected.

The handsome maps provided record geographical advances made in quite recent times, and there are still some inviting areas worthy of a Sven Hedin or a Nansen, skilled in the lore of stream and forest. For the agriculturist there are many assurances that potatoes are not cut off by frosts in summer; but the raising of wheat is naturally more precarious. Mr. Tyrrell (pp. 89–93) describes a forest-belt south-west of Hudson's Bay as suitable for agriculture, owing to the warm bright summers. "The snow

leaves the ground in May, . . . and the frost does not appear in the fall until about September 20." Mr. F. S. Lawrence's experiences with wheat in the Peace River country (latitude 58½° N.) provide valuable information (pp. 101–105). Spring wheat has fully matured here in eighty-six days. The word "muskeg" is used freely by witnesses, and is not very lucidly explained on p. 123; it appears to be a poor wet kind of soil, which may be as much as 6 feet in depth, and is generally to be avoided.

The simple and unvarnished statements of the various witnesses furnish a manly contrast with the prospectuses of company-promoters, and from them we gather that timber and minerals will probably form the main attraction for new settlers. The evidence of Mr. A. von Hamerstein (pp. 36–43) is full of delightful touches. Like Mr. Lawrence, he speaks highly of the Peace River valley, but remarks sadly of the climate of the Athabaska district:—"They say it may change, but up to this time it has not changed." He mentions places where small areas of good soil occur, but says that at Fort Chipewyan "a little garden stuff is raised, on soil brought there by the Sisters in pails." His account of the moral defects of the wolverine, among which is an objection to taking poison, should delight the naturalist. This animal has hung behind in the march of evolution, for "the horse and other animals have developed, but the wolverine has kept his original shape."

We close the book with renewed admiration for those who are engaged in making Canada. There is to be no "boom"; no hardships are to be concealed; the settler is invited to follow the trapper and the Indian, and to see if he can make more out of this enormous tract than they have done. In latitudes below those of Stockholm and the Orkneys, or even as far south as Belfast or Newcastle-upon-Tyne, he is called on to meet the rigours of a continental winter. But he is encouraged by diagrams showing the length of summer days and the shortness of summer nights, themselves as starless as the days; and the cover that encloses so much plain speaking is labelled "Canada's Fertile Northland." Success should surely come to those who have this high faith, and tell no untruths while spreading it.

G. A. J. COLE.

OUR BOOK SHELF.

The Functional Inertia of Living Matter. A Contribution to the Physiological Theory of Life. By Dr. D. F. Harris. Pp. xi+136. (London: J. and A. Churchill, 1908.) Price 5*s.* net.

THE book before us deals, mainly from the physiologico-philosophical standpoint, with a property of living matter which has excited the interest of biologists, and which, indeed, has been the field, not only of much speculation, but also of much experiment. The fact that certain forms of living matter, whether they are integral parts of a highly-developed and differentiated organism, or whether they consist of more or less apparently undifferentiated protoplasm, either do not respond at all or respond only after varying intervals of time to certain stimuli has long been known, and the condition of the protoplasm in question during this time has long been investigated by biologists. We use the term *apparently* undifferentiated advisedly, since, as has been often pointed out, it is sometimes a matter of extreme difficulty to know whether, when dealing with the infinitely simple, we are not really dealing with the infinitely complex.

Dr. Harris's brochure is an elaborate, for the most part literary, examination of this subject, and quite apart from the conclusions he draws from his investigations is of considerable interest, and will well repay the reading. In a short review of this nature it would be quite impossible to consider in even approximate detail the facts related in the book, the observations upon which they rest, or the interpretations to which they are open. The property of living matter upon which the non-response to stimuli or the so-called latent period preceding response depends is termed by the author functional inertia. He at first introduces this term, so well known and accurately applied by physicists, somewhat apologetically, as perhaps complicating physiological nomenclature; in reviewing the literature of the subject, however, he finds many precedents for the use of the term inertia as describing the resistance offered by living matter to any change in its condition. Perhaps to others, as was actually the case to the reviewer, the first cause to occur to one's mind, of failure on the part of living matter to react to stimuli, is fatigue. Dr. Harris discusses fatigue and its bearing upon functional inertia.

In a short summary the author postulates that functional inertia is as fundamental, primary, and primitive a property of protoplasm as its opposite, irritability, and that the phenomena of vitality cannot be adequately conceived in one of these properties exclusively.

We would conclude our remarks upon Dr. Harris's work by simply saying that it is interesting and suggestive, and well worthy of careful perusal, not only by those interested in the many observations relating to the phenomena of the latent period accompanying the stimulation of living matter, but also by those interested in the larger if less accurately conditioned field of biophysical philosophy. F. W. T.

The Elementary Theory of the Symmetrical Optical Instrument. By J. G. Leathem. Cambridge Tracts in Mathematics and Mathematical Physics, No. 8. Pp. vi+74. (Cambridge: University Press, 1908.) Price 2*s.* 6*d.* net.

MAKING a Cambridge tract is a feat, performed in this instance with a finish of which the writer may well be immensely proud. The Gauss theory of refraction through a series of media bounded by spherical surfaces having the same optic axis admits of being handled with that deftness which is the most marked characteristic of the Cambridge mathematician, and which is here admirably exemplified. All the essentials of the Gauss theory are condensed into some fifty octavo pages, and so clearly set out that the average mathematical student should have no difficulty in absorbing the whole in a few hours, to forget it, not impossibly, with equal readiness.

For, in spite of some reference to concrete instruments and some remarks on certain facts of observation not generally recognised, the book remains—unavoidably, perhaps, in view of its aim and its limited space—essentially academic. It will be grateful to the student, and appreciated by the mathematician already familiar with the matter it presents, but we fear there are few designers of symmetrical optical instruments, in this country at least, to whom it will appear attractive—in spite of the avoidance of the now familiar continued fraction. In its very

conciseness it assumes a mathematical training which many of them have never had, and which is much more difficult to acquire even than a knowledge of continued fractions. In some measure, no doubt, it is they who are at fault, and certainly they are the losers.

Such criticism is, obviously, to some extent beside the mark. But it recurs inevitably with the appearance of each fresh Cambridge text-book on geometrical optics. An excellent book; but if only the author had written something which would more obviously advance the practice of optics and the manufacture of optical instruments!

To our mind, the most interesting part of this admirable little tract is contained in sections ix. and x. Section ix. gives a simple and concise explanation of the occurrence and physical importance of von Seidel's five third-order aberrations, very palatable and nutritious for the mathematician! And in section x. is to be found an up-to-date abstract of the elementary theory of the characteristic function, which will be helpful to many. The contents of the tract will have been sufficiently indicated if we add that the titles of sections vii. and viii. are respectively "Entrance and Exit Pupils" and "Chromatic Defects of the Image."

In conclusion, we venture to assert that Mr. Leathem's exposition of the Gauss theory will be adopted as the most serviceable by every optician who takes the trouble to become familiar with this book, and we would add that he will find his trouble well repaid.

Hints for Crystal Drawing. By Margaret Reeks. With a preface by Dr. John W. Evans. Pp. xx+148; with 5 figures and 44 plates. (London: Longmans, Green and Co., 1908.) Price 3*s.* 6*d.* net.

THE importance of accurate drawings of crystals in any crystallographical discussion was recognised by Haüy, the father of crystallography, but the principles upon which such drawings should be made were not clearly explained until the publication by Haidinger of his well-known paper among the memoirs of the Wernerian Society many years later. It is essential that edges which are parallel on the crystal should be represented by parallel lines on the drawing, a condition which entails the supposition that the eye views the crystal from an infinite distance. Consequently, in such a special case as a skeletal cube in which the edges are drawn of equal thickness, the eye would be puzzled as to which is the front, and the cube would appear constantly to be turning inside out; but, as a rule, no such ambiguity would arise. It is also important that the directions of the edges in the drawing should be determined with mathematical precision, even when the crystal is shown in perspective.

In this book Miss Reeks presents Naumann's modification of Haidinger's method. She explains how the projection of the fundamental axial system may be found graphically in the six different systems, and discusses many examples, all of which are illustrated by full working details. It might have been made clearer on p. 7 that the particular rotations employed to give the customary perspective were adopted, not haphazardly, but because the tangents of the angles have the simple ratios given. The student who carefully reads this book cannot fail to master the principles of the method with which it deals; the author's exposition is lucid, and the illustrations, which have been reproduced from her own drawings, are admirable. It may, however, be questioned whether in most cases it be not quicker and easier to draw a crystal from a stereographic or a gnomonic projection by the method devised by Goldschmidt, which was fully explained to English readers by Penfield in one of his illuminating papers.

House-painting, Glazing, Paper-hanging, and White-washing. A Book for the Householder. By A. H. Sabin. Pp. v+121. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 4*s.* 6*d.* net.

MR. SABIN may be known to some readers of NATURE as the author of a pleasantly discursive volume on the technology of paint and varnish. In the present little work he expounds one branch of that technology for the benefit of householders. He describes simply and plainly how to use various preservative coatings in the protection and embellishment of ordinary dwelling-houses.

There is no chemistry in the book, but a chemist tells of the materials to use—of the white lead, turpentine, oil, driers, putty, varnish, and whitewash—as also of the points to note and the pitfalls to avoid in applying the preparations. Whether many householders will benefit is perhaps doubtful. Possibly, in America, where isolated homesteads are more frequent, the householder may be more often than in this country tempted to do his own painting and papering. Here it would rarely seem worth while. There is a proverb about spoiling a horn and not making a spoon, and probably the unskilled user of paint, paper, and varnish would generally do well to get his work done better by a trained craftsman. Even so, however, there is no harm in knowing what are the best materials, how to get the most durable results, and the general why and wherefore of the matter. For anyone who contemplates either trying his own skill or overlooking the proceedings of a workman, Mr. Sabin's book appears, as he claims in the preface, to "set forth fairly safe and sound practice."

C. S.

Mountain Panoramas from the Pamirs and Kuen Lun. Photographed and annotated by Dr. M. Aurel Stein. Pp. 36. (London: Royal Geographical Society, 1908.)

WHEN Dr. Stein visited Central Asia in 1900–1, to explore the ruined cities of Chinese Turkestan, he included in his equipment a phototheodolite, with which a number of panoramas were taken. These not only served as a basis for the production of a map, but gave an excellent idea of the character of the country passed through. The Royal Geographical Society has now published a selection from them which will prove of interest to both geographers and geologists. A feature common to a large number of the photographs is the manner in which they illustrate the progressive desiccation of the region lying north of the Himalayas; the sharp crested ridges, separating deeply-cut valleys, produced by the action of rain and rivers, are seen to be gradually merging into rounded contours under a growing mantle of wind-borne loess. We may also direct attention to the remarkably perfect specimens of embankment moraines in the Ab-i-Panja valley, where glaciers, now vanished, have advanced into the main valley over embankments of the *débris* which they have carried along with them.

Thomas Linacre. By Dr. William Osler, F.R.S. Pp. vi+64. (Cambridge: The University Press, 1908.) Price 2*s.* 6*d.* net.

THIS little volume is the text of the Linacre lecture for 1908, the first under the new regulations. Prof. Osler begins by recapitulating the few facts

known of Linacre's career, and then sets out the subject of his remarks as medical humanist and grammarian, and closes with the Linacre foundations themselves. On a theme so well worn no very striking facts can be expected, but we have a very readable presentation of the man himself, as shown in his works and benefactions to his own university and to Cambridge. The plates in half-tone are of the Holbein-like portrait attributed to Quentin Matsys, a copy of a drawing in the British Museum, and facsimiles of title-pages of nine of his printed works.

B. D. J.

Lands Beyond the Channel. An Elementary Study in Geography. By H. J. Mackinder. Pp. xii+276. (London: George Philip and Son, Ltd., 1908.) Price 1*s.* 9*d.*

IF geography could be learnt satisfactorily by reading alone it would be difficult to find a more suitable and attractive reading book than this. The Mediterranean Sea and Europe are described by the aid of interesting text and numerous maps and pictures. Historical paragraphs emphasising the interrelation of history and geography are frequent, and the pupil who reads the volume intelligently will have accumulated a great deal of curious and useful information. But for the right understanding of geography as a science this descriptive matter must be supplemented by carefully graduated practical exercises, judiciously designed to lead the learner to a knowledge of the foundations upon which geographical science rests.

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.*]

Earthquakes and John Wesley.

THE year 1755, the year of the great Lisbon earthquake, is so remarkable for its seismic activity that any facts relative to earthquakes in that year have their value, and I have recently stumbled on some information from a rather improbable source, viz. the journal of John Wesley.

On Monday, June 8, 1755, he was at Osmotherley, in Yorkshire, and made inquiries of eye- and ear-witnesses of the occurrences of March 25 preceding, and he describes what he heard of noises, motions of the earth, falling and splitting of rocks, and other seismic phenomena which occurred in that neighbourhood, and especially at Whiston Cliffs, about five miles from Thirsk. These phenomena, which commenced on March 25, seem to have gone on, if I read Wesley's statement aright, with intervals to the end of May. Wesley was so much interested in what he heard that on June 1 he made a personal visit to the chief scene of the desolation, and he gives a long and interesting account of what he saw in the vicinity of the Whiston Cliffs. He then proceeds to discuss the cause of what he had seen; if the cause were natural, it must, he says, have been fire, water, or air. He discusses and dismisses each of these as the possible cause, and concludes that it was the direct intervention of God at a spot near where the Hamilton races were held, "wrought in such a manner that many might see it and fear." In Mallet's catalogue of earthquakes (British Association reports for 1852) disturbances are mentioned at York on March 25 and 27 on the authority of *Kant. Géol. Phys.*, t. iv., p. 314, but no further mention is made of the facts stated by Wesley.

I may further add that Wesley also mentions and describes earthquakes in London on February 8, 1750, and March 8, 1750, neither of which is mentioned in Mallet's catalogue.

The passages in which Wesley describes these several seismic facts are too long for citation in your columns, but appear to me well worth reading alike by the seismologist and by the student of Wesley's character. They show an inquisitive mind interested in natural facts, but with a strong tendency to find immediate and direct moral teaching as their final cause. EDWARD FRY.

Failand House, Failand, near Bristol, November 17.

Large Blue Whales.

I HAVE just acquired for the Canterbury Museum the skeleton of a huge blue whale (*Balaenoptera sibbaldii*).

Tail of a Blue Whale stranded at Okarito.

The whale was cast on to the beach at Okarito, on the west coast of the South Island of New Zealand, early this year, and measured 87 feet in length.

My statement that the Okarito whale is among the largest known has been freely challenged in the local Press. The "Ostend whale," the length of which is rendered as 102 feet, has been instanced, but Beddard ("A Book of Whales," p. 155) evidently discredits the record as to size.

A Danish correspondent refers to the skeleton of a whale 150 feet in length, killed off the Orkneys and preserved in the Museum of Northern Antiquities, Copenhagen. Others state that specimens larger than ours may be seen in the British, Paris, and American museums.

I have naturally sought information as to the length of skeletons of great whales preserved in museums, but have been unable to obtain satisfactory data.

I shall be pleased, therefore, if directors of museums possessing the skeletons of large whales will kindly communicate with me direct, or, as the matter is one of general interest, through the medium of NATURE.

EDGAR R. WAITE.

Christchurch, New Zealand, October 8.

Potato Black Scab.

REFERRING to Prof. Johnson's letter in NATURE of November 19 (p. 67) on the black scab or wart disease of the potato, I should like to emphasise the importance of investigating in the open as well as in the laboratory the conditions determining the germination of the resting spores.

Like Prof. Johnson, I have found no difficulty in germinating them in potato-juice at the ordinary laboratory temperature. At the commencement of August they had liberated their contents within four days in a hanging-drop culture. I was not so fortunate as to observe the actual escape of the zoospores, but this stage seems to be followed very rapidly by the amœboid stage, in which condition the organism moves about very actively for some days. In the hanging drop it then becomes passive, withdrawing its pseudopodia and assuming a spherical shape.

In both the ciliate and the amœboid condition it must be very sensitive to fungicides, and it is therefore important to ascertain at what period this susceptible stage is reached in nature, as this will determine the best time for the application of gas lime or other dressing to the soil. Now that so many observers are directing their attention to this fungus, it is to be hoped that we shall soon discover a method of checking the further advance of this destructive parasite. F. E. WEISS.

The University, Manchester, November 21.

Mercury Bubbles.

I HAVE on several occasions noticed the beautiful bubbles described by Mr. Wright and Sir William Crookes (pp. 8 and 37). On each occasion I was purifying mercury in the following way. I half filled a rather large Woulffe's bottle with mercury and poured on to it weak nitric acid. Then, in order to keep the whole in a state of agitation, I carried a tube through one neck to the bottom of the bottle and attached a short tube to the other neck connected with a filter pump, so that air was continuously drawn through the two liquids. I have never noticed bubbles for the first hour or two, but afterwards they are formed continuously, and float for a second or so on the top of the acid before bursting. Some were certainly quite 22 mm. in diameter. From their delay in appearing I gather either that they are only formed in mercury which is fairly pure, or that the nitric acid has to be fairly well saturated with metal. A. T. HARE.

November 23.

WITH reference to Mr. J. G. Ernest Wright's letter in NATURE of November 5, I may be permitted to mention that under the above heading I published a few observations in NATURE of July 2, 1903. Like Mr. Wright, I made an approximate estimate of the thickness of the mercurial pellicle, but the bubbles which were produced in Mr. Wright's experiment seem to have had a slightly greater diameter than any of those which I observed.

HENRY H. DIXON.

School of Botany, Trinity College, Dublin.

An Alga growing on Fish.

IN NATURE of April 18, 1907, vol. lxxv., p. 599, it is noticed that Mr. A. D. Hardy found a cholorophyte, *Myxonema tenue*, ordinarily an inhabitant of rapid streams, also growing luxuriantly on some goldfish in a small pond, thus obtaining water friction necessary to its own well-being.

To some of your readers it might prove of interest to record a similar occurrence in Japan. On October 11, 1902, while I was rambling about the Asso marsh, not far from this town, my eye was accidentally caught by a small fry of *medaka* (lit., eyes-jutting, *Haplochilus latipes*, Schleg.), a fish proverbial for its diminutiveness. In a shallow bog-pool, only some 2–4 feet across, they looked very unhealthy, and were swimming in an unsteady, fidgety manner, infested with what appeared to be Saprolegnia, but greenish in hue. On a closer examination, every one of them turned out to have under or beside its abdomen a horny protuberance giving rise to delicate tufts of an alga up to 1 cm. long. This discovery I made mention of in a letter sent some time after to Prof. G. S. West, then at Cirencester. This plantlet, I have no doubt, belongs to the genus Myxonema, but the imperfection of my microscope, as well as the want of reference books, prevents me from ascertaining what species it really is.

