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Competition and Progressive Industry.

COMPETITION in a general sense is easily defined, and the dictionaries are fairly clear and consistent in their meaning. In the strictly economic sense also there has hitherto been little difficulty. The American economist Walker, for example, is very precise and definite in his description of the essential nature of competition. Competition, he says, signifies the operation of individual self-interest among the buyers and sellers of any article in any market. It implies that each man is acting for himself solely, in exchange, to get the most he can from others, and to give the least he must himself. Competition is opposed to combination in any form, to custom, and to sentiment, even though these, especially the two latter, in actual business have always played a part.

No one to-day believes, however, in the possibility of pure and unalloyed competition, wholly unrestrained and unregulated. Not only does it exist, of itself, in many varied forms and manifestations, but also it has been profoundly affected by the introduction of ethical and moral considerations, many of which have acquired the force and status of law. Moreover, other great forces have sprung into existence and rapidly developed of late years, such as co-operation and combination, the formation of trusts and cartels and of vast international conglomerations, whereby the original conception of competition has either been pushed entirely into the background or has been transformed beyond recognition. The question is thus raised in an acute form : What is the real essence and purpose of competition in industry to-day ? What part, if any, does it seem destined to play in the future ? Can it be reconciled and fit in with the new changes and new forces, or is it being transformed out of existence ?

Much confusion of thought on these questions arises from the divergent views held in regard to industry itself and its proper place in the scheme of things. The socialist attitude, for example, towards competition will be very different from that of the individualist ; and again, those who disbelieve in industrialism altogether will certainly entertain the utmost loathing for competition, the most powerful instrument of progress. It is therefore necessary, at the outset, to make a philosophical distinction, and decide whether we believe in progress or not, whether we have a profound faith in the Baconian philosophy of 'fruit' or in the Diogenic doctrine of the tub, with its reduction

of wants and satisfactions to a minimum. It is not necessary at this time to deal with the larger question of progress and its would-be philosophical critics, or to frame an elaborate apologetic of modern industry. It will be taken for granted that progress, with all its errors and blind gropings and possibly mistaken ideals, is desirable and indeed inevitable ; that it is not necessarily soul-deadening materialism, but can be made subservient to the highest intellectual and moral interests and activities of mankind. It will be shown that competition can play a vital and increasingly nobler part in that progress.

In regard to the socialist attitude, it is of interest to quote J. Stuart Mill's incisive condemnation thereof—and he, of all men, cannot be charged with undue harshness to the socialists. He says :

"I utterly dissent from the most conspicuous and vehement part of their teaching, their declamations against competition. With moral conceptions in many respects far ahead of the existing arrangements of society, they have in general very confused and erroneous notions of its actual working ; and one of their greatest errors, as I conceive, is to charge upon competition all the economical evils which at present exist. They forget that wherever competition is not, monopoly is ; and that monopoly in all its forms is the taxation of the industrious for the support of indolence, if not of plunder. . . . Instead of looking upon competition as the baneful and anti-social principle which it is held to be by the generality of Socialists, I conceive that, even in the present state of society and industry, every restriction of it is an evil, and every extension of it, even if for the time injuriously affecting some class of labourers, is always an ultimate good. To be protected against competition is to be protected in idleness, in mental dullness ; to be saved the necessity of being as active and intelligent as other people."

This no doubt is far too sweeping, and, while showing up the error of the socialist view, commits serious blunders of its own. Every restriction of competition is not of course necessarily an evil ; nor is every extension thereof an ultimate good ; nor is every form of monopoly always evil. In fact, neither Mill nor the socialists have found the real truth. Both competition and monopoly require proper regulation and control, when both may be highly beneficial. It is not indeed by any means certain that unrestrained monopoly is a greater social evil than unrestrained competition, though strangely enough, and through a most remarkable form of mental aberration, free competition has been held by some, for example, the framers of American anti-trust legislation, to be sacrosanct and above reproach, whilst monopoly has been anathematised as everything that is bad. Under the latter misguided view the whole basis of patent law, among other things, is thoroughly wrong and unsound. But a full discussion of monopoly and all its implications must be deferred.

In its natural and original sense competition means the struggle for existence, issuing in the survival of the fittest. It dominates biology and the theory of evolution, and when Herbert Spencer applied evolutionary doctrine to social phenomena it was taken over almost in its entirety—with all its crudeness and cruelty—by the economists, at least for a time. Huxley seems to have been among the first to see that this was going much too far. He realised the necessary checks to the full force of competition which must be imposed by the social framework within which it acts. "Social progress", says Huxley, "means a checking of the cosmic process [of ruthless competition and struggle] at every step, and the substitution for it of another which may be called the ethical process ; the end of which is not the survival of those who may happen to be the fittest in respect of all the conditions which exist (environment), but of those who are ethically the best." Thus an ethical aspect was introduced, and thus incidentally we see also that the question, Who are fittest to survive ? to which reference will be made later, is involved.

Prof. Gide's definition is : When each individual is at liberty to take the action he considers the most advantageous for himself, whether as regards the choice of an employment or the disposal of his goods, we are living under the regime of competition. But this takes too much for granted and lacks precision, for, strictly speaking, robbery with violence, or piracy, or fraud and cunning, are not excluded. It is therefore clear that competition must keep within the law, most of which—written and unwritten—can be summed up in the good old sporting phrase, "Play the game, and take no mean advantage of a rival". Moreover, we no longer believe in the blind uncontrolled evolution of society. We believe it is possible to set definite aims before us, for example, in regard to race improvement and the ultimate attainment of the highest type of manhood. No longer is everything to be sacrificed to the accumulation of wealth ; we place man first ; and with this profound change in aim there is a change in the rules of competition. Slavery has been abolished ; piracy does not now figure in honourable competition ; the labour of young children is condemned ; the hours of work of adult men and women have been reduced. The

cruelties of the cosmic struggle are being constantly mollified by rising ethical and moral standards. What may be called the 'plane of competition' has been raised to loftier heights, and much has been left behind and below in the process. Piracy and all that it means, the arbitrament of force and cunning, has fallen outside of and below that rising plane, and has been replaced by other mighty forces working strongly for social betterment. Of these forces, co-operation, *or the enlargement of the competitive group*, is among the greatest.