By the accompanying parcel post I am sending you five *medaka*-fish with the algal growth *in situ*, and two slides with the latter; also one slide with a large, broadly shuttle-shaped and much constricted desmid found singly suspended among the Myxonema, in the hope that some phycologist will kindly identify them for me.

KUMAGUSU MINAKATA.

Tanabe, Kii, Japan, September 20.

THE alga attached to the *medaka* fish is *Myxonema tenue*, Rabenh. The desmid is a species of Euastrum, too imperfect to determine specifically. A few fragments of a diatom belonging to the genus Gomphonema are also present. GEO. MASSEE.

A Disclaimer.

I WISH to make a disclaimer of responsibility with reference to the journal *Ion*, on the cover of the first number of which my name figures in the capacity of an editor. It is true that at one time, acting on certain representations, I accepted an invitation to superintend the department of the journal dealing with radio-activity, as referred to in the concluding paragraph of the editorial on p. 1 of the first number. Neither the journal itself, nor its cover, however, were submitted to me for my sanction and approval before publication. The appearance of my name on the cover in the capacity of an editor has not been authorised by me, and I accept no responsibility with regard either to the editing or publishing of the journal.

With reference to the department of the journal dealing with radio-activity, I would point out that the first number of the journal contains several articles and reports dealing with the subject of radio-activity, but with the exception of two articles contributed by myself and one report, proofs of which passed through my hands, these articles and reports were not seen by me before publication. The first intimation I had that they were to appear was derived from the advertisement of the journal and its contents in NATURE of November 12, p. xxi. I therefore do not accept any responsibility for that section of the journal I am stated to have the care of. Finally, I wish to say I have now withdrawn from all connection with the journal.

FREDERICK SODDY.

Leonid Meteors.

THE nights of November 13–15 appear to have been generally overcast, and to have furnished no opportunities for watching the display of meteors. But November 16 was clear at some places, and Mr. Ellison Hawks, of Leeds, counted eighty-seven meteors between 10h. and 14h., of which twenty-six appeared to be certainly Leonids, while many others pursued nearly same paths, and probably belonged to same stream. Large meteors were recorded at 12h. 26m. and 13h. 12m. shooting from Taurus and Aries towards the planet Saturn.

At Whitby an observer noticed several conspicuous meteors in the morning hours of November 17. At 6.32 a.m. there was a splendid one descending almost vertically through Orion from the direction of Leo, and there was no doubt that the great November stream returned, though perhaps not richly as in some years nearer the perihelion returns of the parent comet. It is to be hoped that other observers will send their reports of the shower.

The night following Monday, November 16, when the Leonid meteors were seen at Leeds and Whitby as described, was decidedly late for the display. The present year being leap year, it is probable that the shower was at its best on the mornings of November 15 and 16, but no accounts of its appearance at those times have reached me owing to the overcast and starless condition of the visible firmament reported by various observers.

W. F. DENNING.

THE ETHNOGRAPHY OF ASSAM.

THE new volumes of the ethnographical series issued by the Government of Eastern Bengal and Assam, in continuation of Major Gurdon's excellent monograph on the Khasis, are devoted to an account of the Mikirs and the Meitheis. These manuals are in pleasing contrast in appearance to ordinary Anglo-Indian ethnological publications. Printed in England, the format is all that could be desired, and they are fully equipped with excellent half-colour illustrations, photographs, and maps. It is to be hoped that the success of this series will encourage the Central Provinces authorities to issue similar accounts of the Gonds and their kinsfolk, and the Madras Government to arrange for the issue of Mr. Thurston's Bulletins in less inartistic form.

The volumes now before us illustrate the varying condition of the savage or semi-savage tribes on the eastern frontier. The account of the Mikirs, based on materials collected by the late Mr. E. Stack, and largely supplemented by the editor, Sir C. Lyall, describes a race which has been little affected by civilisation. The monograph on the Meitheis of Manipur, prepared by Mr. T. C. Hodson, late superintendent of the State, describes an interesting tribe which has been deeply influenced by the culture and religion of the Hindus. The plan of these monographs is uniform, separate chapters dealing with the geographical distribution, physical characteristics, culture and social life, laws, customs, and religion, to which are added a grammar of the tribal dialect and a chrestomathy which contains a number of folk-tales in the local language, accompanied by an English translation. The reader is thus provided with abundant materials for the study of some of the most interesting tribes within the Indian Empire.

FIG. 1.—Mikir Man. Reproduced by permission from a coloured plate in "The Mikirs."

The Mikir tribe, numbering 87,000 souls, inhabits a hill tract lying south of the Brahmaputra river, abutting on the east on the Naga country, and on the south on that of the Khasis. Their ethnical affinities are still somewhat uncertain. Dr. Grierson, on linguistic grounds, classes them as intermediate between the Boro and Western Nagas, while Sir C. Lyall, mainly on ethnographical evidence, connects them with the tribes forming a link between the Nagas and the Kuki-Chins, especially those dwelling south of the Arakan Roma range, where the Chin tends to merge into the Burman of the Irawadi valley. They are a peaceful agricultural people, accustomed to depend for protection upon the more warlike neighbouring tribes, like the Khasis, from whom they have assimilated much—dress, ornaments, personal names, methods of divination, funeral rites, and the habit of erecting memorial stones, besides many additions to the tribal vocabulary. From the Assamese Hindus they have borrowed certain elements in their language, folk-tales, and religion. At the same time, they have enough which is original about them to make them interesting. Thus the absence of matriarchal institutions clearly distinguishes them from the Khasis; in physique they differ both from Assamese and Khasis; they build their houses on posts, while their neighbours, except the Kukis, build on the ground. In their animistic reverence for Nats they resemble the Burmese. But to this primitive animism they have added from Hindu sources the conception of a hell and a paradise, with a vague belief in metempsychosis. These views, however, do not influence their ideas about a life to come.

The Meitheis of Manipur, though possessing a long and eventful history, were little known in Europe until the tragedy of 1891, when Mr. Quinton, Chief Commissioner of Assam, and other British officers were treacherously murdered. As is the case with the Mikirs, their ethnical affinities are uncertain, but, in spite of their desire since their conversion to Hinduism to affiliate themselves to the Aryan race, they are probably an offshoot of one of the hill tribes like the Nagas. When the Raja and Rani perform the rite of ascending the throne, they wear Naga dress, and the architecture of the coronation hall, with its front beams crossed and carved, suggests the decoration of the Khullukpa houses in Naga villages.

FIG. 2.—Rās Costume. Reproduced by permission from a coloured plate in "The Meitheis."

Though the Brahmans of Manipur date their settlement from the fifteenth century, Hinduism did not become the State religion until the middle of the seventeenth. It is still only a veneer on the primitive animism, its chief social result being the abolition of hunting, except in the case of tigers, for the destruction of which village clubs, with a due provision of nets and spears, are established. Hinduism has brought with it new restrictions in regard to food and drink, but it has removed the curious taboo on the use of milk characteristic of the Indo-Chinese races.

Considerations of space prevent us from directing the attention of anthropologists to all the points of interest in these monographs. Specially noticeable among the Mikirs are the annual compulsory village festival, when sacrifice is made to Arman-paro, the

"hundred god," and to the local deities of hill and river, the flesh being consumed only by the men, who must live apart from their wives during the rites; the cremation of the dead with subsequent interment of the bones, the ceremonies including an elaborate animal sacrifice and a tribal dance; the bachelors' club of youths associated for agricultural work, which is now passing into decay. Among the Meitheis may be noted the selection of a man who gives his name to the year, bears all the sins of the people during that period, and whose luck, for good or ill, influences the luck of the whole country. Sportsmen will be interested in the account of polo, with its primitive regulations. Introduced into Manipur from the Indo-Tibetan region about 1600 A.D., the possibilities of the game were suggested to British officers by Manipur teams which played at Cachar and Calcutta.

SOME SCIENTIFIC CENTRES.

No. XIV.—The Hortus Botanicus at Amsterdam.

THE name of one of the most famous centres in the domain of biology conveys little idea of what goes on there to the average English-speaking man, unless he knows already. The Experimental Garden—as this centre is called—in the Hortus Botanicus at Amsterdam is a laboratory in which the results for which it is famous have been obtained, not by experiment, but by observation, as we usually understand these terms.

This is not the place to discuss the question whether a line can be drawn between experiment and observation; nor, supposing that one can, to attempt to arrive at some conclusion as to where observation ends and experiment begins. But it seems to us that the whole essence and significance of de Vries's work lies in the fact that it has been a work of observation. De Vries's name will be remembered as that of the man who saw what Darwin foresaw; who spent his life in carefully observing and accurately recording the process of the origin of species.

To appreciate the nature of the work which has been done in the Experimental Garden, it is necessary to take a brief glance at the main features of the previous attempts to deal with a problem which, until de Vries attacked it, resisted all attempts to solve it satisfactorily. This survey will also serve to explain more fully what is meant by the statement that de Vries's work was, in the main, one of observation.

The history of the efforts of biologists to deal with the problem of evolution, as told by de Vries in his "Mutationstheorie," is a history of the gradual improvement of the power of observation, which first saw in the genera the units of the natural system; then the Linnean species; and, finally, the elementary species of which the Linnean species are composed. At each stage in this history, the observer very naturally regarded as the ultimate unit of the natural system that unit which he saw by focussing his faculty of observation on it as finely as he could. In pre-Linnean days, the genera were regarded as the units; from then until now, the Linnean species have been so regarded, and the modern view, put forward by de Vries, is that the Linnean species are compound things, being, in fact, composed of the elementary species, which are the real units of the natural system.

In pre-Lamarckian days, the chief attribute of the real unit of the natural system was that it had been created, and had not arisen by natural means. So that when Linnæus elevated the species to the rank of the unit of the natural system they acquired this attribute automatically. *Species tot numeramus quod diversae formae in principio sunt creatae* are Linnæus's words. It is a very interesting fact that Linnæus knew that his species were capable of further subdivision into what he called *varietates minores*; but these had arisen by natural means, and so were not worthy of the attention of the serious student. *Varietates levissimas non curet botanicus* were the words in which he forbade his students to pay any attention to them. The fads of genius are not buried with their authors. Prof. de Vries himself can remember pointing out on one or two occasions, when a student, curious abnormalities and instances of apparent subspecific characters to his professor, and being told by him not to pay any attention to them. He has occupied the rest of his life in doing so.

The nucleus of the Experimental Garden at Amsterdam was a certain potato-field near Hilversum, not far from Amsterdam. It had been bounded on its southern side by a canal from time immemorial. In 1870 the owner of the field, Mr. Six, had an extension of the canal dug along its western and part of its northern side; the result of which was that the original access to the field on its northern border was blocked, and that it could only be reached by its eastern side, where, however, there was, unfortunately, no road. Mr. Six found himself unable to let the field, and decided to plant it with trees. Rough paths were accordingly cut, and small trees planted.

Here was a wonderful opportunity for the wild plants, which had been kept in check with the hoe year after year, to establish themselves and multiply—an opportunity for the supercession of the horticultural by the cosmic process, to borrow Huxley's famous illustration. Yet, curiously enough, the fullest advantage of this opportunity was taken, not by an indigenous species, but by an introduced one which had spread over into the field from a small bed in a park close by, where a few annuals were grown every year. It was the beautiful evening primrose, *Œnothera Lamarckiana*.

De Vries first saw the field in 1886. The Œnotheras spread over a wide zone, the centre of radiation of which was the point at which the species had invaded the field. The centre of this zone was covered by a dense jungle of Œnotheras as tall as a man; outside this zone the adult plants gradually gave way to younger ones, whilst outside of all was an advanced guard of rosettes which did not lift their heads above the level of the ground.

All this seemed to offer to de Vries an opportunity which might never occur again of studying the phenomena of variation as exhibited by a plant multiplying, practically without restriction, in a state of nature. Moreover, he had been trying for some years past to find plants in a state of mutation (that is, of giving off new elementary species) but in vain. Œnothera broke the spell of failure. It was in a mutable period; new elementary species were arising; two had already arisen in the potato-field, *Œnothera brevistylis* and *Œ. laevifolia*. It very soon became evident that, to observe the process of the origin of mutations properly, it was necessary to grow the plants under direct personal observation in one's own garden. In the first place, only a very small proportion of the seeds that are shed in nature can germinate, and, of those that do, a very small proportion can attain maturity; so that if a mutation does arise the chance that the seed which contains it will survive to maturity is small. In the second place it is impossible to know the parentage of any of the plants in the field, partly because it is not possible to know from which plants the seeds which gave rise to

them have come, and partly because, even if this were known, it would still not be known whether they were the result of a self- or cross-fertilisation.

Œnotheras were therefore transported from the field at Hilversum to the garden at Amsterdam. This was done in one of two ways. Either the young first year's rosettes were transplanted (*Œ. Lamarckiana* generally behaves as a biennial, flowering in the year after that in which it was sown), or seed was collected from the mature plants in the field at Hilversum and sown in the garden at Amsterdam.

The expectation, based on the appearance of two new species in the field, that more would arise in the garden was fulfilled. There arose altogether about a dozen new elementary species in the garden. The work of investigating the mode of origin of these new species consisted partly in finding out if the relative numbers of these species appearing every year were at all constant, and, if so, what the "mutation coefficient" (as this number was called) was; it consisted also in testing the constancy of each new species through several generations. Besides this, de Vries was continually on the look out for new species, and for this purpose large sowings of Œnothera seed were made every year. Moreover, crossings between the various elementary species were continually being carried out. The number of plants which had to be examined in the course of this work was enormous; and the number could not have been so great, nor the work so thorough, if de Vries had not paid special attention to the distinguishing characters of the seedlings of the various species.

His plan at first, *i.e.* shortly after the transportation of Œnotheras from Hilversum to Amsterdam, was to sow the seed directly in the bed in which the plants were to flower. The disadvantage of this plan was that all the seed did not come up in the first year; so that, in the first place, all the crop arising from a single sowing could not be recorded at one time, and, in the second, the bed could not be used for another sowing until it was certain that all the seed from the last had come up. Moreover, weeding and the minute examination of the seedlings was not by any means convenient in these circumstances. This plan was therefore soon forsaken, and that of sowing the seed in pans adopted in its stead. The pans were filled with soil which had been baked, a process which killed any seeds which might be in the soil, so that there was no possibility that any of the Œnotheras which came up could have arisen from any other source but the seeds deliberately sown in the soil, and the tiresome and difficult process of weeding was rendered unnecessary. The seedlings could be examined much more minutely and thoroughly in the pans than in the beds.

Prof. de Vries in his greenhouse.

The result of this innovation was that de Vries acquired a most intimate familiarity with the seedling characters of the various new elementary species; this is to a certain extent putting the cart before the horse. It is perhaps truer to say that the majority of the new species which were discovered after the introduction of this innovation owed their discovery to the fact that they differed from the parent form in the seedling stage.

Perhaps the most valuable improvement in the equipment of the Experimental Garden was one which was made possible by the practical way in

which his former students and friends expressed their admiration for de Vries and his work, on the occasion of the twenty-fifth anniversary of his professorship at the University of Amsterdam. On this occasion de Vries was presented with a considerable sum of money, which was expended in the erection of a vast greenhouse, which enabled him to defy the climate of Holland, against which he had been contending for many years with anything but complete success.

The Experimental Garden at Amsterdam, as it now stands, is the result of an attempt to perfect a method of observing the origin of species. The success of this attempt will rank as one of the greatest achievements in biology.

THE SURVEY OF AFRICA.[1]

THE fifth volume of the account of the geodetic survey of South Africa, executed under the supervision of Sir David Gill, has now been issued. With the four volumes previously published the description of the whole work, from the southernmost point of the continent up to the Zambezi River, is thus completed. A sixth and final volume is promised, which will comprise that portion of the thirtieth meridian arc done by Dr. Rubin, carrying the survey northward from the Zambezi to a point 70 miles south of Lake Tanganyika. This will therefore round off the South African part of this great undertaking, the first idea of which was originally conceived by Sir D. Gill in 1879. To him, together with his able lieutenant, Colonel Sir W. G. Morris, the credit of thus carrying through this immense task, in face of many political and financial difficulties, must be ascribed.

The present volume is replete with interest both to the scientific surveyor and to the student of public policy on the questions of survey and map-making. The main interest naturally centres about the introduction by Sir D. Gill, and the introductory report on the trigonometrical survey of the Transvaal by Sir W. G. Morris. The former gives a succinct history of the triangulation of South Africa, recapitulates the now well-known proposal to extend the thirtieth meridian arc through the continent, and concludes with a detailed *résumé* of the negotiations between the Imperial Government and the colonial authorities for the formation of a federal survey department. These extended, with intermissions, from 1901 to 1904, and finally ended abortively, one colony after another deciding that they could not afford the expenditure necessary for the construction of an accurate map of their territory. The expenditure ultimately and implicitly involved by the existence of inaccurate maps or by the complete non-existence of any maps at all, being an item which does not come on the estimates for the year, is, we must perforce conclude, a subject of little concern to the politician. Otherwise, unless we are to assume that public memory is so short that a period of three or four years is sufficient to drive the most striking events out of mind, it is difficult to see how one of the main object-lessons of the South African war, *the extreme costliness of bad maps*, should have been so soon and so completely set aside. Sir D. Gill's account not unnaturally gives special prominence to those parts of these proceedings which took place in Africa, with which he was directly concerned. The result is that he does less than justice to the part played by the War Office, and is apparently unaware that the proposal to carry out a complete survey of South Africa, by cooperation between the Imperial and the colonial authorities, was put forward by that office long before the date of the similar suggestion by Colonel Morris, referred to on p. 16.

The whole history of this geodetic work is a curious inversion of the general order. Usually it is the complaint of the map-maker that, whereas it is not difficult to get money from a Government department for the immediate, practical work of mapping, it is a more laborious task to persuade them of the necessity for a liberal expenditure upon the fundamental geodetic triangulation. In South Africa the exact reverse of this has been the case, and we have the anomalous position of a complete triangulation system without the resulting maps; even as yet it is only in the case of the Orange River Colony and partially in Cape Colony that any of the maps of the country are based upon the positions of the geodetic points.

Of the technical part of the report the most interesting is undoubtedly the account of the base measurements carried out with invar wires hanging freely, at a constant tension, between low tripod supports. Five bases in all, totalling a length of 70 miles, were measured. Each was gone over with the wire three times, and the apparent probable error varied from 1 part in 1,000,000 at the Belfast base, where the staff was inexperienced, down to nearly 1 part in 7,000,000 in the most favourable case. Sir D. Gill maintains that, with a trained staff, a base can be measured in this way with an actual final uncertainty of less than 1 part in 1,000,000 —say, 1 inch in 15 miles—a contention apparently justified by the figures. The rate of progress, including the time spent on the wire comparison with the standard bars, averaged 475 yards per day, and the cost was high—153*l.* per mile of base. In view of this, and in view of the fact that a limiting error of 1 part in 1,000,000 implies a much higher degree of precision than that attained by the angular observations, it would seem more practical, for similar work in the future, to make the bases both shorter and less accurate, and, therefore, cheaper and more rapidly executed. This would have the effect of preserving that balance between the degrees of precision of the different parts of the work so essential to the economical conduct of a cycle of physical operations.

The horizontal angles were observed with the 10-inch Repsold theodolite, the probable error of a single angle being found to be 0″·30 with eight changes of zero, or 0″·39 with four only. It is remarked that as these figures closely coincide with those previously reached in Cape Colony and Natal with the same instrument, they probably represent the highest possible degree of precision attainable under the special climatic conditions and with the instrumental means available. So far as the observing end of each line is concerned this is possibly true, but it is questionable whether the results might not have been improved, with no sacrifice of time or money, if a better pattern of beacon had been employed. The tripod or quadripod beacon, forming from any distant point a double cone, with vertex at the centre, of sufficient height to enable the theodolite or heliostat to be centred without disturbing the legs, is an altogether preferable form to the pole beacon actually used. E. H. H.

[1] Geodetic Survey of South Africa. Vol. v. Reports on the Geodetic Survey of the Transvaal and Orange River Colony, executed by Colonel Sir W. G. Morris, K.C.M.G., C.B., and of its connection by Capt. H. W. Gordon, R.E., with the Geodetic Survey of Southern Rhodesia, with a preface and introduction by Sir David Gill, K.C.B., F.R.S. Pp. xxxvii+463+16 plates; 6 maps. (London: Harrison and Sons, 1908.)

NOTES.

DR. S. F. HARMER, F.R.S., has been appointed, subject to confirmation, keeper in zoology at the British Museum (Natural History), South Kensington. Dr. Harmer has been superintendent of the Museum of Zoology at Cambridge since January 1, 1892. He is a fellow of University College, London, and lecturer in natural sciences at King's College, Cambridge. Dr. Harmer is joint editor of the "Cambridge Natural History," and he has written numerous scientific papers dealing mainly with the Polyzoa. He has also done much to elucidate the affinities of the obscure organism Cephalodiscus with some of the more primitive members of the great group Chordata, which includes the vertebrates. He was president of the zoological section of the British Association at the recent meeting in Dublin, and is a past-president of the Museums Association.

IT is announced by the *Daily Chronicle* that the Nobel prize for medicine will this year be divided between Prof. Metchnikoff, assistant director of the Pasteur Institute of Paris, and Dr. P. Ehrlich, director of the Royal Institute of Experimental Therapeutics at Frankfurt-on-Main.

MR. N. W. THOMAS has been selected by the Secretary of State for the Colonies to conduct an investigation into the laws and customs of the native tribes of southern Nigeria. The tribes to be studied are, in the first instance, those of the old kingdom of Benin, but it is probable that the inquiry will be continued and include the natives of the other West African colonies in addition. Mr. Thomas is leaving to take up his duties in a few weeks.

THE jubilee of the Geologists' Association will be celebrated on Friday, November 27, by a conversazione at University College, Gower Street, W.C. A number of interesting objects will be exhibited, and short lectures will be given by Prof. E. J. Garwood, on "In the Himalayas around Kangchenjunga," and by Mr. G. W. Young, on "Reminiscences of Association Excursions."

BY the will of the late Prof. H. C. Vogel, who died in August, 1907, the Berlin Academy of Sciences has received, we learn from the *Revue scientifique*, a legacy of 17,000 marks for the purpose of awarding medals intended to encourage research work in astrophysics and spectrum analysis. From the same source we note that a prize of 2500 marks has been awarded to Prof. Abegg, of Breslau, for his physicochemical studies of gallium.

THE first general meeting of the Concrete Institute was held on November 19 at the Royal United Service Institution, Westminster. Sir Henry Tanner, I.S.O., principal architect to H.M. Office of Works, a vice-president of the institute, occupied the chair. The institute started with 100 founders, and now has a list of more than 300 members. The Earl of Plymouth is the first president of the institute, the objects of which may be summarised as follows:—to advance the knowledge of concrete and reinforced concrete, and direct attention to the uses to which these materials can be best applied; to afford the means of communication between persons engaged in the design, supervision, and execution of works in which concrete and reinforced concrete are employed (excluding all questions connected with wages and trade regulation); to arrange periodical meetings for the purpose of discussing practical and scientific subjects bearing upon the application of concrete and reinforced concrete, and to conduct such investigations and to issue such publications as may be deemed desirable. In a preliminary statement, Mr. Edwin O. Sachs, chairman of the executive, said it is hoped that British public authorities concerned may find it advisable to contribute in some way towards the expense of the research work necessary in connection with concrete and reinforced concrete. In America the United States Government has already contributed 25,000*l.* for research work in this direction, while the German authorities have contributed 20,000*l.* towards research in reinforced concrete alone. Mr. C. F. Marsh, assistant engineer to the Metropolitan Water Board, then read a paper on the composition and uses of plain and reinforced concrete.

THE habits and bodily pose of the sauropod dinosaurs, and more especially Diplodocus, form the subject of a very interesting paper by Dr. O. P. Hay in the October issue of the *American Naturalist*. In place of being mammal-like in carriage, the author is of opinion that these reptiles were built more like crocodiles, and, instead of walking, were consequently able only to crawl on land, and that perhaps slowly and laboriously. On the other hand, they were eminently amphibious, and capable of swimming easily. The great weight—some twenty tons—of these creatures would, according to Dr. Hay, inevitably lead to their being mired if they walked on land in quadruped-fashion, while the idea of their raising themselves on the hind-limbs is regarded as preposterous. Their food doubtless consisted of floating, and perhaps also submerged, water-plants, the latter of which could be readily reached by means of the long neck. In the case of Diplodocus, with its weak teeth, the chief nutriment may have been formed by masses of floating alga of the Chara type.

DR. HAY communicates a second paper on dinosaurs to the Proceedings of the U.S. National Museum, in which he deals with the carnivorous group, discussing the nomenclature of certain forms, and directing special attention to the skull-structure of *Ceratosaurus nasicornis*.

WE have to acknowledge the receipt of a large budget of papers published in the Proceedings of the U.S. National Museum. In one of these (No. 1635) Mr. J. O. Snyder describes a number of new fishes from Japan and the Riu-kiu (Liu-kiu) Islands, while in a second (No. 1643) he discusses two rare Californian fishes. American moths form the subject of papers by Mr. A. Busck (No. 1644) and Mr. W. D. Kearfott (No. 1649), the mosquitoes of tropical America are discussed in No. 1632 by Messrs. Dyar and Knab, and new neotropical Acrididæ are described by Dr. J. A. G. Rehn in No. 1650. Crinoids form the subject of two contributions (Nos. 1634 and 1636) by Mr. A. H. Clark, in the first of which the axial canals of recent pentacrinids are discussed, while the arm-joints of that group and the comatulids are considered in the second.

THE greater portion of *Naturen* for November is taken up with a memoir of the great pioneer geologist Leopold von Buch, with special reference to the fact that the present year is the centenary of the completion of his visit to Scandinavia. Von Buch, who was born in 1774, spent two years in a geological exploration of Norway, bringing his tour to a close on November 12, 1808, on which day he left the country.

HORSE-BREEDING in America forms the subject of an article by Mr. J. G. Speed in the November number of the *Century Illustrated Magazine*. Special attention is directed to the Denmark and Kentucky breeds, the latter being regarded as unusually well fitted for campaigning purposes, for which it is now generally admitted that the English thoroughbred is unsuited. The paper is illustrated by portraits of a number of notable horses.

INHERITANCE in biology forms the subject of an address delivered by Mr. Angel Gallardo before the Instituto de Enseñanza General at Buenos Aires. Of this address, which has been published in the *Biblioteca* of that institution, we are indebted to the author for a copy. In the same cover is bound up a reprint of a paper by Mr. Gabriel, published in the *Comptes rendus* of the Paris Academy of Sciences under the title "Sur l'Épruve statistique de la Loi de Mendel."

THE Transvaal Museum, according to the report for 1906–7, is making strenuous efforts to obtain a representative collection of the animals of South Africa, both for exhibition and for study purposes. Already the exhibited series of antelopes is complete, with the exception of three species, although a few old specimens require replacing by better examples. The aim of the authorities goes, however, much beyond this, and efforts are to be made, with the aid of trained collectors, to institute a biological survey of the country, in the hope that new species and races may in the future be described locally instead of in Europe or America.

To the *Afhandlinger* of the Bergens Museum Aarbog for 1908 Mr. J. A. Grieg contributes the first part of an article on the Pleistocene fauna of Norway, dealing in this instance with the red deer, of which a number of antlers are figured. The author regards these Pleistocene red deer as practically identical with the existing Norwegian race, and this in turn as inseparable from the Scottish animal. In regard to the latter point, he writes as follows:—"The existing Norwegian red deer accords in most respects with the Scottish deer. As already pointed out, it cannot have travelled from Scotland to Norway by way of a land-bridge; and the resemblance between the two forms must accordingly be attributed to the similar physical conditions obtaining in their respective habitats, both of which possess a mild and moist climate on the coast."

THE results of a study of the weights of developing eggs, by Messrs. Ritter and Bailey, are recorded in vol. vi., No. 1, of the Zoological Publications of the University of California. The eggs of the Californian mud-fish (*Fundulus parvipinnis*) formed the subject of experiment, and it was found that during development they lost perceptibly in weight. This diminution appears to "have been due to carbon dioxide and organic salts representing the albuminoid loss, which had passed out through the egg-membrane and been washed away in the sea-water." It is suggested that weighings of large holoblastic eggs of amphibians might be advantageously compared with the weights of meroblastic eggs of allied species.

FROM a long series of papers in the Proceedings of the Indiana Academy of Science for 1907 we select for brief notice one by Mr. D. M. Mottier on the history and control of sex. After a long survey of the various views which have been suggested to explain the development of sex in the germs of animals and plants, the author rejects as untenable the theories that either nutrition or environment is the inducing cause of the differentiation. On the other hand, he appears to regard with more favour the hypothesis as to sex being pre-determined in the germ-cells, and consequently a matter of heredity. According to this view, certain parts of the hereditary substance of chromatin contain only male and others only female characters or determinants. If the determination of sex be a problem of heredity, and hereditary phenomena are connected with a physical basis, a theory of the foregoing nature is regarded by the author as worthy of fuller investigation.

To the seventh number of the *Bulletin International de l'Académie des Sciences de Cracovie* for 1908, Mr. M. Siedlecki communicates a preliminary note on the structure, habits, and development of the so-called flying-frog (*Rhacophorus reinwardti*) of Java. The sexes differ, it appears, in size, the female being one-third larger and twice as broad as her partner, while she is further distinguished by the smaller development of her voice-organs and somewhat less brilliant colouring. By means of sucking-organs, which are different in structure from those of Hyla, these frogs are able to ascend and cling to vertical tree-stems. The author confirms Wallace's statement as to the webbing of the toes serving the purpose of a parachute during a fall from a height. On such occasions the toes are extended and the limbs held close to the sides of the body, so as to increase its superficies, with the result that what would otherwise be a vertical descent is converted into a spiral course.

THE vitality of trawl-caught fishes, with special reference to their potential survival in aquariums connected with biological investigations, forms the subject of a paper by Dr. A. T. Masterman, issued as No. 42 of *Publications de Circonstance* by the Permanent International Committee for the Exploration of the Ocean. A second publication by the same body is the second volume (dealing with the year 1905) of a statistical bulletin of the marine fisheries of the various countries of northern Europe. The values of the commoner kinds of fish taken in each country during the year in question are set out in one set of detailed tables, printed in English and German on alternate pages, and the quantities in a second set. The largest item in the British Isles is 1,343,080*l.*, yielded by the Scots herring-fishery, next to which comes the English catch of haddock, with a value of 1,329,537*l.*

A STUDY of cell structure in Porphyra, contributed by Miss S. M. Wislouch to the *Bulletin du Jardin Impérial Botanique de St. Pétersbourg* (vol. viii., part iv.), deals with the structure of the nucleus and the chromatophore with its prominent embedded pyrenoid. An account is also furnished by Mr. G. A. Nadson of bacteria identified in samples of mud taken from the bottom of Lake Ladoga.

THE connection between forests and rainfall is argued from a somewhat original standpoint in an article contributed to the *Indian Forester* (October). Transpiration of water from a forest is computed to be six hundred times the amount evaporated from a water surface of the same area. Calculating the proportion of land to water on the surface of the globe as 1 to 3, and reckoning that forest occupies one-quarter of the land, the moisture given off by forests is many times greater than that evaporated by the whole water surface. Hence it is reasoned that diminution of forest areas must lead to diminished rainfall, or, regarded conversely, the moisture which may be condensed to rain is primarily dependent upon the extent of forests.

THE chief feature in the lime fruit industry of Dominica, as stated in the report for 1907–8 on the botanic station and agricultural school, has been the large increase in the export of citrate of lime. Vigorous efforts are being made to improve cocoa cultivation on the island by demonstrating the use of manures on experimental plots and the value of grafted plants. The data recorded for the experimental trials of manures provide facts regarding the general action of certain ingredients besides proving the

positive value of manures for cocoa. A comparison of rubber yielded by Castilloa and Hevea trees points to the superiority of the latter both as to quality and facility of preparation, but the Hevea demands shelter from gales. It is mentioned that clusters of dates were obtained for the first time from trees introduced some years ago.

In the course of a lecture reported in the *West Australian* (September 21) upon the adaptation of plants to their environment, Dr. A. Morrison refers to some of the modifications displayed by West Australian xerophytes. *Calythrix flavescens* and *Nuytsia floribunda* are mentioned as examples of extensive root development, where, however, the main roots run horizontally, while the smaller roots dip downwards. In the dry north-west, where trees are scarce, the few growing there are protected either by a thick cork or a smooth, white bark. *Eragrostis eriopoda*, a grass, is remarkable for the excessive hairy covering on the leaf sheaths, and *Poa nodosa* is characterised by the formation of bulbous swellings at the base of the stem.

Messrs. F. E. Becker and Co. have issued a series of lantern-slides, prepared from botanical photomicrographs, that will interest teaching botanists who make use of the lantern for lecture purposes. Among the first series of fifty slides are sections of stems, roots, and leaves of phanerogams, mostly illustrating regular structure, but a few specimens of irregular structure, as exemplified by Calycanthus, Strychnos, &c., are included. The sections of fossil plants from the Oldham Coal-measures are likely to meet with the largest demand. The slides of *Zygopteris petiole* and Heterangium stem provide very good representations, being in some respects superior to the other specimens that have been examined.

The reports of the sugar-cane experiments in the Leeward Islands for the year 1906–7 are full of interest, especially to those who have followed the course of the experiments that have extended over several years. Turning to the trial of different varieties, it is clear that considerable advantage will be derived from the introduction of new seedlings. So far, the introduction of new seedlings into plantations has proceeded more rapidly in St. Kitts, owing to certain circumstances detailed in the report. Another feature that has become more marked as the series of experiments has lengthened lies in the suitability of different canes for Antigua and St. Kitts. Thus Sealy Seedling provides the best record for the heavier soils of Antigua, while B. 208 heads the list for St. Kitts. The difference is only partially due to the soil, as the climatic conditions in St. Kitts are also more favourable to B. 208, that matures early, but is susceptible to drought. The varying yield of cane per acre, the quality of the juice, immunity to disease and other characteristics furnish data for discrimination of the varieties.

Plankton workers in general will welcome an addition to the somewhat sparse literature dealing with that interesting and difficult group, the Peridiniales, in a report on the Peridiniales of Danish waters, by O. Paulsen, issued from Copenhagen in the *Meddelelser fra Kommissionen for Havundersøgelser* (plankton series). The report is in English, and deals in a masterly way with identification keys to the various sections of the group. The figures and descriptions given of the various genera and species are apt, and likely to be of great use to observers who make identifications from preserved specimens. The bibliography appended is extensive and up to date. The section on the genus Ceratium is worthy of commendation on account of its careful treatment of this very variable section of the Peridiniales. The descriptions and figures of species suggest the great need of cultural treatment of a genus, the growth forms of which tend so strongly to break down specific limits.

Students of the occult will welcome the elaborate paper by Dr. W. L. Hildburgh in the current issue of the Journal of the Royal Anthropological Institute on Sinhalese magic. He illustrates with copious detail the equipment of the magician, devil-dancer, and astrologist, describes their methods, and provides an ample supply of curious charms, amulets, and horoscopes. He does not enter upon the question of the origin of this system of magic. Probably, as is the case with its religion, Ceylon is indebted for most of its magical lore to the neighbouring peninsula of India.

In the October number of *Man* Father W. Schmidt throws new light on the disputed question of totemism in Fiji. He points out that there is a fundamental distinction between principal and secondary totems, the former being always double, an animal or a tree, both of which are protected by a rigid tabu; the latter consisting of various products used for food, as the yam, taro, or banana, which may be eaten, but only under specially defined conditions. He also discusses the relationship of totemism in Fiji to that of certain Australian tribes, like the Arunta. In both these regions we find a great number of plant totems; totemism is closely connected with magic, especially with rites intended to produce abundant crops; in both countries it is associated with conception and childbirth; and in both we find localisation of totems. It is worth noting, also, that while in North Australia the tabu is confined to the eating, in South Australia it extends to the killing of the totem. In this respect the system in Fiji resembles that of the northern Australian tribes.

In the current issue of the Journal of the Royal Anthropological Institute Dr. C. S. Myers sums up his conclusions on the investigation of the races of Egypt. The current view is that from time immemorial there have always been at least two races in Egypt, the one Caucasian (Mediterranean) and the other Negroid, and that to this day both races are present throughout the country, though prevalent in different degrees in different regions. In opposition to this, Dr. Myers holds that every province contains a homogeneous population, notwithstanding that the mean measurements vary in degree of "negroidness" according to province, and that there is no anthropometric evidence of duality of race. Hence he concludes that the Egyptians were always a homogeneous people, who varied now towards Caucasian, now towards negroid characteristics, according to their environment, "showing such close anthropometric affinity to Libyan, Arabian, and like neighbouring peoples, showing such variability and possibly such power of absorption, that from the anthropometric standpoint no evidence is obtainable that the modern Egyptians have been appreciably affected by other than sporadic Sudanese admixture." In support of these novel and valuable conclusions he provides a copious statistical apparatus.