At first sight it would appear that increasing co-operation means decreasing competition, but this is probably a superficial misconception. There has been co-operation from the beginnings of things. Even among animals, with the struggle for existence at its keenest, there is, nevertheless, a certain amount of mutual agreement and help among the members of a group or community. What has happened in modern times, with growing co-operation, is a difference in degree rather than in kind: the competitive group has become larger, and new groups have been formed. This coalescing into groups, political, economic, scientific, and the like, is one of the most characteristic phenomena of modern society, and its reaction on competition is of profound interest. One of the results so far is an infinite variety of competitive groups, and although the competition, as between different groups, may be keener than ever, it is also cleaner, and the effect on an individual is softened and modified, not only by association with others in the group, but also by a rising tide of sympathy, benevolence, and public humanitarianism expressed both through law and custom; and the group is thereby strengthened. Darwin realised this clearly enough. He says:

"Animals endowed with the social instincts take pleasure in one another's company, warn one another of danger, defend and aid one another in many ways. These instincts do not extend to all the individuals of the species, but only to those of the same community. As they are highly beneficial to the species they have probably been acquired through natural selection."

In human affairs, however, the groups are getting larger, are reaching out rapidly to international dimensions. This is a stern fact of our times, and we see not as yet clearly whither it will lead us, or how it will end. It is the greatest and most perplexing problem of the age. But one thing at least seems perfectly clear. If we take for examination any one particular group, say, a trade union of workers in any one industry, do we not see that the grand idea of co-operation is not necessarily antagonistic to or mutually destructive of competition; that competition, in one very important direction, may be retained in full force, namely, *in the terms of admission to the group*? Membership of a group in most professions, and formerly in the old trade guilds, is or was a guarantee of a certain standard of workmanship and character. It is surely in the best and highest interests of a group or union to maintain a high standard. It would still be possible to permit of several grades within the group, and the good workman should not be penalised and brought down to the level of the inferior, or the latter unduly bolstered up to heights beyond his deserts. As we have already seen, even J. Stuart Mill would allow no weak sentiment, no excess of humanitarian zeal, to thwart the exercise of this salutary principle.

In regard to another important manifestation of industrial grouping, namely, that of the trust and international combine, and its effect on competition, it is only possible to refer here very briefly to one or two points. It is now generally agreed that complete monopoly is very difficult of achievement, and even if achieved it must be subject to control by the State. But the form of control, as the Federal Trade Commission of the U.S.A. has found, presents great practical difficulties. The combine itself, however, and also the trade association, is finding that, in its own best interests, it must put service to the public before exploitation, and that control should be exercised so far as possible from within rather than imposed from without. Hence it is that there is now much talk of ethical rules and standards by trade associations, especially in the U.S.A., and that unfair methods adopted by any member should justify the expulsion of that member from the group. Here again the competitive principle may be applied in the selection of the right men to control the destinies of the group, and perhaps also by the imposition of certain conditions and standards of membership. This also applies to the co-operative societies in all their manifold forms.

It is being increasingly realised, even by the most powerful combine, that trade is healthiest and most flourishing when built up, not on selfish aggrandisement but on service, good quality, and moderate prices; and those groups are 'fittest to survive' who take their stand on these adamantine foundations. Competition of the right kind is still the mainspring of progress, but it is constantly rising to higher levels, and implies worthy struggle for the things that matter.

History of Biology.

The History of Biology: a Survey. By Erik Nordenskiöld. Translated from the Swedish by Leonard Bucknall Eyre. Pp. xii + 629 + xv + 16 plates. (London: Kegan Paul and Co., Ltd., 1929.) 25*s.* net.

A SYSTEMATIC historical account of the development of biology has long been a desideratum, and, as Dr. Raymond Pearl says of the German edition, "the blank has been admirably filled by Erik Nordenskiöld". The author is a trained original worker in zoology, whose experiences, among others, ranged over the shores of the North Sea at the St. Andrews Marine Laboratory, and whose zeal, erudition, and scientific accomplishments enabled him to deal with the subject no less adequately than his facile pen portrayed.

The task undertaken by the author was one of no ordinary magnitude, involving infinite labour and careful judgment in addition to an extensive and sound knowledge of biology, so that he was enabled to grasp the trend of the labours and epitomise the main facts or theories of the writers from various points of view, as well as bestow sound criticism. The work is divided into four heads: (1) Biology in classical antiquity; (2) biology during the Renaissance; (3) biology in the seventeenth and eighteenth centuries; (4) biology during the first half of the nineteenth century. The author centres in Babylon, that ancient home of civilisation, the early acquaintance with the subject from contact with animals—though Oriental wisdom was largely composed of the mystical and the magical—matured and developed by a powerful priesthood. The Egyptian and Israelitic, the Hindu and Chinese conceptions followed. Amongst the earliest scientists of Greece, again, were the Ionian philosophers, some of whom, like Thales, regarded water as the cause of all things—even the earth coming into being from its condensation, whilst living forces were evolved by a kind of primordial procreation in the mud. The influence of the philosopher Pythagoras on scientific development was great, as also was that of Plato, who laid the foundation of biological systematisation. The early medical writings of Greeks, such as those of Hippocrates (the Great) "on air, water, and places"; and the belief that the body was composed of four elements—fire, air, water, and earth—closed the period of natural philosophers' speculations. Yet about this time human osteology was studied so far as the skeleton, the brain, nervous system, the eye, ear, and the urogenital system.