A note by Maud DeWitt Pearl and Raymond Pearl, of the Biological Laboratory of the Maine Experiment Station, on the relation of race crossing to the sex-ratio appeared in the September issue of the *Biological Bulletin*. Some breeders have held that hybrids exhibit an excessive proportion of males, and the authors have examined the birth statistics of Buenos Aires with the view of testing this belief. It appears that during the

ten years 1896–1905, crossed marriages, in which the father returned his nationality as Italian or Spanish and the mother gave her nationality as Argentine, did give a slightly larger proportion of male births than pure matings in which both parents were Argentine, Italian, or Spanish respectively. The differences are not great, the numbers of male births per 1000 female births ranging from 100·8 for the marriages between Italians, 103·3 for those between Argentines, and 105·6 for those between Spaniards, to 105·7 and 106·7 for the crossed matings; on the number of births used the differences exceed, however, twice the probable error in every case except one. As the authors very truly state, vital statistics notoriously abound in pitfalls, but they conclude that preponderance of males observed appears not to be capable of explanation as the result of environmental or demographic influences.

IN the November number of the *Popular Science Monthly* (New York), Prof. A. E. Kenelly returns to the subject of the relation between record times and distances for different races, using as fresh illustrations the records of the Olympic Games held in London last July. In his original memoir, of which a notice appeared in NATURE for March 14, 1907 (vol. lxxv., p. 463), Prof. Kenelly showed that a linear relation subsisted between the logarithm of the record time for a race over a course of given length and the logarithm of that length. The Olympic records give points on the diagram lying close to, but above, the line determined by earlier records, the times being in every case relatively high. The divergence is most conspicuous in the case of the Marathon race, but this is not unnatural, as the conditions were scarcely similar to those of a race run over an artificial and almost strictly level course. Prof. Kenelly argues that records would be most easily beaten by the racer attempting to maintain until near the finish a uniform speed, equal to the average speed corresponding to the existing record, and suggests a mechanical method of pace-making for attaining this end.

THE English edition of the "Report of the International Meteorological Conference at Innsbruck, September, 1905," has been published recently by the Meteorological Committee. The work extends altogether to 156 pages, and has been excellently translated from the original German edition by Mr. R. G. K. Lempfert. The conference was attended by fifty-six gentlemen (including a few guests), several of whom represented organisations outside Europe. Some forty items for discussion were included in the provisional programme; some of these were referred to special commissions, while a few were ruled out as being of a purely theoretical character. An account of the opening and second and third meetings appeared in NATURE of September 21 and October 5, 1905 (vol. lxxii., pp. 510, 562). Among the matters subsequently dealt with we may mention a proposal by M. Durand-Gréville for the special study of squalls (hail, thunderstorms, &c.); a permanent commission was appointed to organise the observations. Thanks were accorded to MM. Hellmann and Hildebrandsson for the preparation of the International Meteorological Codex, a systematic collection of the resolutions passed at various meetings since 1871. The comparison of standard barometers, which had engaged the attention of previous conferences, was advocated, both for European and other stations. The magnetic commission also advocated a comparison of instruments and prompt exchange of records for disturbed days. Sir Norman Lockyer read the reports of the solar commission at Cambridge (1904) and Innsbruck (1905); observations are required, *inter alia*, at a number of island stations (specified) for all oceans. All the resolutions of the cloud commission, containing desired improvements in definitions, &c., were adopted by the conference without discussion.

A TWELFTH edition of Mr. Andrew Jamieson's "Elementary Manual of Steam and the Steam Engine" has been published by Messrs. Charles Griffin and Co., Ltd.

MR. C. BAKER, 244 High Holborn, has just issued a revised edition of his catalogue of microscopes and accessory apparatus. The catalogue includes particulars of a number of new instruments of interest to workers in microscopy, whether they be students, teachers, naturalists, or men concerned with studies in medicine or public health. The list of lantern-slides also includes many sets of interest.

THE fourth edition of Behrens's "Tabellen zum Gebrauch bei mikroskopischen Arbeiten" (Leipzig: S. Hirzel, price 8 marks) has been received. It contains tables of weights and measures, specific gravities, solubilities, and formulæ of fixing and hardening agents, stains, microchemical reactions, &c., and should prove of the greatest service in biological, bacteriological, and pathological laboratories.

A SECOND edition of "British Mosses," by Sir Edward Fry, G.C.B., F.R.S., has been published by Messrs. Witherby and Co. With one exception, the illustrations in the new edition have been re-drawn; the short treatment of the liverworts, which formed part of the earlier issue, has been omitted, since the author hopes shortly to deal with this group in a separate volume. The price of the book is 1*s*. 6*d*. net.

MESSRS. W. HEFFER AND SONS, Cambridge, have published a second edition of Mr. Sydney W. Cole's "Exercises in Practical Physiological Chemistry." The first edition of the book was reviewed in NATURE of March 2, 1905 (vol. lxxi., p. 412). It is sufficient to point out that the chief changes are the adoption of the new nomenclature for the proteins as recommended by the Physiological Society, a new set of exercises on the globulins of blood serum, and new methods for the quantitative estimation of sugar.

THE Iron and Steel Institute has published separately an excerpt from its Journal (No. 3 for 1908) dealing with the visits and excursions at the Middlesbrough meeting this year. The report, which is edited by Mr. L. P. Sidney, the assistant secretary of the institute, provides a brief *résumé* of the proceedings at the Middlesbrough meeting, the speeches at the various functions, accounts of visits to places of interest in the neighbourhood, and descriptions of the various steel and iron works visited by parties during the Middlesbrough meeting. The booklet will serve as an interesting memento of a successful meeting.

THREE books of especial interest to those connected with the tropics are shortly to be published by Messrs. J. and A. Churchill. They are:—"Report on the Prevention of Malaria in Mauritius," by Prof. Ronald Ross, C.B., F.R.S.; a new volume of "Studies from the Institute of Medical Research," issued by the authority of the Government of the Federated Malay States; and "Lessons on Elementary Hygiene for Especial Use in Tropical Climates," by Dr. W. T. Prout, C.M.G. The eighteenth edition of Squire's "Companion to the British Pharmacopœia" is also announced by the same firm.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN DECEMBER:—

Dec. 2. 2h. 11m. Saturn in conjunction with the Moon (Saturn 2° 56′ N.).
7. 9h. 55m. Middle of penumbral eclipse of the Moon visible at Greenwich.
,, 11h. 32m. Occultation by the moon of 105 Tauri (mag. 5·8), reappearance 12h. 43m.
,, 17h. 36m. Occultation by the Moon of η Tauri (5·2), reappearance 18h. 21m.
8. 10h. 58m. Occultation by the Moon of 1 Geminorum (4·3), reappearance 12h. 13m.
9. 19h. 2m. Neptune in conjunction with the Moon (Neptune 2° 38′ S.).
13. 14h. 37m. Occultation by the Moon of *i* Leonis (5·7), reappearance 15h. 44m.
14. 10h. 47m. Jupiter in conjunction with the Moon (Jupiter 4° 22′ S.).
17. 17h. 50m. Occultation by the Moon of 80 Virginis (5·8), reappearance 18h. 53m.
19. 13h. 56m. Mars in conjunction with the Moon (Mars 2° 58′ S.).
20. 12h. 37m. Venus in conjunction with the Moon (Venus 0° 56′ S.).
22. 23h. 49m. Eclipse of the Sun. Invisible at Greenwich.
24. 0h. 39m. Uranus in conjunction with the Moon (Uranus 1° 25′ N.).
25. Comet Morehouse (1908*c*) in perihelion.
29. 8h. 14m. Saturn in conjunction with the Moon (Saturn 3° 4′ N.).

MOREHOUSE'S COMET, 1908*c*.—Its declination having become southerly on November 22, and its R.A. being within 2¾ hours of that of the sun, comet Morehouse is now becoming a more difficult object to find, and this condition has been considerably aggravated, in town, during the past fortnight, by the haziness of the sky between sunset and midnight. The comet now sets below the horizon of London at about 8.15 p.m.

A continuation of Dr. Ebell's ephemeris, prepared by Dr. Smart, appears in No. 402 of the *Observatory* (p. 422, November), and shows that, after its perihelion passage, the comet will never rise above our horizon from about the middle of January until the middle of May, 1909.

The greatest southerly declination, 80°, will be attained about March 24, and during its period of visibility the comet will have practically travelled from pole to pole. According to the ephemeris, its apparent brightness is now decreasing slowly, but will not fall below that at the time of discovery until the end of April.

A second set of elements and a new ephemeris have been prepared by Messrs. Einarsson and Meyer, of the Berkeley Astronomical Department, and are published in No. 139 of the Lick Observatory Bulletins; the ephemeris extends to December 28·5.

HALLEY'S COMET.—A search-ephemeris for Halley's comet, published in *Popular Astronomy*, gives the position for November 27 as 6h. 21m. 18s., +11° 15′ 17″, and shows that the R.A. is at present decreasing at the rate of about 44s. per day, whilst the declination is decreasing by about 30″ per day. On November 27 the calculated distance of the comet from the earth will be about 5·26 astronomical units.

According to Mr. Wendell, the radiant point of the meteors from Halley's comet is R.A. = 22h. 43m., dec. = +1° 18′, and it is suggested (the *Observatory*, No. 402) that meteors should be looked for from this radiant about May 12 during the next three years.

In anticipation of the return of Halley's comet and the increase of our knowledge of comets that is likely to result therefrom, the Astronomical and Astrophysical Society of America has appointed a committee to organise the proposed observations, so that the most useful results may be obtained.

A SIMPLE INSTRUMENT FOR FINDING THE CORRECT TIME.—In the November number of the *Bulletin de la Société astronomique de France* (p. 483) Prof. S. de Glasenapp gives an illustrated description of a very simple apparatus by which the true time may be determined with wonderful precision.

The device is called the *cercle solaire*, and consists of a metallic cylinder, about 4 inches in diameter and half an inch in height, so suspended that a diameter always hangs vertically, and so that its direction in azimuth may be fixed. A conical hole is drilled through one wall of the cylinder at a point 45° from the top, the smaller end of the hole being directed towards the centre.

The method employed is really that of equal altitudes before and after the meridian passage, and the sunlight passing through the conical hole forms a "disc" image on an arbitrary scale marked on the interior wall of the cylinder. To find the error of a watch, the times at which the solar image transits, or is tangent to, or symmetrical with, the same scale marks before and after midday are noted, and by a suitable reduction of the observations the time, by the watch, of actual solar noon is found. Applying the corrections for the equation of time and the difference of longitude, if any, the actual mean time is obtained.

The instrument has been rigidly tested at the St. Petersburg Observatory, and the results show that the true time may be obtained within forty seconds even when the change of the sun's declination is neglected; if the latter be taken into account, the reduction necessarily becomes a little more complicated, but results correct within one second may be obtained.

EPHEMERIS FOR JUPITER'S EIGHTH SATELLITE.—A new set of elements and an ephemeris for the eighth satellite of Jupiter, calculated at the Berkeley Astronomical Department, appear in No. 140 of the Lick Observatory Bulletins. The ephemeris gives the distances, in R.A. and declination, between the satellite and Jupiter until December 2. The period of the satellite, according to the new elements, is 2·2948 years.

DESIGNATIONS OF RECENTLY DISCOVERED VARIABLE STARS.—No. 4278 of the *Astronomische Nachrichten* contains the final designations of fifty-three variable stars discovered during 1907, as fixed by the Commission for the A.G. Catalogue of Variable Stars. The table also contains the provisional number, the position (1900), the precession (1900), and the range of magnitude of each star, and is followed by numerous notes dealing with the peculiarities of many of the variables.

THE ENUMERATION OF MINOR PLANETS.—The permanent numbers for recently discovered minor planets (1907–8) are given by Prof. Bauschinger in No. 4278 of the *Astronomische Nachrichten*. The increase, during the past few years, of the number of these objects known is shown by the fact that the permanent number for 1908 C.S. is 659.

THE VARIATION OF LATITUDE.—In reducing the international latitude observations it is assumed that the individual variations, in a definite interval of time, are equal, whatever star pairs be used, and in order to test the validity of this assumption Mr. Hirayama has examined the results of the observations for the period 1900–4. The results of his research appear in No. 4281 of the *Astronomische Nachrichten* (p. 133, November 7), and show that the variation of latitude deduced from each individual pair deviates more or less in a systematic manner. It is also shown that the amplitude of the z variation depends to some extent upon the zenith distance, the brightness, and the difference in right-ascension of the pair of stars observed.

THE FOREST REGION OF MOUNT KENIA.

KENIA is the only snowy mountain in the Old World lying exactly on the equator. Its height is 17,150 feet; it has fifteen glaciers, and the snow-line is there somewhat lower than to the north and south, where there is more variation of season. Kenia is the culminating point of the richest part of British East Africa. The Kenia snows can now be reached in little more than a month from England by way of Mombasa and the Uganda Railway. Mr. E. Hutchins (chief conservator of forests) and Mr. Ross (director of public works in British East Africa) recently returned from a tour round the Kenia forest and a visit to the glaciers.

Quite recently the Pax Britannica has been extended completely round Kenia, though a portion of the route traversed by Hutchins and Ross was through country ranked until then as hostile, that is to say, the Mwèru country, lying on the eastern side of Kenia. A special escort was provided, and no hostility of any kind was experienced. The route followed comprised a journey completely round Kenia, and almost the whole time in the Alpine region at an elevation of about 12,000 feet. Two months was spent in the journey round Kenia. The object of the expedition was to ascertain the exact extent and value of the great forest girdle which stretches round Kenia. For this purpose it was found most convenient to travel at an altitude of about 12,000 feet in order to avoid the tussock grass, which extends above the upper forest limit, and is a serious impediment to progress in the open Alpine country. The tussock grass of Kenia grows in bunches 3 feet or 4 feet high and 3 feet or 4 feet through, and when, in the wet season, it is covered with half-frozen rain and hail, progress through it is not easy. Above the tussock is a zone of shorter grass, with a sufficient supply of firewood in the trunks of the giant heath. This tree, *Erica arborea*, marks the upper limit of tree growth on the Kenia Mountain.

Four glaciers on the western side were visited, and found much as described in Mr. Mackinder's account of their condition nine years ago. Scenes of extraordinary Alpine beauty were traversed, and Mr. Ross obtained a series of photographs, which it is hoped may soon be published. He had charge of the triangulation which determined the boundaries of the forest, and he traversed all but a small portion of the Alpine region.

A number of weather observations were made, the chief feature of which was a persistent high-level north-east current at an altitude of about 20,000 feet. On Kenia Mountain, between elevations of 7000 feet and 14,000 feet, the atmosphere was singularly calm and serene. The general air movement was towards the central snowy peak by day and off it by night, exactly the reverse of what one would have expected in the case of a cool, damp, forest-clad mountain surrounded by dry, sun-scorched plains. Below 7000 feet elevation, and on the plains away from the mountain, the south-east trade wind blew strongly by day from the south and east. On the northern highlands, at about 10,000 feet elevation, the climate was curiously mild and equable. It was not only pleasant and healthful, but extraordinarily exhilarating. There was little or no frost at night, and the small quantity of rain that fell came mostly at night, while by day the equatorial sun was almost invariably screened by a thick mantle of cloud. This great uninhabited plateau, so singularly beautiful, so eminently a white man's country, suggests itself naturally as the site for the future capital city of the British possessions in mid-Africa—the Bogota of the Old World!

The whole of the Kenia Alpine region is healthful and invigorating, but there is a great contrast, during at least half the year, between the wet and misty southern slopes of Kenia and the dry, bracing plateau country of northern Kenia. The expedition consisted of three white men and about fifty natives, and, with the exception of a few cases of lung trouble among the coast natives, there was no sickness, in spite of hardships which, in a less favourable climate, would have told immediately. Hail was experienced on numerous occasions; in fact, on the wetter southern side of the mountain there was a severe hailstorm daily. A real snowstorm was experienced on one occasion only. Then the snow fell in light flakes exactly like a snowstorm in extra-tropical latitudes. This snowstorm lasted for some hours. For some miles, too, around the glaciers a light mantle of snow covered the ground, but this rapidly melted under the influence of a little sun and the warmer air which was experienced at higher altitudes during the day. Kenia peak was bare of snow on the north-eastern side, presumably on account of this comparatively warm upper current. These observations have a peculiar value, since they were made at the wettest time of the year—April, May, and June. The weather on the southern side of Kenia was at this season a striking contrast to what Mackinder and Hausberg experienced. During the wet season, April and May, Hutchins and Ross found the southern side at Alpine altitudes dripping with moisture, and the air nearly saturated with moisture the greater portion of the time. There was a small portion of the southern side of the mountain which was too wet for the upper traverse, and the forest there had to be inspected and mapped from below only.

Everywhere else the forest was examined from above and below, and linear sample areas of the timber measured. The forest belt that encircles Kenia had been reported to be interrupted on the northern side. This was found not to be the case. It is practically continuous right round Kenia. There is, indeed, a small break on the north-west side, but so small as to be scarcely worth mentioning. This break was barely eight miles long, little more, in fact, than the average width of the forest belt, which was found to vary from six to nine miles in breadth. On the northern and western sides, where the forest belt was thinnest, the quality of the forest was the best, it being there largely composed of cedar, which is found in the drier forest only. In the magnificent reach of forest filling up the great south-eastern bay of Kenia, Ibean camphor was abundant, but here cedar is entirely absent, and the effective thickness of the forest belt on this side is reduced by a broad strip of bamboo, *Arundinaria alpina*. In the drier parts of the mountain the bamboo belt is much reduced in breadth; it is frequently broken, and sometimes absent.

The most valuable timbers in the Kenia forest are Ibean camphor on the wet south-eastern side, and cedar, *Juniperus procera*, on the drier western and northern sides. The former is no doubt a timber of exceptional value. Its botanical name has not yet been determined, its flower being now seen for the first time; but cedar is a loftier and far more abundant tree than camphor. It runs up in straight stems to heights of more than 100 feet, and a tree was measured (on northern Kenia) with a diameter of nearly 12 feet. It is extremely durable, and the forest was found richly stored, not only with the live timber of to-day, but with the dry and still sound timber of past ages. Fire does incalculable damage in these cedar forests. The most abundant timber in the Kenia forest is yellow-wood, *Podocarpus thunbergii*, var. *milanjianus*, a tree differing little from the widespread and well-known yellow-wood of South Africa. Another yellow-wood, *Podocarpus gracilior*, in stature and shape has been compared to the Kauri of New Zealand, but this yellow-wood is but sparingly represented. The finest timber is in the great south-eastern Bay of Kenia, but this is largely composed of hardwoods, which have not the same value as the camphor and conifers. Altogether the expedition disclosed a forest of great value, and a particularly important asset to a young country such as British East Africa, without mineral wealth.

THE INTERNATIONAL FISHERY CONGRESS AT WASHINGTON.

THE fourth International Fishery Congress, which met in Washington on September 22, and adjourned *sine die* on September 25, is generally conceded to compare well with the high standards set by its predecessors in Paris, St. Petersburg, and Vienna. Although several of the more important fishery nations were not represented, the membership was truly international. About twenty foreign countries of Europe, Asia, North and South America, and Australasia were in attendance through delegates of Governments, scientific bodies, and fishery societies, and practically all the States of the United States were officially represented. Although the place of meeting and the preponderance of American membership tended to accentuate the American point of view, the strength and ability of the foreign delegation gave to the proceedings a catholicity of expression not always observable in international congresses.

The international regulations of the fisheries on the high seas was the subject of considerable discussion, three papers having that title being presented, respectively, by Mr. Fryer and Dr. Olsen, of England, and Mr. Stevenson, of Washington.

The recognition of the freedom of the seas by the stronger maritime Powers has been slow and grudging, and the crystallisation of the now recognised distinctions between international and territorial waters has been the growth of comparatively recent years. The conventions which have been entered into between nations respecting the regulation of the fisheries common to the subjects of the contracting parties have been surprisingly few considering the importance of the interests involved, though this is not surprising to those in a position to appreciate the biological, legal, and practical difficulties presented for solution.

These international fishery regulations fall into two classes, the one for the conservation of the resources of the sea, the other for the maintenance of order and the protection of life and property. Concerning the necessity for the latter there was not much difference of opinion, and, in fact, most of the accomplished fishery conventions between nations have been for these purposes. That the resources of the sea are in actual need of conservation through international agreement or the concurrent action of the maritime nations was by no means clear to many who took part in the discussion, though most were agreed that the fisheries for sessile organisms, such as sponges, corals and pearl oysters, or for whales, seals, and other marine mammals, were doomed unless means can be devised for the extension of protective measures beyond the present recognised limits of territorial jurisdiction.

It was contended with considerable force that in the case of sessile organisms (as distinguished from feræ naturæ) susceptible of culture involving actual occupation of the bottom, not only justice, but necessity, demands the extension of a restricted form of property right beyond the marine league from shore. The requirements of man have outrun the bounty of nature, and the barren bottoms covered by the high seas should no longer be permitted to go to waste. In other words, it was held that the present and future needs of mankind demand the extension to certain international waters of the measures which experience has shown to be necessary for the edible oyster within territorial limits.

The recent convention between the United Kingdom and the United States, looking to the enactment of concurrent legislation for the control of the fisheries in waters contiguous to the United States and Canada, was referred to with approval by speakers from both countries interested, and among the American participants in the discussion there was a surprising unanimity favouring Federal control of the fisheries in inter-State waters now subject to several State regulations.

In the field of aquiculture two very important papers were submitted by Prof. A. D. Mead. The first was a description of an apparatus for hatching, rearing, and transporting fishes and other aquatic animals. In this the great departure from former methods is that the hatchery is taken to the water rather than the water to the hatchery. It "consists essentially of creating and maintaining within an enclosure of 'native' water a gentle upward, swirling current" by means of propellers revolved through the medium of suitable gearing by a gasoline engine or other motor. The rotary currents set up by the propellers aërate the water, eliminate the toxic gases of respiration, and prevent the suffocation of the eggs and larvæ by their massing on the bottom and sides or through the deposit of sediment. For hatching and rearing the compartments or units, about 10 feet square, are mounted on suitable floats surrounded by the open natural waters, which maintain the cars at an equable optimum temperature. For transporting fishes the same principle is applied to receptacles packed in ice.

Prof. Mead's second paper was an exposition of the use of this apparatus in hatching and rearing lobsters. The artificial hatching of these crustaceans presents few difficulties, but, on the other hand, it possesses no very great advantage over the natural method. The heaviest mortality in this species is in the period of three or four weeks between the emergence of the young from the egg and the period when it assumes its bottom habit. During this time the larvæ are helpless and exposed to many enemies, and Dr. Mead's method is the only one yet proposed which permits the young to be reared to a stage where they can care effectively for themselves. Equally good results can be attained with various fishes passing through similar critical stages, and fish culturists now have in their possession an entirely new and simple method, not only for hatching fishes, but for economically rearing them in large numbers to an age when they can care for themselves. The method is a wide departure from those previously employed, and marks the greatest advance in fish culture within recent years. It may be added that it has for several years demonstrated its practical utility.

The "lobster question" in general provoked considerable debate, in which English, Canadian, and American representatives participated. Dr. Geo. W. Field proposed a radical departure in the regulation of this fishery, advocating the use of apparatus which will automatically exclude the large breeding lobsters from capture, while taking those between 9 inches and 11 inches in length, which produce few or no eggs. This proposal was strongly combated, especially by the advocates of artificial hatching, who contended that present methods are now resulting in an increase in the lobster catch, and that a change would prove disastrous.

Three papers by Messrs. Paul Reighard, Frank N. Clark, and S. W. Downing, on the subject of the promotion of white-fish production in the Great Lakes, while dealing with a fishery in which the United States and Canada only are concerned, precipitated a discussion of international interest. The three writers, reasoning along somewhat different lines, all reached the conclusion that artificial propagation offers the only feasible plan for increasing the white fish; that a close season during the spawning period is worse than futile, especially where there are offered facilities for taking and hatching eggs; and that closed seasons and restrictive measures should not be applied to the spawning fish, but to small and immature specimens. These propositions, while representing the preponderance of American opinion on the subject, met with vigorous opposition from Mr. Chas. E. Foyer, of England, and from several American delegates, while Prof. E. E. Prince, of Canada, doubted the practical feasibility of preventing the capture of small fish if fishing were permitted at all.

Dr. P. P. C. Hoek, of the Netherlands, presented a paper on the propagation and protection of the Rhine salmon. The Rhine is distinguished among the salmon streams of the Atlantic basin by its productiveness, and Dr. Hoek demonstrated that, as under existing conditions comparatively few salmon reach their natural spawning grounds, the present supply of fish is maintained principally by artificial propagation. To be effective, however, this must adhere in many particulars as closely as possible to nature's method; especially must the fry be planted in these upper waters in which the proper conditions exist for their year-long stay in fresh water. The loss sustained in the long downward run to sea must be compensated for by more extensive planting in the headwaters.

Bearing upon this question of the utility of fish culture, an interesting paper was presented by Mr. L. G. Ayson, of New Zealand, on the introduction of American fishes into New Zealand waters. New Zealand, though bountifully provided with rivers and lakes, presents the extraordinary characteristic of an almost total lack of freshwater commercial and sporting fishes. About twenty-five years ago three consignments of eggs of the steelhead trout, *Salmo gairdneri*, were planted, and the species artificially propagated, with the result that to-day they exist in extraordinary numbers in nearly all streams and lakes in the northern part of the country. The Chinook salmon, *Oncorhynchus tschawytscha*, was planted between 1901 and 1907, about two-million eggs being imported. The first returns were in 1905, when a few were caught by anglers, and as there has been a spawning run each year since, it is believed that the species is now firmly established. Several other American fishes have been introduced into the waters of New Zealand, where they have become thoroughly acclimatised. The results of planting certain American Salmonidæ in Europe are well known, and recent experiments in carrying them to Argentine have been favourably reported on. Experiments in the acclimatisation of fishes, however, have not

always met with success. Certain lakes possessing all the obvious biological and physical requirements have been repeatedly planted without result, and it has been but recently determined, through the work of Prof. E. A. Birge, that the failure is due to peculiarities of the gaseous content of the water. In a paper on the gases dissolved in the waters of Wisconsin lakes, Dr. Birge illustrated his studies, which are of the highest value to fish culture.

A paper on the utilisation of sea-mussels and dogfish as food, presented by Dr. Irving A. Field, opened a very general discussion on a subject which appealed to both the biologists and the practical fishermen. During recent years the horned dogfish (*Squalus acanthias*) has been extremely destructive to fish and fishing on the coasts of Canada and New England, while the smooth dogfish (*Mustelus canis*) is a perennial menace to the lobster. In Canada oil and fertiliser works have been established for the purpose of supplying a market and encouraging the destruction of the dogfish, and Prof. Prince is of the opinion that they have to some measure decreased in numbers.

Dr. Field's experiments have demonstrated that the smooth dogfish, salted and dried, makes a product closely resembling the cod, and in a fresh condition it is not inferior in texture and flavour to halibut; the horned dogfish, being more oily, is better adapted for tinning. Mr. Fryer stated that the equally destructive dogfish of the English coasts had been placed on the markets by the fishermen, and while it was unobjectionable as to quality, it met with prejudice on account of its name, a difficulty which also confronts the exploitation of dogfish as food in the United States and Canada. An euphonious name, not deceptive in character, would assist greatly in converting a fishery menace into a valuable product and important source of cheap food supply. The practical difficulties confronting the utilisation of these fish are being made the subject of inquiry by various technical bodies in the United States and Canada.

A communication from the Rhode Island Commission of Inland Fisheries, in reference to the effects of gun-fire on schools of fishes, developed a difference of opinion between the scientific men and the practical fishermen. The latter declared that the heavy detonations from cannon drive the fish away from the coast, but the results of experiments at Woods Hole, as recounted by Dr. Sumner, indicated that mackerel and other surface-living fishes were but little disturbed by either gun-fire or the noises made by boats using explosive engines. The investigations of Dr. Parker at the fisheries laboratory prove that certain fishes are influenced by sound stimuli as distinguished from the grosser mechanical vibrations of the water, but that their sudden movements of alarm are dictated by sight rather than by hearing.

Eighteen corporations and individuals interested in the fisheries offered prizes for contributions on special subjects, and of these seven were unawarded, either because the papers submitted did not satisfy the strict conditions of the award or because they did not conform to the standard of merit imposed by the international jury of awards. Two awards were made to Prof. A. D. Mead for the papers above-mentioned, two to Dr. H. F. Moore for papers on the sponge fisheries and on growing sponges from cuttings, one to Mr. Dwight Franklin for the best method of preparing fishes for museum purposes, one was divided between Dr. F. A. Lucas and Mr. R. W. Minor, for papers on the best plan for an educational exhibit of fishes, one was given to Mr. Chas. H. Stevenson for the paper above alluded to, one to Mr. Paul Reighard for the best plan to promote the white-fish production of the Great Lakes, one to Prof. Jacob Reighard for the best methods of observing the habits and recording the life-histories of fishes, one to Mr. Chas. G. Atkins for a paper on foods for use in rearing young salmonoids, and one to Mr. John J. Solomon for a process for preserving the pearl fisheries and increasing the yield of pearls.

Many papers of much practical and scientific merit were submitted, but not read for lack of time, but they will be published in the proceedings of the congress. The fifth congress will be held in Rome in 1911, the year of the semi-centennial of the Italian Federation.

PSYCHOLOGY OF PLEASURE AND PAIN.

THE last two numbers of the *Psychological Review* (July and September) have contained important articles by Prof. Max Meyer, of the University of Missouri, on the nervous correlate of pleasantness and unpleasantness. In the former the author brings out the contradictory character of the present views of psychologists on this subject, and in the latter proposes a theory that he believes accords with all known facts and gives proportionate weight to the various aspects of the question upon which his predecessors have dwelt too exclusively. The clearest opposition has hitherto been between the psychologists, who hold that pleasantness and unpleasantness are merely weak (and therefore badly localised or entirely unlocalised) forms of the sensations, which at a higher degree of intensity become respectively sexual sensation and pain, and those who, denying their substantive status, regard them merely as aspects or "tones" of sensational processes.

Prof. Meyer's theory is of a different type altogether, and is based upon the concept of an hierarchy of reflex arcs or a "centralisation by degrees." Let A and B be two sensori-motor systems of neurons relatively independent, but having at least one connecting neuron in common. It is always possible for these to merge into a more complex sensori-motor system, C. The marks of this higher organisation will be (1) that stimulation of a sensory point of either A or B may produce simultaneous reactions at motor points both of A and B; and (2) that simultaneous stimulation of sensory points of both A and B may produce a reaction at a motor point of A or B only. In the case of such a system, if the subsystem A is functioning a strong stimulation of subsystem B will produce a decrease in the intensity of the current in A (drawing it off, in fact, towards motor points of B), while a gentle stimulation of B will merely increase the current setting towards motor points of A. The decrease or increase in the flow through system A, due to the action of B, is the nervous event which will be experienced as unpleasantness or pleasantness respectively. For example, the slight degree of pain produced by scratching after an insect's bite is rather pleasant, for it actually increases the energy of the scratching process. If, however, the pain becomes too intense, its own typical reaction is set up; energy is drawn off from the scratching process, and unpleasantness is felt.

It follows on this theory that pleasantness and unpleasantness are attributes of the relatively more complex psychophysical functions, and, therefore, that their highest intensity may be expected to accompany intellectual activity—a result which the author claims as a powerful piece of evidence of the superiority of his doctrine over that which would regard them as "feeling tones" of sensations.

SCIENTIFIC EDUCATION OF NAVAL ARCHITECTS.[1]

IT has occurred to me that an appropriate subject for the address, which it is my duty to deliver as chairman of the council, may be found in a brief account of the methods adopted for the education of naval architects in this country during the past century. I venture to hope that, apart from its particular interest for those engaged in shipbuilding, the narrative may have some value and attraction for those interested in technical education generally, and that it may throw some light on problems of higher technical education which still await solution in this country.

In 1806 the Commission of Naval Revision reported in regard to the principal shipbuilding officers of the Royal Navy. There is evidence that outside the Admiralty service the standard of professional attainment amongst British shipbuilders was then low. As practical ship-carpenters they excelled; their ships were "well and truly built," strong and durable. As ship-designers they depended on

[1] From an address delivered before the Society of Arts on November 18 by Sir W. H. White, K.C.B., F.R.S., chairman of the Council of the Society.

precedent and experience. British warships were designed in accordance with "established dimensions," according to which ships of a certain tonnage carried a certain number of guns of specified sizes. The tonnage was estimated by an unscientific rule; and a competent authority, speaking of the condition of things existing at the beginning of the last century, asserted that "scarcely an individual in the country knew correctly even the first element of one of our numerous ships." As a matter of fact, the official "established dimensions" were varied but little from 1680 to 1810, and there was practical stagnation in British shipbuilding.

Instead of advance having been made in the practice of naval architecture in this country during the eighteenth century, there is reason to believe that there had been retrogression, so far as scientific knowledge and methods were concerned.

The movement in favour of better education for British shipbuilders and the adoption of scientific methods in ship design a century ago was chiefly due to men unconnected with the industry, and was not welcomed by shipbuilders of the older school. Fortunately, opposition from various quarters was overcome, and the first school of Naval architecture began its work at Portsmouth in January, 1811, under the direction of Dr. Inman, a distinguished graduate of the University of Cambridge. The intention was to train men who should unite sound practical experience with high scientific knowledge, to give them employment subsequently at sea and in the work of ship-designing, and so to provide efficiently for the higher ranks of officers at the Admiralty and in the Royal dockyards.

When the steam-reconstruction of the Navy had to be undertaken about fifty-five years ago, and was rapidly followed by the use of armour as a protection against attack by explosive shells, it became impossible any longer to pretend that naval officers, untrained as naval architects, could undertake the responsible work of designing British warships. Fortunately, trained men were available in the persons of Dr. Inman's old pupils, who had been compelled to wait twenty years before their opportunity came.

Sixteen years elapsed before a second school of naval architecture was established by the Admiralty at Portsmouth, under the title of the "Central School of Mathematics and Naval Construction." Five years earlier the Admiralty had framed a scheme for schools in the Royal dockyards, at which all apprentices were required to attend "every afternoon for three hours, commencing an hour and a half previous to that at which the yard closes." Under this rule the Admiralty paid the boys' wages for one-half the period of school attendance, and required them to give the other half out of their own time. Beginning with "elementary matters, such as reading, writing, common and decimal arithmetic, Scripture, English history, and geography," the apprentice passed on to more advanced instruction. At the end of three years a selection was to be made by means of an examination, and those whose abilities entitled them to a higher course of instruction were allowed to attend school for two years more. For the majority of apprentices this ended their education: but the Admiralty order provided that "two or three of the best apprentices in each yard should be elected to the first class, should be instructed in 'laying off' and the leading principles of ship construction, and, so far as it is necessary for that purpose, should be taught mechanics, hydrostatics, and mathematics." Its main features have been continuously maintained for sixty-five years, with results which more than justify any expenditure incurred. As the national standard of elementary education had been raised, so the required standard for the admission of apprentices had been elevated, and out of the dockyard schools there had come multitudes of well-educated, intelligent workmen, from amongst whom, by a process of gradual selection, had been found subordinate and principal officers for the Admiralty service, while no small number had passed from that Service into the private trade, and occupied positions of importance and responsibility in shipyards throughout the country and on the staffs of the registration societies for shipping, of which Lloyds' Register is the greatest. The scheme is broad and generous; it gives facilities and aid, while requiring apprentices on their side to study in time that would otherwise be their own for leisure or recreation. It carries on, side by side, practical and educational training; it exercises a gradual selection of those whose ability and application show them to be capable of benefiting by higher instruction. It sets up a "ladder of learning" from the lowest level, and there has been no bar to any capable man in striving to reach the highest position. Its cost is extremely moderate in proportion to its beneficial results. For the current financial year the dockyard schools at home and abroad are estimated to cost less than 6200*l.*, while the wages vote for these establishments exceeds two and a half millions sterling.

The second school of naval architecture constituted the final stage in the Admiralty scheme for the technical education of its naval architects. Its students were intended to be the pick of dockyard apprentices of five years' standing, who during that period had received an excellent general education, a good training in the practice of shipbuilding, and a special course of mathematics bearing on naval construction. It differed from the first school, therefore, because the former institution had been intended exclusively for a higher class of apprentices, to whom appointments were guaranteed when their course of training was satisfactorily completed. In other words, the fundamental idea of the first school was to train students who were intended to become superior officers subsequently. On the contrary, the working apprentice class, by a process of selection applied at intervals during five years, was intended to supply the students to be trained in the second school, and they were not guaranteed appointments similar to those promised to their predecessors.