The advent of Aristotle, one of Plato's students, and the greatest biologist of antiquity, meets with ample treatment. He upheld the domination of form, that is, of the spirit, over matter, and of motion as the origin of all things. As a prolific writer on biology, metaphysics, statesmanship, and art, his influence was great. He interested himself in marine as well as land animals; indeed, the former are better represented in his works than the latter. His evolution was a product of divine wisdom, whereas that of Democritus was the dominion of necessity.

The anatomists of Alexandria and those of Arabia next come under review, and thereafter Pliny and Galen are dealt with, as well as the condition of science in the Middle Ages. Moreover, the institution of universities in the twelfth century as growths from the cathedral schools was a noteworthy development. As the pupils at these schools increased in number the teachers combined to form what was termed a *Universitas magistrorum*, and thus the Universities of Paris, Oxford, and Leipzig were founded.

During the latter part of the Middle Ages biology was often prominent, though the writings of Aristotle were chiefly followed, and a compilation of the literary material of the past was common. One man, however, resolutely fought the schoolmen and their antiquated views; this was Roger Bacon, and he led the way to the future Renaissance. Nature was now to be studied unfettered by Church dogmas and scholastic systems, and thus biology reached results far beyond those of Aristotle or Galen. Ushered in by the "Novum Organum" of Francis Bacon, a number of distinguished authors in zoography, anatomy, medical science (including dissection), such as Vesalius and Fabricius, led up to the epoch-making discovery by Harvey of the circulation of the blood, which ousted from the field all the previous erroneous views.

The end of the seventeenth and the eighteenth century was marked by the appearance of mechanical Nature-systems such as those of Descartes, Hobbes, and Spinoza; yet Boyle, the first modern chemist, and Newton, the illustrious discoverer in mathematics and optics, flourished. The end of the seventeenth century saw the discovery of the lymphatic system and notable advances in anatomy and physiology, the author consistently giving to each discoverer a due meed of praise—the result of his own industry in master-

ing their researches. Names familiar to every student of biology, such as Leeuwenhoek and Malpighi, are crowded in this great period in the history of anatomy. The beginning of the eighteenth century saw a further series of able workers, commencing with Sydenham and Hoffman (the latter holding that matter and motion formed the foundations of existence), to Swedenborg's investigations of the brain.

Before the advent of Linnæus, attempts to classify plants had been made by Cesalpinus, Tournefort, and Ray, the "Historia plantarum generalis" of the latter forming an important treatise. He also wrote two zoological works of note; and, besides his later publications, which were extensive, he made advances in realising the difference between species and genus, and he had a keen eye for natural groups.

In the treatment of Linnæus the author's skill in epitomising the salient features of a distinguished man's career are conspicuous. He shows that Linnæus possessed an extraordinary capacity for observing natural objects and surroundings, and such he used in the various important works, for example, the "Systema Naturæ". His plant-system and his binomial nomenclature are amongst his most successful performances. The account of Buffon and his friend Daubenton follows, the theoretical ideas of the former and the anatomy of the latter bearing important fruits.

The advance of natural science in the eighteenth century by Réamur, the experimental and speculative biology of Haller, Bonnet's parthenogenesis, Wolff's generation-theory and epigenesis and other noteworthy features of the period are fully dealt with. Descriptive and comparative anatomy by Albinus and Camper, as well as the labours and the museum of John Hunter, carry us to Pallas, zoologist, botanist, and traveller—all receiving careful treatment. Modern chemistry and its influence on biology is then considered, whilst critical philosophy and romantic conceptions of Nature follow. Kant, Fichte, Goethe and his metamorphosis of plants are all ably criticised, as also Oken's natural philosophy, Erasmus Darwin and his "Zoonomia", E. G. St. Hilaire and his fundamental type of vertebrates.

We now reach biology in the first half of the nineteenth century—a period in which a galaxy of eminent comparative anatomists occur—from Vicq d'Azyr to De Blainville, two names being especially familiar, namely, Lamarck and Cuvier, though all are noteworthy. Lamarck, from his numerous works, is looked on as a pioneer of modern biology. His life-theory is motion, and he asserted that spontaneous generation goes on incessantly under heat, light, and electricity. Cuvier's chief investigations were in the vertebrates —both living and extinct. To the last he held to the immutability of species and to the incomparability of types; Bichat and De Blainville both accomplished important work. Embryology received great advances, especially experimentally; workers in microscopy and cytology were numerous, others in the field of geology also made great strides. Then came Darwin, whose sketch gives another example of the author's method and fairness to the great naturalist, his supporters and opponents. His theory early found a home in Germany, championed by Gegenbauer and Haeckel, and his influence compelled a whole generation everywhere to follow his line of thought.

The discovery of microbes by Koch, the work of Anton Dohrn at Naples, the researches on heredity and descent, the advance of experimental biology, and distinguished workers who followed Mendel, or extended biochemistry, conclude this remarkable book with its thirty-two portraits of ancient and modern biologists. The author, indeed, has accomplished a task almost as formidable as that of his distinguished uncle in surmounting the North-East Passage. W. C. M.

Medieval Devil Worship.