Cambridge University again supplied a principal for the school of naval construction in the person of Dr. Woolley, who proved a worthy successor to Dr. Inman. During the five years of its existence men were trained who subsequently achieved high distinction in the theory and practice of shipbuilding, and who proved capable of taking up the primary responsibility for warship design when age and failing powers compelled the retirement of men trained in the first school. The grave responsibilities incidental to the iron-clad reconstruction were borne, and successfully borne, by men from this college for a period of more than twenty years, and it was a fortunate circumstance that the Central School of Mathematics and Naval Construction was in existence even for so brief a period, because its students ably filled the gap that would have otherwise existed in the ranks of trained naval architects at a most critical period in our naval history.

The third school of naval architecture was founded in 1864, and placed at South Kensington, the Education Department being associated with the Admiralty in its establishment and maintenance. Its creation was due to the action of the Institution of Naval Architects, which had been formed in 1860 on the joint initiative of naval architects trained for the Admiralty service, of a number of leading private shipbuilders and marine engineers, and of naval officers, yachtsmen, and men of science. In many respects the Royal School of Naval Architecture and Marine Engineers differed from, and was more comprehensive than, its predecessors.

The new school was intended to train students for the private industry as well as for Admiralty service. Its founders hoped to attract the sons and relatives of shipbuilders and marine engineers, as well as to provide for young men selected by the Admiralty from the dockyard schools. Marine engineering was recognised as the younger sister of shipbuilding, needing equally good and systematic training for those making it their career. Foreign students were admitted as well as British subjects. The institution was designed to be, or to become, a school of which the greatest maritime nation of the world might be proud. It started under the fairest auspices; there was no failure in organisation, courses of study, teachers, or lecturers; the Admiralty played its part and sent up well-prepared students; foreign Governments also sent students, but in regard to private British students there was disappointment, both as to numbers and previous preparation. What should have been the chief source of supply for British students, and for income, failed lamentably. Looking back on the result, it does not appear so surprising as it did at the time. The scheme of instruction was admir-

able, only it required for its good working a standard of previous attainment, which was reached only by Admiralty students who had spent five or six years in practical work at the dockyards, and in attendance at the special schools therein provided. Even the best of the private students were far less advanced on entry, consequently very few of them were able to benefit fully from the higher and specialised instruction provided at South Kensington. Many private students did derive advantage from attendance, and have shown this to be true in their subsequent careers. On the whole, however, it must be admitted that the scheme was pitched too high in relation to the means of preliminary instruction then existing in this country, and that to give it full effect a preparatory school should have been created also, through which students could have passed before proceeding to the Royal School of Naval Architecture. Even to this day one of the greatest difficulties in the way of utilisation by students of the higher instruction provided in technical colleges consists in the want of proper preparation.

There are certain distinctive features in the arrangements at the Royal Naval College which have stood the test of thirty-five years' experience, and consequently may be worth consideration by those engaged or interested in technical instruction elsewhere. To a few of these I would refer, because they have a bearing on higher technical education in its general aspect.

First, great care is taken thoroughly to prepare the Admiralty students before they enter the college, so that they may derive full advantage from the special facilities existing there. For many years past the Admiralty has maintained at Devonport a college in which those who are to become engineer officers of the Navy receive a practical and scientific training extending over four or five years. Entry to this school has been governed by competitive examinations, and the parents of students have been required to contribute to the expenses of the education of their sons, so that the selection of the students has been made from a higher class than that which furnishes ordinary dockyard apprentices. At the end of the training in this preparatory college a final selection is made of a limited number of students of naval architecture and marine engineering, who proceed to the Royal Naval College to undergo a further period of three years' training in the higher branches of their profession. During the three years' course at the college the summer vacations of the students are spent in the Royal dockyards on practical work, so that Admiralty practice for about forty-four years has represented what is now termed the "sandwich system" of instruction, and it has worked well.

Secondly, private students admitted to the Naval College have been required to possess and give evidence of possessing a knowledge of practical shipbuilding obtained by a period of service in shipyards, as well as a certain standard of attainment in mathematical and scientific subjects. In Germany a similar condition has been insisted on in recent years, and a period of practical training must be undergone by every student who aims at any branch of engineering as his life's work, in the interval between leaving the secondary schools and entering the higher technical schools.

Thirdly, the teachers of naval architecture and marine engineering at the Royal Naval College are officially called "instructors," but really perform the duties of professors. They are appointed only for limited periods, coming from and returning to their professional work. All of them have been distinguished graduates of the college, and, after the completion of their studies, have acquired considerable practical experience at the Admiralty, in the dockyards, and (in many cases) during periods of service at sea. Thus equipped they enter upon their work as teachers. It is ensured that teachers never "lose touch" with the practical side of their professional work, and shall never continue so long in the position of instructors as to become stale, and therefore less capable of dealing with the professorial duties entrusted to them.

Care seems to be required also in another direction at the present time. No teacher of any branch of engineering can be regarded as properly qualified until he has gained actual experience and borne the burden of responsibility in connection with the design and execution of important works. It should never happen that those who teach should be lacking themselves in one side of the training—and that the not less important side—which, by common consent, is needed for the modern engineer. The Admiralty system meets this requirement, and has worked well. It has furnished capable professors of naval architecture and marine engineering, not merely for Admiralty establishments, but for universities at home and abroad.

Turning to results obtained from the work of the Royal Naval College during the last thirty-five years, it must suffice to say that they have been altogether satisfactory when judged by the positions which have been or are occupied by men who graduated there. The Admiralty staff of naval constructors and marine engineers has been mostly recruited from that source, and the highest offices have been successfully filled by ex-students of the Royal Naval College.

It may be interesting to add that about twenty-five years ago the Admiralty constituted a Royal Corps of Naval Constructors. The scheme for that corps provided for the admission of qualified men who had not received their training under the Admiralty, or in Admiralty establishments, subject to the condition that candidates for entry showed proof (by examination and by recorded service) of thorough training in both the science and practice of shipbuilding.

Closely allied with the scientific education of shipbuilders and marine engineers is the provision for instruction of naval officers and shipowners in the fundamental principles governing the construction and propulsion of ships. As regards officers in war-fleets and in mercantile marines, it is advantageous that they should possess some knowledge of the principles of buoyancy, stability, and structural strength, and should have mastered the elements of engineering. On the side of shipowners similar knowledge would undoubtedly assist commercial success. From the nature of the case shipowners must determine the governing conditions of the trades in which ships are to be employed, and naval architects must discover the best possible solutions of the problems laid before them. In the case of warships, naval officers properly claim the right to select the qualities of armament, protection, speed, coal endurance, &c., which they wish to have embodied in designs. It is equally undesirable for the naval architect to assume the right of laying down the conditions to be fulfilled in new designs, as it is for shipowners or naval officers to assume the position of amateur ship designers. If naval officers or shipowners can be endowed with an understanding of the elementary principles affecting ship construction and propulsion they must be better able to appreciate what is or is not possible under the conditions of practice, and therefore they will be much less likely to lay down conditions which are incompatible with one another or impossible of realisation. These considerations led me to suggest in 1873 that the Department of Naval Architecture in the Royal Naval College at Greenwich should include classes in which officers of the higher ranks in the Royal Navy should receive elementary instruction of this kind. These classes have now been in successful operation for more than thirty years, and there is ample evidence of their utility. Subsequently to the establishment of these classes at Greenwich it was decided also to give systematic instruction to junior naval officers in the principles of shipbuilding and engineering, and good results were obtained. In the most recent arrangements for the education of naval officers at Osborne and Dartmouth fuller expression has been given to the same idea, and no one questions the advantages which will be gained thereby. In these days it is obviously a necessity that every naval officer charged with the great responsibilities attaching to the use and management of warships, which are full of complicated machinery, should possess a considerable knowledge of engineering. The only matter on which difference of opinion exists is in regard to the further training of that class of officers who will eventually be placed in responsible charge of the propelling and other machinery of warships.

From the preceding remarks it will be understood that the sole provision made for the higher education of British naval architects for a very long period was in schools established by the Admiralty; but this reproach was re-

moved about a quarter of a century ago by the creation of a professorship of naval architecture in the University of Glasgow, thanks to the generosity of Mrs. John Elder. About the same time a professorship of engineering was established in connection with the University of Durham at the College of Science (now the Armstrong College), Newcastle-on-Tyne, and instruction in naval architecture is included in the curriculum of studies in this department. It was always desired to have an independent professorship of naval architecture in this great centre of shipbuilding, and by persistent effort this desire was fulfilled about a year ago. The country now possesses three schools of naval architecture, two of which are independent of the Admiralty, and sustained by the private shipbuilding industry.

It has been suggested that the multiplication of schools of naval architecture in Great Britain may be overdone, but when compared with the provision now made for the education of naval architects in Germany, France, and the United States, and taking into account the overwhelming preponderance of British shipowning and shipbuilding, there need be no fear that four schools of naval architecture, each with a considerable number of students, would constitute an excessive provision for this country. In the Technical High School of Charlottenburg, near Berlin, there were not long ago about 400 students of naval architecture and marine engineering, all of whom had received adequate preparatory training before entering the high school and specialising in these studies. Even at the present time the total number of equally qualified students of naval architecture and marine engineering attending the classes in British schools is only about 170, or less than one-half the number of men studying at Charlottenburg. In the United States excellent schools of naval architecture exist at the Massachusetts Institute of Technology and as departments in several universities. These are well equipped, and attended by considerable numbers of students. When it is borne in mind that the aggregate tonnage of steamships belonging to the British Empire is seventeen millions of tons, as against 3,705,000 tons owned by Germany and 1,542,000 (exclusive of the shipping on the great lakes) owned by the United States, and that in 1907 the gross tonnage of ships launched in the United Kingdom aggregated 1,608,000 tons, as against 291,000 tons for Germany and 486,300 tons for the United States, it will hardly be maintained that the provision made or contemplated for the higher education of British naval architects is likely to prove excessive.

Possibly it may be thought that the German provision for such education is extravagantly large, and that the number of highly trained men who annually pass out from the High School at Charlottenburg is in excess of the real requirements of the shipbuilding industry of that country. This is not the opinion entertained in Germany itself, for another school of naval architecture has been creafed at Dantzic recently.

The last half-century has witnessed unprecedented progress in British shipping and shipbuilding. It is apt to be forgotten that when the Civil War broke out the tonnage of American shipping was rapidly overtaking that of this country, and threatened to surpass it before long. It is true, no doubt, that the lead which we took in the use of iron instead of wood as the chief material of construction, and in the development of steam navigation, helped forward the remarkable progress that has been made. It is equally true that great assistance to progress has been given by the application of scientific methods to ship construction and propulsion. It would be ridiculous to suppose that the contemporaneous development of technical and scientific training amongst naval architects and marine engineers had only been a coincidence, and had not played a great part. Many circumstances, as well as many persons, have assisted in bringing British shipping and shipbuilding into its present unrivalled condition, but the underlying and predominant cause must be found in the general recognition of the necessity for scientific as well as practical training on the part of those engaged in the design and construction of ships and their machinery.

Ship-designing can never be dealt with on purely scientific methods. Exact estimates cannot be made of the most trying conditions to which ships at sea may be subjected. Accumulated experience, based on careful observation and experiment, must always be the foundation of successful work. Direct experiments on models of ships and propellers are of incalculable value; but the arrangement and conduct of these experiments, the carrying out of observations on the behaviour of ships, the grouping and analysis of results, and the deduction therefrom of facts and principles for future guidance, all demand scientific knowledge and scientific procedure. Of course, this is not peculiar to shipbuilding, and I have no desire to magnify the importance of that branch of engineering to which my life has been devoted. It is equally true of engineering as a whole, and of the applications of science to industrial processes generally. My chief object in describing to-night what has been done in the technical education of naval architects has been to present an object-lesson to those interested in technical education as a whole.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Prof. Adam Sedgwick, president of the Philosophical Society, has been appointed to represent the society at the Darwin centenary celebrations in June, 1909.

In a letter to the Vice-Chancellor, the secretaries of the Royal Society announce that, as Sir William Huggins desires now to relinquish the care of the stellar spectroscopic equipment placed in his hands by the Royal Society in 1871, the president and council of the society are prepared to present these instruments as a gift towards the equipment of the astrophysical department of the Cambridge Observatory, subject to an assurance of their permanent profitable employment being obtained. This assurance having been given by the observatory syndicate, the installation will be transferred permanently to the University as it now stands in full working order in Sir William Huggins's observatory. In view of the historical importance of this equipment, and its intimate connection with the foundation and development of the science of astrophysics, it is desired that the name of Sir William Huggins be permanently connected with the instruments.

The electors to the Isaac Newton studentships give notice that, in accordance with the regulations, an election to a studentship will be held in the Lent term, 1909. These studentships are for the encouragement of study and research in astronomy and physical optics. The persons eligible are members of the University who have been admitted to the degree of Bachelor of Arts, and who will be under the age of twenty-five years on the first day of January, 1909. It will be the duty of the student to devote himself during the tenure of his studentship to study or research in some branch of astronomy or physical optics. The student's course of study or research must be, as a rule, pursued at Cambridge. The studentship will be tenable for the term of three years from April 15, 1909. The emolument of the student will be 200*l.* per annum, provided that the income of the fund is capable of bearing such charge.

LONDON.—The new deans of faculties are:—for medicine, Prof. S. H. C. Martin, F.R.S.; for science, Prof. J. M. Thomson, F.R.S.; for engineering, Prof. W. E. Dalby.

Prof. T. G. Brodie has resigned his post as professor-superintendent of the Brown Animal Sanatory Institution on his appointment as professor of physiology in the University of Toronto.

The degree of D.Sc. in physiology has been granted to Dr. F. H. Scott, an internal student, of University College, who submitted a thesis entitled "On the Relative Parts played by Nervous and Chemical Factors in the Regulation of Respiration," and other papers; also to Dr. H. W. Bywaters, an internal student, of the physiological laboratory of the University, who submitted a thesis entitled "An Inquiry into the Chemical Mechanism concerning the Absorption of Protein and Carbohydrate Food," and other papers.

A separate board of studies is to be constituted for ethnology.

THE council of the University College, Bristol, has appointed Dr. John Beddoe, F.R.S., honorary professor of anthropology.

DR. V. H. BLACKMAN, professor of botany in the University of Leeds, has been appointed by the Senate to represent the University at the commemoration, in June next, at the University of Cambridge, of the centenary of Darwin's birth and the fiftieth anniversary of the publication of the "Origin of Species."

LORD IVEAGH has been elected Chancellor of the University of Dublin in succession to the late Lord Rosse. Lord Iveagh has been a generous benefactor of the University, and contributed a sum of 16,500*l.* for the construction and equipment of the laboratory of experimental physics, which was completed in 1906.

SPEAKING at Edinburgh on November 19, in opening the new science and art rooms of George Watson's College for Boys, Lord Avebury said that, considering how much we owe to science, it is a marvel that so little time is devoted to the study of nature in the public-school and university system. Scientific men do not undervalue or wish to exclude classics from the curriculum, but their point of view is that a man, however much he may know of the dead languages, if he knows nothing of science is but a half-educated man after all.

AN article by Prof. Rudolf Tombo, jun., in *Science* for October 30 last, on the geographical distribution of the student body at a number of American universities and colleges, deals incidentally with the number of foreign students in attendance at these institutions. The total number of students from foreign countries in attendance at the twenty-seven institutions in the United States selected for the purposes of the comparison is 1088. Of this number Europe contributes 219, Asia 332, Australasia 58, and Africa 9. Pennsylvania University has the largest foreign clientele, followed by Columbia, Cornell, and Harvard, each of which attracts more than one hundred foreigners. Taking the representation of foreigners at all the selected institutions, we find that the largest number of students are sent by the following countries:—Canada, 210; Japan, 142; China, 139; Mexico, 90; Cuba, 67; Great Britain and Ireland, 60; Argentine Republic, 56; and India, 54. Of European countries, England sends the largest number, namely, 60, followed by Russia with 40 and Germany with 32. Of the students from Great Britain and Ireland, 8 attend Columbia University, 9 Harvard, and 12 Pennsylvania.

THE opening of the new memorial buildings at Eton College by the King took place on Wednesday, November 18. The ceremony was most impressive, and the King's reply to the address of the boys expressed in admirably clear and dignified words the feelings which must have pervaded the whole assembly. "You all have the opportunity of leaving Eton trained in the knowledge and accomplishments of English gentlemen, and disciplined to the self-restraint, the consideration for others, and the loyal acceptance of private and public duties which are the ideals of our race. I exhort you to value and make the most of that training and discipline. You can have no better example than that of the brave men of whom this splendid building is a loyal and lasting memorial." It would be difficult to give a better expression to the public-school ideal, and the King's words may well be studied by every school in his kingdom. Eton has for some time possessed laboratories, chemical, physical, and biological, as well as workshops, and, as at other public schools, boys have the opportunity of acquiring some of the wider culture which science is ready to supply, and which Osborne and Dartmouth are adding to the knowledge and accomplishments of English princes; but hitherto Eton has had no single building capable of accommodating the whole school. The new hall supplies this defect, and it will be used for concerts and lectures, provision having been made for an electric lantern. The acoustic properties of the hall seem to be excellent, and every word, not only of the King's speeches, but also of the address read by the captain of the school, was distinctly audible. Adjoining the hall is a dome, in which the school library will find adequate accommodation.

THE annual report of the Glasgow and West of Scotland Technical College, adopted by the governors of the college at the end of September last, has reached us. There was during the session 1907–8 an increase of 156 students, bringing the total up to 5918 individuals if, as is done in the report, the pupils of Allan Glen's School are included. We observe that the completion of the long-contemplated amalgamation of the Incorporated Weaving, Dyeing, and Printing College with the Technical College has been effected, and this department, like all the other departments of the college, will continue under the supervision of leading members of the industry with which the work is associated. A condition of the amalgamation is that the governors shall make their best endeavours to provide new premises for the weaving department in the new buildings. Efforts are to be made to improve the preliminary education of students entering the college; notice has been given that in September, 1910, the standard of the preliminary examination will be raised to that of the leaving certificate of the Scotch Education Department. As the report points out, there is no reason why a boy of average capacity and diligence should not obtain this certificate at the age of seventeen or eighteen. The report acknowledges the encouragement received by the college from the Carnegie Trust for the Universities of Scotland by a grant of 4000*l.*, from the Education Department by an additional grant of 8805*l.* towards the building and equipment fund, from the Corporation of Glasgow of a sum of 4500*l.* from the residue grant, and also 900*l.* in respect of the weaving college, and from local associations, industrial firms, and others by gifts of prizes for students and of material for use in the laboratories.

THE report on the work of the department of technology of the City and Guilds of London Institute for the session 1907–8 has reached us. We notice that since the institute, some sixteen years ago, first established classes for the training of teachers in the use of wood-working and metal-working tools, instruction in this subject has made great advances, and has been very much improved. Originally introduced by way of experiment in a few elementary schools, manual training is now a recognised subject in the curriculum of most elementary and secondary schools, and is one of the subjects studied by men students in training colleges for teachers in elementary schools. A recent alteration in the Board of Education Code regulating the work of public elementary schools, by which boys of eleven years of age are admitted to classes in handicrafts, will result most probably in a further demand for qualified teachers in these subjects. The technology committee of the institute directs attention to the fact that the Board of Education has under consideration the question of developing all forms of manual instruction and of encouraging continuity throughout such teaching from the classes for infants to the upper standards of the elementary school. Since 1892, the date of the first public examination, 4861 teachers' certificates in manual training have been awarded by the institute. The work of the department as a whole continues to progress. The number of subjects in which examinations were held during the year dealt with in the report was seventy-two, as compared with sixty-nine in the previous year, the number of separate classes increased from 3311 to 3604, and the number of students in attendance from 46,048 to 48,223. The programme of courses of instruction for the current year contains, the report states, seventy-six different syllabuses, including courses of instruction relating to more than a hundred distinct branches of industry.

PART ii. of vol. i. of the Journal of the Municipal School of Technology, Manchester—a record of the work of the school—has just been issued. It consists of 130 pages of reprints of ten papers written by members of the staff of the school, and communicated to the scientific societies or published in the scientific Press during the four years 1903–7. One of the papers deals with a mathematical, another with an electrical, a third with a sanitary, two with engineering, and five with chemical questions. The journal is printed in the school, and reflects great credit on the printing department. Its issue raises several momentous questions. In the first place, Manchester appears to be the only technical school in this country

which considers it worth its while to reprint the papers written by the members of its staff, and the conclusion is forced on us that no one of the dozen polytechnics of London or of the score of technical schools in the large towns of the provinces—Birmingham, Glasgow, Belfast, and others—contributes to the advancement of science so much as Manchester does. In the next place, it may reasonably be asked, Is Manchester doing as much as it ought to do in this direction? To answer this question we must remember that the school cost a third of a million, has a staff of nearly 100, and claims to be second to none in the kingdom in point of equipment. Judging by Continental schools, about one-sixth of the staff might reasonably be expected to be doing something to solve the problems met with in their own departments, and on this basis Manchester does not yet produce its proper quota of research; and if Manchester does not, what must be the state of the other schools of the kingdom? and why are they in this state? They were founded for the training of those who intend to apply science to industry, who can render no greater service to industry than the solution of some of its problems. What better training for this purpose can there be than working out one of those problems under the guidance of a teacher, and how can the teachers act as guides unless they themselves have been pioneers? No technical school is fulfilling its highest purpose when its staff is not carrying out research, but is merely retailing text-book knowledge which, from the nature of things, must be a dozen years behind the times. Yet how many of the schools of the kingdom are content to do nothing better than point to their records of how many thousand students have passed through them, and probably learnt nothing more up-to-date than Euclid or the atomic theory, both of which they might have learnt just as well in any primary school?

THE seventh annual meeting of the North of England Education Conference is to be held on January 7, 8, and 9, 1909. United conferences are to be held in the Manchester Town Hall on the mornings of January 8 and 9, and sectional meetings at the Manchester Municipal School of Technology in the afternoons of the same days. One of the subjects for discussion in the sectional meetings of the second day of the conference is the training of girls in domestic subjects, concerning which papers are to be read by Miss Alice Ravenhill and Miss E. J. Ross. The united conference on the concluding day is for the discussion of the coordination of the curricula in primary and secondary schools, and papers are to be read by Messrs. J. L. Paton and J. W. Iliffe and Miss Isabel Cleghorn. The following subjects are to be considered in sectional meetings on the last day of the conference:—the place of the higher elementary school in the scheme of education, with papers read by Mr. C. H. Wyatt and Prof. J. J. Findlay; the relation of the universities to evening teaching in industrial centres; papers by Messrs. R. H. Tawney and W. J. Bees; and methods of teaching mathematics; papers by Messrs. T. J. Garstang and H. Brotherton. The committee has deemed it desirable to ask delegates to pay a membership subscription of one shilling, which will contribute in some measure towards the expense involved. Admission to the conference meetings will be by ticket, application for which should be made to the honorary secretaries at the Manchester Municipal School of Technology, accompanied by a postal order or stamps for one shilling as membership subscription in respect of each person attending the conference. The committee has arranged to display the Manchester Education Committee's exhibit as shown at the recent Franco-British Exhibition. It is designed to show the complete and varied educational work of a large county borough, and will be set up in the examination hall of the Municipal School of Technology. A comprehensive exhibition of educational apparatus and books will also be arranged.

FOR more than a year a committee, composed of representatives of the University of Oxford, on the one hand, and of labour representatives on the other, has been considering the question of the relation between the University of Oxford and the education of working men. It is expected that the report of the deliberations of the committee will be published shortly. In connection with the same movement a conference, largely attended by delegates of trades unions and other organisations of working men, was held on November 21 at Toynbee Hall. The scheme to be recommended by the Oxford committee in the forthcoming report was described by the joint secretary. The Bishop of Birmingham delivered an address, during the course of which he said it appears to him to be beyond the possibility of question that the proportion of young men who are at Oxford because it is "the right thing" to go to Oxford and because they want to have a good time is ridiculously great. No serious person can think about Oxford without seeing that this is a gross misappropriation of the purposes and resources of the University, and that, by one means or another, it requires fundamental alteration. A system is to be desired in which it shall be understood clearly, and effectively brought about, that persons who do not at once show that they come to the University because they want to be students will have to go elsewhere. If carried out there would be a great displacement of well-to-do young men who want to have a good time by serious students who would come equally from all classes, but in large measure from among the workers. There is in most classes a body of people who want to be serious students, and possess the requisite qualifications. These persons have the right to be at the University, because it exists for such students. The endowments of the place should be so re-arranged as really to be again applicable to the ends for which they were first given, namely, to enable those who have no means of their own, but have the capacity and desire to be students, to avail themselves of the resources and the opportunities of the great centres of learning. Then would follow a re-modelling in the University of the whole scale and standard of living.

SOCIETIES AND ACADEMIES.

LONDON.

Challenger Society, October 28.—Mr. A. E. Shipley, F.R.S., in the chair.—Ostracoda of the Bay of Biscay captured during the 1900 cruise of H.M.S. *Research*: Dr. G. H. **Fowler.** More than 7000 specimens had been identified, and in the case of more than 3000 the sex had been determined and the length of the shell measured. As the result of these measurements the author was enabled to formulate provisionally a new law of growth in Crustacea:—"during early growth each stage increases at each moult by a fixed percentage of its length which is constant for the species and sex"; for this the name of Brooks's law was suggested, Prof. W. K. Brooks having made the first observations which led to it; it had been checked to some extent by observations on lobsters (Herrick) and crabs (Waddington). In several cases it was shown that two stages of the same species had been described as different species. Twenty-five species occurred in the collection, and in some cases as many as five stages had been recognised. As regards the vertical distribution, attention was directed to an increase in the number of specimens captured between 750–400 fathoms as compared with those from 400–100 fathoms, and the suggestion made that this was due to a check in the velocity of fall of dead and dying specimens, produced by the increased viscosity of the water, which in its turn was dependent on increased pressure and diminished temperature. All the four plentiful species, which were recognised on other grounds as mesoplanktonic, attained their maximum intensity in this zone, which would constitute a rich food-zone. Three species were apparently purely mesoplanktonic; eleven reached their maximum intensity in or near the epiplankton, but extended into the mesoplankton, and of these eleven three were apparently purely mesoplanktonic at their oldest stage; four were purely mesoplanktonic. The question of the vertical oscillation of the species was discussed, and several were shown to be more abundant in the epiplankton by night than by day; in one case an attempt was made to trace the movement of the species at different times of day. The proportion of males to females seemed to point to the probability that one species was parthenogenetic.

In another species the death-rate at three stages was worked out, and appeared to be 50 per cent. Except in one case the maximum intensity of closely similar species appeared to be at different levels.

Geological Society, November 4.—Prof. W. J. Sollas, F.R.S., president, in the chair.—The relations of the Nubian Sandstone and the crystalline rocks of Egypt: Hugh J. L. **Beadnell.** The conclusions of previous observers are mainly in favour of the view that the granites are not intrusive into the Nubian Sandstone, but that the latter was deposited round denuded masses of the granite. The crystalline rocks south of the Oasis of Kharga are first dealt with. Eight exposures of crystalline rocks were met. The sediments near the contact with the crystalline rocks are generally inclined at a high angle. The bedded rocks contain no fragments derived from the crystalline rocks. The author concludes that the Nubian Sandstone was unconformably deposited, partly on preexisting sedimentary formations, and partly on the planed-down surfaces of still older crystalline and metamorphic rocks. Subsequently it was invaded by outbursts from the underlying magma, the intrusions being probably connected with the elevation of the mountainous regions on the east side of the Nile.—The fossil plants of the Waldershare and Fredville series of the Kent coalfield: E. A. Newell **Arber.** At the boring at Shakespeare Cliff, Dover, Coal-measures were reached at a depth of 1100 feet, and subsequently penetrated to a depth of about 2270 feet. Thirteen seams of coal, varying in thickness from 1 foot to 4 feet, were pierced. Coal-measures were struck at 1394 feet at the boring in Waldershare Park, and pierced for 1260 feet more. Five seams of coal, varying from 1 foot 4 inches to 5 feet 2 inches in thickness, were struck. The boring near Fredville Park reached Coal-measures at 1363 feet, pierced three seams of coal, and was continued to a depth of 1813 feet. The specimens of plants collected from the Waldershare and Fredville borings were compared with plants found at Dover and in other localities in Britain and abroad. The majority of species tabulated are either confined to the Upper Coal-measures and the transition series below, or are Middle and Lower Coal-measure forms which are known to occur in the transition series. Thus the beds are the homotaxial equivalents of the Newcastle, Etruria, and black-band horizons of north Staffordshire, the Hamstead beds below 1233 feet in south Staffordshire, the Coed-yr-allt beds and Ruabon marls of Denbighshire, the Ardwick series and beds above the Bradford four-foot coal in south Lancashire, the Lower Pennant Grit of South Wales, and the New Rock and Vobster series of Somerset. The majority of species are also common to the highest zone, or the "Charbons Gras," in the Pas de Calais.

Entomological Society, November 4.—Mr. C. O. Waterhouse, president, in the chair.—*Exhibits.*—W. G. **Sheldon**: Examples of *Melitaea aurinia*, var. *iberica*, from Barcelona, taken last May, and examples from various British and Continental localities for comparison, suggesting that eventually this particular form of *aurinia* might prove to be a distinct species.—Rare Tachinidæ: H. W. **Andrews.** A short series of *Gymnosoma rotundatum*, L., and a specimen of *Ocyptera brassicaria*, F.—two uncommon Tachinids—from Glengarriff, co. Cork.—Erebias from the Vosges: P. J. **Barraud.** A series of *Erebia stygne* and *E. ligea* from the French Vosges, taken in June and July this year.—Nonagria new to Britain: E. P. **Sharpe** and A. J. **Wightman.** A series of *Nonagria edelsteni*, wrongly identified as *N. neurica*, Hb., from Sussex, taken in August this year, this being the first time that the species, which is quite distinct, had been observed.—Pseudogynes of *Formica rufa*: H. St. J. **Donisthorpe.** Pseudogynes captured alive at Nethy Bridge in September last, where they occurred in some numbers in two nests of *Formica rufa*, thus indicating that *Atemeles pubicollis*, Bris., a beetle new to Britain, is to be found in Scotland.—Rare British Coleoptera: H. St. J. **Donisthorpe.** Examples of *Harpalus cupreus*, Dej., from Sandown, Isle of Wight (one specimen with red legs discovered by Mr. J. Taylor at Atherstone); *Cafius cicatricosus*, Er., from Southsea; and *Cryptocephalus bipunctatus*, L., taken at Niton, Isle of Wight, where it was discovered by Mr. R. S. Mitford last year.—A "stick" insect—apparently a new species of the genus Melaxinus—bred parthenogenetically by Mr. H. Main: R. **Shelford.**—A long series of hybrid *S. ocellatus* × *populi*: L. W. **Newman.**—Life-histories of Coleophorids and hybernating Porthesia: H. J. **Turner.** (1) Ova, larvæ, and photomicrographs to illustrate the life-history of *Coleophora virgaureae*. (2) "Nests" of the gregarious hybernating larvæ of *Porthesia chrysorrhoea* from Wakering marshes, Essex; on several parts of the coast this species has now become very abundant again. (3) Dead flower-stems of *Statice limonium* collected on November 1, containing the full-fed hybernating larvæ of *Coleophora limoniella*.—Rare earwig and cells of wasp: W. J. **Lucas.** (1) An example of *Labidura riparia*, Pall. (shore earwig), a large male taken near Bournemouth, August 10, and kept alive since that date. (2) Two cells of the solitary wasp *Eumenes coarctata* found in the New Forest.—Specimens of the genera Celastrina (Cyaniris) and Everes to demonstrate the racial identity of *C. sikkima* and *C. argiolus*, *C. jynteana* and *C. limbatus*, *E. diparodes* and *E. argiades*: Dr. T. A. **Chapman.** All these species occur together, and appear to form a mimetic group, but it would be impossible at present to determine which is the model and what may be the object of the mimicry.—The male and female imago, the preserved larva, and the cocoon of an interesting new Lasiocampid from Durban: Prof. E. B. **Poulton.**—Butterflies captured on a patch of zinnias on the north of the Victoria Nyanza: Prof. E. B. **Poulton.** Seventeen specimens were shown of *Danais chrysippus*, L., of the type, and *alcippus* forms together with the intermediate examples, but no single specimen of *dorippus* (*klugii*), although of three females of *Hypolimnas misippus*, L., two were of the *inaria*, Cr., form mimicking *dorippus*.—Specimens of *Heliconius amphitrite*, Riff., and *H. charithonia*, Linn., also a coloured drawing of *H. hermathena*, Hew.: Dr. F. A. **Dixey.** Each of the first two species showed a distinct and well-marked aposeme or warning character, each of them, and especially the first, belonging to an extensive mimetic assemblage. In the third species these two distinct aposemes were combined.—Aberrant forms of *Polyommatus bellargus* and of *Zygaena trifolii* and *Z. hippocrepidis*: Dr. G. G. **Hodgson.**—The life-history of *Erianthus versicolor*, Brunner, an Orthopteron of the family Mastacidæ: J. C. **Kershaw.**

Linnean Society. November 5.—Dr. D. H. Scott, F.R.S., president, in the chair.—Notes on some parasitic Copepoda, with a description of a new species of Chondracanthus = *C. inflatus*: Miss M. E. **Bainbridge.**—Some nemerteans from the eastern Indian Ocean: R. C. **Punnett** and C. F. **Cooper.**—Report on the echinoderms, other than holothurians, collected by Mr. Stanley Gardiner in the western parts of the Indian Ocean: Prof. F. Jeffrey **Bell.**

Mathematical Society, November 12.—Prof. W. Burnside, president, and subsequently Prof. H. M. Macdonald, vice-president, in the chair.—Address of the retiring president: Prof. W. **Burnside.** The address dealt with the neglect of the theory of groups of a finite order by English mathematicians. It was pointed out that numerous opportunities arise in comparatively elementary teaching for emphasising the importance of some of the simpler notions of the theory of groups. If such opportunities were taken a student of the more advanced theory would approach it with a mind already stored with concrete examples.—(1) The second mean value theorem of integral calculus; (2) the representation of a function by means of a series of Legendre's functions: Dr. E. W. **Hobson.** In the second of these papers it is pointed out that a difficulty, not presented in the analogous theory of Fourier's series, arises in the theory of the expansion of a function in a series of Legendre's functions, through the existence of two critical points of the differential equation satisfied by these functions, and an asymptotic formula for the functions of high index, valid in the neighbourhood of the critical points, is obtained.—The eliminant of three quantics in two independent variables: A. L. **Dixon.** A method is given for exhibiting the eliminant as a single determinant, the elements of which are formed by a rule

analogous to Bezout's rule for forming the eliminant of two quantics in one independent variable.—The Dirichlet series and the asymptotic expansion of integral functions of zero order: J. E. **Littlewood.**—The norm curves on a given base: Prof. F. **Morley.**—The arithmetical nature of the coefficients in a group of linear substitutions (third paper): Prof. W. **Burnside.**—The conformal transformations of a space of four dimensions and their applications to geometrical optics: H. **Bateman.**—Periodic properties of partitions: D. M. Y. **Sommerville.**—The solution of integral equations: Prof. A. C. **Dixon.**—Note on the continuity or discontinuity of a function defined by an infinite product: G. H. **Hardy.**—The energy and momentum of an ellipsoidal electron: F. B. **Pidduck.**—(1) q-Integration; (2) q-transformations of power series: Rev. F. H. **Jackson.**—The complete solution in integers of the Eulerian equation $X^4+Y^4=U^4+V^4$: Dr. T. **Stuart.**—Waves of finite amplitude: W. J. **Harrison.**—An asymptotic formula for the generalised hypergeometric series: T. J. I'A. **Bromwich.**—Satellite curves of a plane cubic: A. C. **O'Sullivan.**

Royal Meteorological Society, November 18.—Dr. H. R. Mill, president, in the chair.—Investigation of the electrical state of the upper atmosphere, made at the Howard Estate Observatory, Glossop: W. **Makower,** Miss M. **White,** and E. **Marsden.** There exists under normal atmospheric conditions a potential gradient in the atmosphere surrounding the earth. The earth being negatively charged with respect to the air, a continuous electric current flows from the upper atmosphere to the earth. It follows, therefore, that a kite attached to an earth-connected wire will tend to assume the potential of the air surrounding it, and an electric current will flow continuously down the wire to earth through the winding machine to which the wire is attached. The experiments described in the paper were undertaken with the view of determining the magnitude of this current when the kite was at different heights above the ground. The authors found that in general a high wind produced at a given altitude an abnormally high value of the current flowing down the wire. Whether the action of the wind is to be accounted for by the greater volume of air which passes in a given time over the sails of the kite, so giving a greater volume of air from which electricity is collected, or whether the action of the wind is to be attributed to electrification by friction, the authors find it difficult to say, but there is no question that the velocity of the wind does play an important part in determining the current flowing down the kite wire. In further confirmation it may be added that observations made with a captive balloon in very calm weather gave abnormally low values for the current.—Balloon observations made at Birdhill, co. Limerick, during July and August, 1908: Captain C. H. **Ley.** These observations were carried out on behalf of the joint kite committee of the Royal Meteorological Society and of the British Association. Captain Ley in this paper gave full details of the observations made on twenty-five pilot balloons, seven of which carried registering instruments. The method employed is similar to that known by surveyors as the subtense method, that is, obtaining the range of a known vertical bar by observation of the angle subtended by it at the theodolite with an eye-piece micrometer. In this case the bar is the line joining a hydrogen balloon and a comparatively heavy air-filled balloon, and the balloons appear as discs to be bisected simultaneously by the fixed and movable wire in the diaphragm. Several balloons were observed to a horizontal distance of twenty-four miles. Two of the balloons dropped in the river Shannon; these were sent up in exceptionally calm atmosphere, and Captain Ley considers that the river had a suction effect upon them. The immediate neighbourhood of stratus or cirrus cloud appears to cause a collapse of vertical velocity, and, generally speaking, the highest horizontal velocity of wind appears to occur below the cirrus level. A feature developed during the course of the experiments was the observation of the balloons at night by means of naked acetylene lights. After some trouble these proved quite successful, gave long runs with less risk of being lost in small clouds, and afforded points of light which could be observed on with great accuracy.