The History of the Devil: the Horned God of the West. By R. Lowe Thompson. Pp. xiv + 172 + 8 plates. (London: Kegan Paul and Co., Ltd., 1929.) 7*s*. 6*d*. net.

IT is interesting as well as instructive to reflect that, even at the beginning of the present century, it was not an uncommon thing to find the religious practices of primitive peoples described in the pages of missionary magazines as 'devil worship', and the term is still frequently ascribed in popular language to the Voodoo rites of Haiti. The missionary of to-day will not be responsible for a like crudity; but his predecessors in stigmatising what was outside the pale as the province of the Adversary, was following the precedent of the early Church. For the early Christians the devil was a very real problem. Not only had eastern religion and philosophy made familiar the opposition of the good and evil principles; the Church was constantly confronted with the problem of backsliding, more often than not involved in the performance of civic duties. Further, the Christians were the more harsh in their condemnation because they themselves in

their attitude to the world of spirits were not far removed from the pagans, even though they worshipped other gods.

Therefore heretics, whatever their heresy, were ensnared by the devil; Manichees, gnostics, and the like were not merely theologically in error; they were actively worshippers of the evil one, their assemblies orgies of debauchery—scenes such as Walter Mapes describes writing of the Patarini, when indeed he seems to be attributing to these heretics nothing more than an inversion of the Christian agape or love feast. Most of the accusations of blasphemy brought against the witches show the same lack of imagination and were formulated by a simple inversion in every detail of the practice of the Church. Whether or not these accusations had any foundation in fact, the practices thus recorded are not pagan ritual unless the sexual licence is regarded as a fertility rite. The sacrificial meal in the circumstances points no more in one direction than the other. In fact, if the Bull of Innocent VIII. be taken as defining the medieval witch, it appears that outside certain popular conception of magical powers—blasting crops, casting spells on cattle and persons, and the like, ideas common to all primitive peoples—the distinguishing mark of the witch is the compact with the devil. This is purely a theological conception which can be traced back to the early days of the Church. So far there is support for those who hold that witchcraft was a form of heresy which threatened the existence of the Church and therefore exonerates it from the odium of a persecution which grew out of a baseless superstition.

To the average modern the medieval mind is a closed book. Of all its manifestations the witchcraft persecutions are the most difficult to understand. Any investigation or theory which can help to bridge the gap between modern times and the Middle Ages deserves to be weighed before it is rejected. It is for this reason that Miss Murray's book on the witch cult in Western Europe and now Mr. Thomson's book on the devil are welcome. They offer theories which, to an anthropologist at least, come within measurable distance of an intelligible formula, of a cause for action which, if not such as moves the modern educated mind, is at least intelligible at a certain stage of culture. Mr. Thomson, with Miss Murray, believes that witchcraft was a system of religious worship with a regular ritual, meaningless in its medieval context, which had survived from a primitive fertility cult. Of this the central figure, the devil, was in earlier times the Celtic horned god Cernunnos, a figure in turn derived from the masked figures of palæolithic art, and in particular the well-known *sorcier* of the Trois Frères cavern at Les Eyziès. The horned tailed figure of the last named must inevitably recall the horned medieval devil.

Mr. Thomson supports this view by a wealth of argument; but there are difficulties. For one thing, there is a lengthy gap between palæolithic times and the Cernunnos of the Iron Age. It is difficult to believe in a popular cult entirely submerged for that length of time. Further, is Cernunnos himself indubitably indigenous to Western Europe? The cult of the goat in connexion with witchcraft did not reach Britain. Is that because it had a Mediterranean origin and distribution only? There is, however, this much to be said for the view, that there was something of the nature of a popular cult at the back of witchcraft. It is difficult to explain away the evidence in the English trials, and some of the Scottish and Continental evidence, on any other view. The actual words of the confessions seem to convey the convictions of the speakers and seem to be too consistent *inter se* to be hallucinations. If it were not for this the whole witchcraft persecution and the devil cult might be more properly regarded as an inglorious, if logical, climax of the whole body of previous Christian theology and ecclesiastical history.

Mr. Thomson follows the lead of the devil along many entertaining by-paths. Among his modern instances his account of the recent case of the Abbé Desnoyers, near Melun, would have gained in interest had he told the whole story. This remarkable case was really a battle between two cults. In this, as in the previous case six years before, the original offence which gave rise to the accusation of witchcraft was not in the details given in the courts which Mr. Thomson quotes, but in the fact that an image of the Madonna which shed real tears and belonged to Mme. Mesmin, on whose behalf the Abbé was attacked, had been made by him to cease to function.

Neurology and Psychology.

The Matrix of the Mind. By Prof. Frederic Wood Jones and Prof. Stanley D. Porteous. Pp. xi+457. (Honolulu, T. H.: University Press Association; London: Edward Arnold and Co., 1928.) 21*s.* net.

THE two authors of this unusual book, one an anatomist, one a psychologist, set out to blend the "subject matter and viewpoints of two sciences . . . neurology and psychology". As they point

out in the preface, the ordinary text-book of psychology makes little or no attempt to relate the structure of the brain to its function. Neurology, however, comprises more than the facts of the structure of nervous system, and the author of the first portion of the book (that dealing with structure) has produced a most readable general review of comparative neurology in both its structural and functional aspects. The evolution of the neopallium, the portion of the brain believed by the morphologist to be the cortical structure concerned with the complex correlation of the different sensations, and therefore probably the organ of mind, is traced through the vicissitudes in the phylogenetic development of the sense organs. The reflection of animal behaviour upon the sense organs, and consequently upon their nervous connexions, is illustrated by many particularly entertaining and original accounts of the behaviour of some of the Australian fauna in relation to the structure of their brains.