Institution of Mining and Metallurgy, November 19.—Mr. Alfred James, president, in the chair.—Notes on tin dressing: H. W. **Hutchin.** A record of investigations of dressing operations conducted at South Crofty Mine with the view of determining the losses incurred in tin dressing and their nature. The ground covered embraced mainly the first stage of concentration, in preparing concentrates for the calciner, and comprised a systematic investigation of the battery tailings. The range of the present inquiry was, however, restricted to tin alone of all the metallic constituents, and in this connection the author had collected a mass of valuable data resulting from experiments with different grades of crushing and different modes of treatment.—Working costs on mines, as practised on the Rand: J. A. **Dennison.** In this paper, which was originally submitted to the standardisation sectional committee of the institution dealing with mine accounts and cost sheets, the author reviews the practice of the Rand with the object of seeing to what extent it is capable of standardisation in itself and as a guide to other localities. His brief is in favour of standardising general principles and systems rather than details, and of securing the utmost simplicity consistent with a clear and full statement of accounts.—A manganese deposit in southern India: R. O. **Ahlers.** A description of the manganese deposits in the native State of Sandur, Bellary district, an elliptical basin composed geologically of a bed of the Dharwar (Archæan) series of schistose rocks, which is surrounded by gneiss, the predominating rock in that part of India. Iron and manganese are intimately associated in the Sandur deposits, which, though of large extent on the surface, go but a short distance in depth. The author inclines to the theory that these ore bodies are the result of metasomatic action, a replacement of the original rock by oxides of manganese and iron, by the agency of meteoric waters.—Extinguishing the fire in the Testasecca Mine, Sicily: F. C. **Chrambach.** A brief description of the method adopted in dealing with an incendiary outbreak in a sulphur mine in Sicily, the operation being greatly assisted by the employment of the Westphalia "rescue" apparatus, whereby the working party was enabled to penetrate and carry on its labours in the highly vitiated air of the underground sections.

MANCHESTER.

Literary and Philosophical Society, October 20.—Prof. H. B. Dixon, F.R.S., president, in the chair.—Further notes on the separation of cobalt and nickel: R. L. **Taylor.** The author referred to a former paper in which he described a modification of Rose's method (barium or calcium carbonate in presence of chlorine or bromine). In that paper he pointed out that various conditions caused a remarkable retardation in the precipitation of the cobalt. He now proposes the use of magnesium carbonate instead of calcium or barium carbonate, and finds that with this there is practically no uncertainty in the action.—Some questions connected with the constitution of the atom: H. **Bateman.** It is shown that a continuous succession of infinitesimal conformal transformations of space can be derived by stereographic projection from a figure on a hypersphere which moves as a rigid body in a space of four dimensions. This gives ten degrees of freedom, so that the model atom would have at most ten degrees of freedom. It is suggested that the number of degrees of freedom possessed by an atom in given circumstances is equal to three *plus* the valency exhibited in those circumstances. When two atoms are in a state of chemical combination there is, in general, a loss of three degrees of freedom for a single bond and five degrees of freedom for a double bond. By means of this rule it is possible to calculate the number of degrees of freedom of a molecule. In the case of a molecule consisting of several atoms there are additional restrictions due to the atoms arranging themselves at equal distances from one another or in a plane. The ratio of the specific heats calculated from the numbers n obtained in this way and the formula $\gamma=1+2/n$ agree with the results of observation.—A collection of fossil insects from Shiobara, Japan, collected by Dr. Marie Stopes: C. Gordon **Hewitt.** In the collection there were a large number of the aquatic larvæ of ephemerids. There were

examples of certain larvæ and a single pupa of insects belonging to the dipterous family Culicidæ. In addition to these, a number of different families of Diptera were represented, including one or two excellently preserved specimens of Culicidæ. The insects are preserved in a light grey laminated shale, and the fossiliferous deposit is evidently of fresh-water origin, and appears to belong to the Tertiary age.

November 3.—Prof. H. B. Dixon, F.R.S., president, in the chair.—The nature of the α particle: Prof. E. **Rutherford** and T. **Royds.** In order to give a definite proof of the identity of the α particle with a helium atom, it is necessary to show that helium can be obtained from accumulated α particles, quite independently of the active matter from which they are expelled. This has been done by the authors. In the experiments every precaution was taken to prevent possible contamination of the apparatus with helium. The experiments afford a conclusive proof that the α particle after losing its charge is an atom of helium. Other evidence indicates that the positive charge on the α particle is twice that carried by the hydrogen atom.—The action of the radium emanation on water: T. **Royds** and Prof. E. **Rutherford.**—Some properties of the radium emanation: Prof. E. **Rutherford.** In 1906 (NATURE, October 25) the author directed attention to the fact that the emanations of radium, thorium, and actinium were completely absorbed by cocoa-nut charcoal at ordinary temperatures. He has recently repeated these experiments with much larger quantities of radium emanation, and has found that the actual volume of emanation capable of absorption by charcoal at room temperature is very small. For example, several grams of cocoa-nut charcoal are required to absorb completely the emanation from 200 milligrams of radium at ordinary temperature, although the volume of the gas is only one-tenth of a cubic millimetre. As was to be expected, the absorptive power of charcoal for the emanation increases rapidly with lowering of the temperature. It appears from the results that at 10° C. the charcoal absorbs about 0·03 cubic mm. of emanation per gram, and at −40° C. about 0·06 cubic mm. per gram.

PARIS.

Academy of Sciences, November 16.—M. Bouchard in the chair.—Compensation of a closed chain of triangulation: P. **Hatt.** In a closed chain of triangles resulting from a survey, there is necessarily a slight discrepancy at the junction owing to the experimental error. The problem of the distribution of this error round the whole system, giving a polygon with a minimum deformation, in the general case is extremely complicated, and involves an amount of labour out of all proportion to the value of the result. A shortened approximate method of dealing with this problem is given in the present paper.—The turning of aëroplanes: E. L. **Bertin.**—The use of calcium cyanamide in agriculture: A. **Müntz** and P. **Nottin.** It has been shown in previous papers that the rapidity with which nitrogenous manures are converted into nitrates is a measure of their usefulness as manures, and calcium cyanamide has been studied from this point of view. It proved to be as active as ammonium sulphate, and this result was confirmed by culture experiments.—A new species of Sarcocaulon of south Madagascar and the resinous bark of Sarcocaulon: Édouard **Heckel.** The resin is present in the bark to the extent of 20 per cent. to 30 per cent., and owing to its perfume may prove to be of commercial value.—Report on a memoir entitled "Experimental Researches on the Resistance of the Air carried out by M. G. Eiffel": Maurice **Levy** and M. **Sebert.** An account of experiments on the resistance of the air to falling bodies, carried out on the Eiffel Tower.—Yellow fever at Saint-Nazaire: M. **Chantemesse.** The infection was brought from Martinique by the steamship *La France* on September 24, and as no case had developed during the nine days' voyage from the infected port, the vessel was not placed in quarantine by the port authorities. Eleven cases resulted, seven of which were fatal. The infection was carried by the mosquito *Stegomya fasciata*, specimens of which were caught on the ship after the epidemic broke out.—Differential equations of the third order the general integral of which is uniform: R. **Garnier.**—The resistance of fluids: the necessary experiments: Marcel **Brillouin.** The rational construction of aëroplanes requires the experimental determination of numerous coefficients, the more important of which are indicated.—Different curves of the same sung vowel: M. **Marage.**—The radio-activity of the soil: F. **Bordas.** The radiations from radio-active materials are known to possess the property of causing colorations in glass and porcelain, and the fact that in certain regions near the nitrate mines of the province of Aconcagua white glass became coloured has led to the discovery that at certain spots the soil is strongly radio-active.—The volumetric composition of ammonia gas and the atomic weight of nitrogen: Ph. A. **Guye** and A. **Pintza.** Ammonia, set free from a weighed apparatus, was decomposed by passing over an electrically heated platinum spiral, and the mixed gases measured at a definite temperature and pressure. The method, which is not capable of high precision, gave 14·014 as the atomic weight of nitrogen (O=16), the extreme values being 14·002 and 14·022, a new confirmation of the international value 14·01.—Some constituent principles of *Sclerostomum equinum*. The presence in this parasite of a crystallised alkaloid possessing great hæmolytic power: Th. **Bondouy.**—The colloidal properties of starch and its spontaneous jelly formation: E. **Fouard.**—The preparation of fused alumina in the amorphous state and the reproduction of the blue colour of the Oriental sapphire: Louis **Paris.** The addition of small quantities of lime (2 per cent. or less) to the alumina before fusion has the effect of retaining the blue colour due to cobalt or iron oxides. Without this addition the alumina, on solidification, is colourless, with an external, deeply coloured crust.—Comparative effects of amides as food on the development of the adult plant, the seed, and the free embryo: J. **Lefèvre.**—The presence of *Planaria alpina* in Auvergne: C. **Bruyant.**—The Plumulariidæ of the *Challenger* collection: Armand **Billard.**—A new parasite of *Œnophtira pilleriana* of the vine: Henri **Sicard.**—The extent of the possible colour changes of *Hippolyte varians*: Romuald **Minkiewicz.**—The shaping of mountain slopes: P. **Berthon.**—The stems of Clepsydropsis: Paul **Bertrand.**—The seismic disturbance of November 11, 1908: Alfred **Angot.**

NEW SOUTH WALES.

Royal Society, September 2.—Mr. W. M. Hamlet, president, in the chair.—The discharge of electricity from glowing carbon: Prof. J. A. **Pollock** and A. B. B. **Ranclaud.** The flow of negative electricity from hot carbon, in a circuit containing an air-gap, up to three millimetres in length, between a hot and a cool carbon rod, has been investigated for temperatures of the hot rod from 1100° C. to 1800° C., and for various voltages up to the point at which an arc forms between the carbons, the experiments being made in air at natural pressure. A suggestion is made as to the development of the arc from the non-luminous discharge which seems to account for the observed phenomena. The discontinuity of potential at the surface of the heated carbon, due to the projection of electrons, is found to range from 1·1 volts at 1300° absolute to 16·7 volts at 3690° absolute. From these values the velocities with which electrons are projected from hot carbon are deduced, the results being of the order of 10^8 centimetres per second.—The re-lighting of the carbon arc: Prof. J. A. **Pollock,** Dr. E. M. **Wellisch,** and A. B. B. **Ranclaud.** In connection with the re-lighting of the carbon arc, without movement of the electrodes, when the circuit is opened and re-closed, the relation between the potential difference, established between the carbons at the moment of the re-making of the connections, and the maximum time of interruption of the circuit, within which the arc will re-form, has been investigated for various conditions.—Evidence of recent submergence of coast at Narrabeen: Prof. T. W. E. **David** and G. H. **Halligan.** The general physical features of the N.S. Wales coast are described, as showing distinct evidence of recent coastal submergence. The evidence supplied by bores, shafts, &c., in the vicinity of Sydney and Newcastle, is traversed, and its bearing upon the subject of land movement is discussed. The strongest evidence of all is the

finding of an old land surface, with a mangrove fauna and fresh-water flora, at a depth of about 52 feet below high water, at Narrabeen, on the Manly-Pittwater Road. Details of this bore, put down by the authors, assisted by university students, in 1904, are given, and the conclusion arrived at that in this bore we have direct and positive evidence of a submergence of the coast-line, in the vicinity of Sydney, within very recent geological time.

Linnean Society, September 30.—Mr. T. Steel, vice-president, in the chair.—Some remarkable Australian Libellulinæ, part ii., descriptions of new species: R. J. **Tillyard.** The tendency of the Libellulinæ found in tropical Australia appears to be gradual simplification along the following lines:—abolition of superfluous nervures, loss of pruinescence, decrease in size, simplification of colour-pattern, and contraction and intensification of dark pigmentation of the wings. Eight species are added to the Australian list, of which six are proposed as new.—The life-history of *Loranthus exocarpi*, Behr.: C. C. **Brittlebank.**—Geological notes on Kosciusko, with special reference to glacial action: Prof. T. W. Edgeworth **David.** The gneissic granites of Cooma have been proved to pass in places into coarse mica-schists, and the series is classed provisionally as pre-Cambrian. Fossiliferous Ordovician rocks have been found to occur near Berridale. The origin of Lake Coolamatong is attributed to a downthrow fault. The total area covered by the ice calotte of Kosciusko was probably from 80 to 100 square miles. The ice-cap was fully twelve times as large, and at least double the thickness, formerly estimated, while the snow-line was quite 300 feet lower than at present, involving a lowering of the mean temperature by about 10° F. In more recent geological time there was another period of glaciation, during which Lakes Cootapatamba and Albina, the Blue Lake, &c., were formed.—Opsonisation from a bacterial point of view, and opsonic technique: Dr. R. **Greig-Smith.** It was found that a two days' culture of *Staphylococcus aureus* is more completely opsonised than younger or older cultures; the intraphagocytic digestion is the greater the older the culture; there is no auto-opsonic action manifest in moderately old cultures; races of different ages are opsonised to the same extent; bacteria grown upon agar are more easily opsonised than bacteria from bouillon-cultures.—Revision of the Australian Curculionidæ belonging to the subfamily Cryptorhynchides, part ix.: A. M. **Lea.** The ninth instalment of the revision deals with the genus Chætectetorus and some of its allies, of which eleven genera, including four proposed as new, and twenty species, including eight proposed as new, are described.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 26.

ROYAL SOCIETY, at 4.30.—Some Experiments made to test the Action of Extract of Adrenal Cortex: S. G. Shattock and C. G. Seligmann.—Further Results of the Experimental Treatment of Trypanosomiasis; being a Progress Report to a Committee of the Royal Society: H. G. Plimmer and Captain H. R. Bateman, R.A.M.C.—A Trypanosome from Zanzibar: Colonel Sir David Bruce, C.B., F.R.S., and Captains A. E. Hamerton, D.S.O., and H. R. Bateman.—The Proportion of the Sexes produced by Whites and Coloured Peoples in Cuba: W. Heape, F.R.S.—Further Researches on the Etiology of Endemic Goitre: Captain R. McCarrison, I.M.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Domestic Electricity Supply (including Heating and Cooking) as affected by Tariffs: W. R. Cooper.

SOCIETY OF DYERS AND COLOURISTS, at 8. Reaction between Picric Acid and Fibre Colloid: W. P. Dreaper and W. Sickes.—Colouring Matters in Sole Leather: H. G. Crockett.

FRIDAY, NOVEMBER 27.

PHYSICAL SOCIETY, at 5.—A Graphic Method of dealing with Refracting Surfaces: H. S. Allen.—A Method of Determining Moments of Inertia: The late Prof. W. Cassie.—An Experimental Examination of Willard Gibbs's Theory of Surface Condensation regarded as the Basis of Adsorption: W. C. M. Lewis.—On the Diffusion of Actinium and Thorium Emanations: S. Russ.—On the Elliptic Polarization produced by the Direct Transmission of a Plane Polarised Stream through a Plate of Quartz cut in a Direction Oblique to the Optic Axis, with a Method of Determining the Error of a Plate supposed to be Perpendicular to the Axis: James Walker.

SATURDAY, NOVEMBER 28.

ESSEX FIELD CLUB, at 6 (at the Essex Museum of Natural History, Stratford,)—Report of Club's Delegate at Corresponding Societies Committee, British Association, Belfast: Prof. E. G. Coker.—The Re-afforestation of Hainhault: Francis Dent and T. S. Dymond.

MONDAY, NOVEMBER 30.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Panama Canal in 1908: Dr. Vaughan Cornish.

ROYAL SOCIETY OF ARTS, at 8.—Twenty Years' Progress in Explosives: Oscar Guttmann.

INSTITUTE OF ACTUARIES, at 5.—Inaugural Address by the President, G. F. Hardy.

TUESDAY, DECEMBER 1.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further Discussion*: Glasgow Central Station Extension: D. A. Matheson.—*Possible Paper*: The Rotherhithe Tunnel: E. H. Tabor.

WEDNESDAY, DECEMBER 2.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Gravimetric Estimation of Antimony and Tin: E. Cahen and Dr. G. T. Morgan.—The Oil from Carapa Guianensis: Dr. J. Lewkowitsch.—The Detection and Estimation of Formaldehyde in Milk: H. S. Shrewsbury and A. W. Knapp.—The Determination of Aldehydes in Oil of Lemon: A. H. Bennett.—Some Analyses of Cream Cheese: C. H. Cribb.

GEOLOGICAL SOCIETY, at 8.—The Geological Interpretation of the Earth-movements Associated with the Californian Earthquake of April 18, 1906: R. D. Oldham.

ROYAL SOCIETY OF ARTS, at 8.—Mechanical Flight: E. S. Bruce.

ENTOMOLOGICAL SOCIETY, at 8.

THURSDAY, DECEMBER 3.

LINNEAN SOCIETY, at 8.—Biscayan Plankton, the Ostracoda: Dr. G. Herbert Fowler.—Note on *Juniperus taxifolia*, Hook. and. Arm.: Bunzō Hayata.—Mimicry in Spiders: R. I. Pocock.

RÖNTGEN SOCIETY, at 8.15.—Phenomena observed in Electrical Currents of Continuous Oscillation: Dr. H. Manders.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—The Influence of Track upon Railway and Tramway Carriages: J. S. Warner.

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