This means of approach to the study of mind reveals, however, that the morphologist has to restrict himself to wide generalisations in the relation of behaviour to structure. It is evident that, just as the morphologist is unable to deduce from the structure of the nervous system of a certain frog that it will react to the sound of a splash by diving into water, so the psychologist cannot, at present, base any but the most gross errors in mental make-up on any structural alteration. Nevertheless, since the evolution of behaviour does carry with it recognisable structural changes, there is presumably some structural basis, as yet unknown, underlying minor changes in behaviour in any one particular species, and it would therefore seem profitable to make the utmost use of such structural alteration as can be found in cases of human psychological abnormality.

The second portion of the book (dealing with the psychological aspect) is disappointing from this point of view, for little attempt is made to enlarge upon the behaviouristic significance of the morphology of the sense organs and the neopallium in connexion with psychology and psycho-pathology. Instead, the working of the mind, with the usual discussion of sensation, attention, and behaviour, in terms of the outworn physiological principles of 'facilitation' and 'synaptic resistance', is here further involved in new functional theorems such as the "theory of neural counter-currents" deduced from physiological statements which are inaccurate, and a theory of the origin of motor and sensory decussations which is difficult to harmonise with the appearance of such decussations very low in the animal scale, but also entirely disregards the nature of the sensory pathways except for the number of times they cross the central axis. An admirable feature of the whole book, however, is the emphasis which it lays on the necessity for adequacy of stimulus in appraising reaction.

Our Bookshelf.

Bird Watching on Scolt Head. By E. L. Turner. Pp. viii + 84 + 47 plates. (London: *Country Life*, Ltd., 1928.) 10*s.* 6*d.* net.

IN the present volume Miss Turner gives us the results of her two years' watching on Scolt Head, one of the sanctuaries run by the Norfolk and Norwich Naturalists' Society. Miss Turner is one of those very few people who possess not only keen powers of observation, a wonderful knowledge of bird life, with an immense store of energy and perseverance in carrying out any work upon which she embarks, but, fortunately for us, also has the ability to set forth the results of her work in a most charming manner.

Naturally, everyone will not agree with all the opinions which Miss Turner expresses, but, even where we disagree with them, we shall be none the less interested in what she tells us, or the less pleased with the manner in which she does it. Scolt Head is now undoubtedly one of the most interesting sanctuaries in the whole of Great Britain, both on account of the many birds which breed there and because it forms a wonderful resting-ground for migratory birds on both their spring and autumn travels. Miss Turner's work lay principally with the breeding birds, but during her long months' vigils she lost no opportunities of dealing also with the visitors to her island, and the oldest observers may learn something from her work on Scolt Head. Even the keenest of Nature lovers make slips sometimes, and we should like to have seen the dwarf fire-crest which Miss Turner says measured only 2½ in. *across* the wings; perhaps she meant 4½ in.

The book is profusely illustrated with very beautiful photographs, both of the birds themselves and of the scenery in which they live; the paper on which the text is printed is good and light, and the book is a pleasure to read without being a labour to hold.

(1) *Atomic Structure as modified by Oxidation and Reduction.* By Dr. W. C. Reynolds. Pp. viii + 128. (London: Longmans, Green and Co., Ltd., 1928.) 7*s.* 6*d.* net.

(2) *La structure du noyau de l'atome, considérée dans la classification périodique des éléments chimiques.* Par Charles Janet. Pp. 67 + 3 planches. (Beauvais: Imprimerie Departementale de l'Oise, 1927.) n.p.

(1) THERE are no problems of greater interest at the present time than those of atomic structure as elucidated by the study of emission and absorption

spectra. This study has the merit of providing a rigid experimental basis for chemical doctrines of valency and of molecular structure; but the author ignores all this valuable material and prefers to rely on imagination rather than on knowledge of the behaviour of electrons. In these circumstances a responsible teacher might well be excused if he advised his students to seek wisdom elsewhere, and to spend their money in purchasing a real romance from the learned pen of Mr. J. J. Connington (who, we believe, is in private life a professor of chemistry), rather than spend both time and money in an effort to distinguish between fact and fancy in Dr. Reynolds's tables of atomic structure.

(2) A similar criticism can be made of Janet's study of the structure of the nucleus. At a time when the relevant energy-levels are being determined experimentally from the properties of β-rays, the value of a purely imaginative study of the distribution of electrons and protons in the nucleus is surely negative rather than positive, since it represents a dissipation of energy which might have been converted into useful work.

Contributions to Analytical Psychology. By C. G. Jung. Translated by H. G. and Cary F. Baynes. (International Library of Psychology, Philosophy, and Scientific Method.) Pp. xi + 410. (London: Kegan Paul and Co., Ltd.; New York: Harcourt, Brace and Co., Inc., 1928.) 18*s.* net.

IT is several years since Jung's "Psychological Types" was published in this series, and the present volume is the first of the author's works to appear in English since then. It is well known that there is, under the name psycho-analysis, no common body of doctrine which is held by its most distinguished representatives. Attempts have been made to show that the theories of Freud and Jung, for example, are not so antagonistic as they seem. One such attempt constitutes a volume in this same series. But Jung himself can scarcely keep within the bounds of polite language in denouncing the Freudian sex-hypothesis as a fanatical creed. The volume before us is full of interest from cover to cover, and it well exemplifies what the reviewer regards as Jung's reasonableness and sanity. He applies his theories to problems of modern life, including women in Europe, marriage as a psychological relationship, analytical psychology and the poetic art, and analytical psychology and education. It is to be noted that, apparently on the principle that one cannot touch pitch without soiling one's fingers, Jung eschews the term 'psycho-analysis'. He prefers the term 'analytical psychology'.

Der Bau der Erde: eine Einführung in die Geotektonik. Von L. Kober. Zweite neubearbeitete und vermehrte Auflage. Pp. iv + 499 + 2 Tafeln. (Berlin: Gebrüder Borntraeger, 1928.) 27·60 gold marks.

THE first edition of this work appeared in 1921, and was a series of discussions of tectonic problems rather than a text-book. This present edition practically amounts to a new work, for much of the arrangement, terminology, and substance is new. The book now consists of five hundred pages compared with the three hundred of the first edition. Prof. Kober justly claims the present work as the first text-book of geotectonics. The book certainly stands alone; it is approached by some recent German publications, but there is nothing in English of the same calibre.

The author, starting with the division of the earth's crust into kratogenetic (stable) and orogenetic (mobile) zones, proceeds to discuss these divisions with respect to facies, movements, and mountain-building. The results are applied to the continents and oceans in turn. Finally, many theories, such as those concerning the origin of continents and oceans, are summarised. The book is up-to-date; it includes, for example, an account of Stille's work in Saxony, of G. M. Lees' work in the Persian Gulf, and of the results obtained by the *Emden* during echo-sounding cruises in 1927.

The typography is good, illustrations adequate, and misprints few. The bibliography is not up to the standard of the book, and an index would have been useful for a volume of this size.

Recent Advances in Hæmatology. By Dr. A. Piney. (Recent Advances Series.) Pp. x + 318 + 4 plates. (London: J. and A. Churchill, 1928.) 12*s.* 6*d.* net.

THE demand for a second edition of this book within twelve months of the appearance of the first is an indication of its well-deserved popularity. Dr. Piney has made additions to every chapter, in order to include the most recent views on all aspects of his subject, and a new chapter is given describing the spleen in various infections.

The author considers hæmatology on an essentially morphological basis. Modern views on blood chemistry are therefore not included, and, as is pointed out in the preface, the term hæmatology is not generally intended to cover the subject of serology. Treatment is discussed in relation to each disease or group of diseases; little progress has been made recently in this direction, but the administration of liver in the treatment of pernicious anæmia is mentioned. The glossary is very useful to those not familiar with pathological terms, and there are numerous references to original articles and text-books.

A Manual of Elementary Zoology. By Dr. L. A. Borradaile. (Oxford Medical Publications.) Sixth edition. Pp. xvi + 683 + 25 plates. (London: Oxford University Press, 1928.) 16*s.* net.

THE principal alterations in the sixth edition of this excellent and well-produced text-book are the revision and extension of the chapters on sex, embryology and evolution. A "concise account"—about a page—of the snail (*Helix*) has been added, but this is too short to be really serviceable. It contains no description either of the reproductive apparatus or the ganglia—the former is simply noted as "complicated, hermaphrodite" and the latter as "concentrated into a clump around the gullet". The figure of the senile form of *Entamœba* with buds might have been omitted.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Mass-Spectrum of Lead from Bröggerite.

IN the issue of NATURE for Mar. 2, 1929, Dr. Aston gives the results of his determination of the mass-spectrum of a sample of lead in the form of its tetramethyl compound, of which the lead had been extracted by us from a sample of Norwegian bröggerite. We obtained the lead in the form of chloride, and took particular care to have it free from impurities. The conversion of the chloride into tetramethyl was kindly carried out for us by Mr. S. C. Witherspoon, and care was taken to test all chemicals and reagents used to see that they were free from lead.

Dr. Aston discusses his results and reaches interesting conclusions, and a further discussion is given by Sir Ernest Rutherford. It may be of interest to consider the matter further, in the light of our analysis of the mineral.

The specimen was obtained from a trustworthy dealer and bore the label "Uraninite, var. Bröggerite, Karlshus, Raade, Smaalenene, east of Kristianiafiord, Norway". It appeared to be homogeneous except for a little pink feldspar, mica, and quartz, and was of an iron-grey colour and of the general appearance of massive magnetite, but with some crystal faces. Close examination showed no evidence of its having been acted upon by weathering processes. Our analysis is as follows:

U_3O_8 = 72·12 per cent	equi-		U = 61·158 per cent.	
ThO_2 = 4·98 ,, ,,	valent		Th = 4·377 ,, ,,	
PbO = 8·64 ,, ,,	to		Pb = 8·018 ,, ,,	

We have confidence in the essential accuracy of these figures.

For calculating the age we used the formula given by the International Critical Tables of the National Research Council:

$$\text{Age} = \frac{\log (\text{U} + 0{\cdot}38\ \text{Th} + 1{\cdot}156\ \text{Pb}) - \log (\text{U} + 0{\cdot}38\ \text{Th})}{6{\cdot}5} \times 10^{11}\ \text{years.} \quad . \quad . \quad (\text{I})$$

This gives an age of $919{\cdot}5 \times 10^6$ years for this mineral. Changes which might be made because of some variation in the values of the disintegration constants involved in the factor 6·5 of the formula are not likely to be of large amount. The calculated age is in good agreement with previous determinations by others on uranium minerals from the same general locality. We may now compare this value with results obtained by making use of Dr. Aston's figures in connexion with our analytical results.

Dr. Aston gives the figures 86·8, 9·3, and 3·9 as the percentage values obtained for Pb^{206}, Pb^{207}, and Pb^{208} present in the lead tetramethyl. Of these isotopes of lead, the first and second have presumably been derived from uranium and its isotope actino-uranium, and the third from thorium. In analysis, uranium^{238} and actino-uranium are necessarily determined together as 'uranium', and their disintegration has resulted in Pb^{206} and Pb^{207} respectively. Calculations of age from these elements, disregarding thorium and Pb^{208}, should give practically the same result as the original calculation, and these results in turn should agree with the result that thorium and Pb^{208} give. For uranium plus actino-uranium we express the formula as

$$\text{Age} = \frac{\log (\text{U} + 1{\cdot}156\ \text{Pb}^{206+207}) - \log \text{U}}{6{\cdot}5} \times 10^{11}\ \text{years} \quad (\text{II})$$

and get

$$\text{Age} = 908{\cdot}4 \times 10^6\ \text{years.}$$

This may be considered a satisfactory agreement with the $919{\cdot}5 \times 10^6$ years previously obtained.

For thorium and its lead we have

$$\text{Age} = \frac{\log (0{\cdot}38\ \text{Th} + 1{\cdot}156\ \text{Pb}^{208}) - \log (0{\cdot}38\ \text{Th})}{6{\cdot}5} \times 10^{11}\ \text{years.} \quad . \quad . \quad (\text{III})$$

From this calculation, however, we get the result

$$\text{Age} = 1313 \times 10^6\ \text{years,}$$

which is widely different from the previous figures.

It is pertinent to inquire as to the probable cause of the discrepancy.

In Dr. Aston's account he expresses some uncertainty as to relative intensities of the lead lines, and gives a margin of possible error of ± 2 for Pb^{208}. In view of the small total quantity of Pb^{208}, this means a large percentage error, the possible variation running from 5·9 to 1·9 per cent, and corresponding ages (calculated by formula III) running from 1900×10^6 to 671×10^6 years. The limits of error, therefore, include the value $919{\cdot}5 \times 10^6$ deduced from the original calculations, but if this is accepted as correct, Dr. Aston's figure for Pb^{208} apparently requires correction to bring it into harmony. The limits of error he himself sets likewise point to the desirability of greater refinement of photometric measurement in order to make the results serve for age calculations. Instead of 3·9 per cent of Pb^{208} given by him, our figures indicate 2·64 per cent, which is obtained by substituting in formula III the age $919{\cdot}5 \times 10^6$ years and the analytical value of thorium, and solving for Pb^{208}.

There is, however, another aspect of this matter which should be considered. Formula III involves the factor 0·38, accepted as expressing the disintegration equivalence of thorium in terms of uranium. It may be thought that it is this factor which should be revised, as there has been some variation in determinations of the value of this quantity among different experimenters. As a basis for judgment in this matter we may make a new calculation of the conversion factor from the data supplied by Dr. Aston. For this purpose we combine formulæ II and III in the form

$$\frac{\text{U} + 1{\cdot}156\ \text{Pb}^{206+207}}{\text{U}} = \frac{x\text{Th} + 1{\cdot}156\ \text{Pb}^{208}}{x\text{Th}} \quad (\text{IV})$$

and solve for x.

Such a calculation does not involve the correctness of the constants in the uranium series, but only the value of the conversion factor required to get identical results for the uranium series and the thorium series.

Proceeding in this manner, we get the result 0·57. Possibly it may be regarded as an open question whether the accepted value 0·38 obtained by direct measurement by physicists does not require correction to bring it into closer accord with the figure 0·57 derived from Dr. Aston's work, but in reading Dr. Aston's letter we are left with the impression that Dr. Aston himself does not wish to be held too strictly to the numerical values that he gives.

Furthermore, previous work by one of us (*Amer. Jour. Sci.*, November 1928) has given support to the substantial correctness of the figure 0·38. Two

minerals from a certain deposit in Brazil were analysed, after taking means to remove weathered products. One was a uranium mineral carrying little thorium, and the other was a thorium mineral carrying almost no uranium. From the results the ages were calculated, using for thorium the equivalence ratio 0·38. The ages found for the two were in close agreement.

The investigation, of which the results have been reported by Dr. Aston, was suggested (by C. S. P.) in the hope of obtaining a direct determination of uranium lead (Pb^{206}) and thereby improving the accuracy of the existing formula for calculating ages. It was also hoped that the uranium-thorium equivalence factor (0·38) could be independently determined and perhaps improved, in order that the determination of geological ages might be rendered more certain. From a consideration of the matter in the light of the analysis, it seems probable that a higher degree of precision in the measurement of the intensity of lead lines will be necessary in order to attain these ends. We hope that future work by Dr. Aston will bring this about. In any event, we are happy to know that our sample has been useful to Dr. Aston in finding fairly conclusive evidence of the existence of actino-uranium.

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C. S. PIGGOT.

Geophysical Laboratory,
Washington, D.C.,
Mar. 25.

Estimates of the Ages of the Whin Sill and the Cleveland Dyke by the Helium Method.

THE helium method of measuring geological time, originally devised by Lord Rayleigh, has hitherto been applied only to minerals or other materials that were found to be relatively rich in the radioactive elements, uranium and/or thorium. It is already well known that the results obtained are to be regarded as minima, on account of the special tendency of accumulated helium to escape from such specimens during their exposure to the atmosphere and during their preparation for analysis. This tendency is necessarily most marked in old and richly radioactive minerals, like uraninite and thorianite, in which large quantities of helium have been generated (for example, 10 c.c. per gm.). In very feebly radioactive materials, like ordinary igneous rocks, the amount of helium is correspondingly minute (for example, about 10^{-4} to 10^{-5} c.c. per gm.), and its proportion to that of other gases (about 1 c.c. per gm.) is very low. The ordinary gases of an igneous rock are not appreciably extractable by a pump, even when specimens are ground *in vacuo*; nor, as a rule, do they begin to escape in appreciable quantity as a result of heating, until the temperature exceeds 300° C. It is therefore to be anticipated that the loss of helium from specimens of close-grained igneous rocks awaiting analysis will be much less serious than that from radioactive minerals.

The technique introduced by the late Sir William Ramsay, and developed by Prof. Collie and by Lord Rayleigh, for the determination of minute traces of helium has recently been still further improved by Prof. F. Paneth and, independently, by Dr. R. W. Lawson. It is now possible to measure with a reasonable degree of accuracy the helium accumulated in ordinary igneous rocks, even if their geological ages date from epochs no more remote than those of the Tertiary. In the case of plateau basalts, possibly some 40 million years old, the average radium and thorium content is such that the accumulated helium should be of the order 10^{-5} c.c. per gm. With modern methods amounts down to 10^{-9} c.c. can be estimated, and therefore quantities of the order found in rocks and ordinary rock-forming minerals are readily determinable.

With these considerations in mind the helium method has been successfully applied to two north of England rocks (the Whin Sill and the Cleveland Dyke) that have recently been under detailed petrological investigation (A. Holmes and H. F. Harwood: *Min. Mag.*, **21**, pp. 493-542; 1928; and **22**, pp. 1-52; 1929). The determinations of radium and thorium were carried out (by V. S. D.) in the laboratories of Prof. H. Mache, at the Radium Institute, Vienna, while those of helium were done in Prof. Paneth's laboratories in Berlin (also by V. S. D.). The materials used for these determinations were in each case parts of the specimens already analysed chemically and mineralogically in the course of the investigation to which reference has been made. The following are the results obtained:

Rocks Investigated.	$Ra \times 10^{12}$ gm./gm.	$U \times 10^{6}$ gm./gm.	$Th \times 10^{6}$ gm./gm.	$He \times 10^{6}$ c.c./gm.
Whin Sill, Scordale Beck, Westmorland (No. 551) .	0·27	0·81	3·0	36·0
Cleveland Dyke, Bolam, Co. Durham (No. 402) .	0·61	1·83	6·1	11·0

The approximate age (omitting a negligible time-correction for the wearing out of uranium and thorium during the life-time of the rock) is given by the formula

$$\frac{He}{U + 0{\cdot}29\ Th} \times 8{\cdot}5 \text{ million years},$$

where U and Th are the percentage contents of the rock in uranium and thorium, and He is the volume in c.c. of helium at N.T.P. in 100 gm. of the mineral (A. Holmes and R. W. Lawson: "Factors involved in the Calculation of the Ages of Radioactive Minerals", *Amer. Jour. Sci.*, April 1927, pp. 334-5).

From the data of the above table the ages are found to be:

Whin Sill . . .	182 million years.
Cleveland Dyke . .	26 million years.

The Whin Sill was injected into the Carboniferous rocks of the north of England in very late Carboniferous times. The Cleveland Dyke was injected in post-Liassic time, and the recognition of its definite status as an outlying member of the Mull dyke-swarm points more closely to an early or middle Tertiary age. The numerical ages are thus seen to be in excellent agreement with the geological evidence. They also conform quite satisfactorily with the scanty results based on lead-ratios. The latter give 192 million years for the late Carboniferous (Joachimstal pitchblende provisionally corrected by atomic weight evidence for primary lead); 36 million years for the (?) late Miocene (brannerite from Idaho, uncorrected); and 66 and 52 million years for the late Cretaceous (pitchblendes from Colorado and Wyoming respectively, also uncorrected).

While it is probable that the helium results may be slightly low, it must be remembered that there is no real proof of this, for the lead-ratios cited are themselves not yet so securely founded as one could wish. There may be traces of primary lead in the Tertiary and late Cretaceous pitchblendes of North America, and, if so, the figures given would be too high. The Joachimstal evidence, while generally consistent, suffers from the fact that the specimens analysed were

not the specimens from which lead was separated for atomic weight determination.

Clearly there is a vast field of geological research now open to investigation by the long neglected helium method. If our initial hopes are realised—and these preliminary results provide ample encouragement—a method is now available for dating all fresh igneous rocks which have not been heated up or metamorphosed since they came into place. There should not be the slightest difficulty, for example, in distinguishing Carboniferous dykes and sills from those of Tertiary age. It should be equally easy to settle with certainty the controversy as to whether the Carrock Fell complex belongs to the Ordovician or to some later epoch of igneous activity. There are many such problems awaiting solution in every country where igneous rocks occur. Moreover, since igneous rocks suitable for the helium method are far more abundant and far better distributed in time than are radioactive minerals suitable for the lead method, there is now available a practical means of effecting long-distance correlations and of building up a geological time-scale which, checked by a few reliable lead-ratios here and there, should become far more detailed than could ever be realised by means of the lead method alone.

Further work is in progress on the north of England rocks, and it is our intention as soon as possible to begin the systematic prosecution of this extremely promising line of research. Dr. R. W. Lawson has consented to collaborate in the work by making the helium determinations and by carrying out a quantitative investigation on the possibilities of escape of helium in various circumstances.

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ARTHUR HOLMES.

The University, Durham, May 6.

A Case of 'Siamese Twins' in the Spiny Dogfish (*Squalus fernandinus*).

THE occurrence of a case of Siamese twins in fishes has, so far as we are aware, not previously been recorded. The present example was recently discovered by one of us (J. M.) amongst the material collected during the survey of the Cape seas by the s.s. *Pieter Faura* about twenty-five years ago. Unfortunately, no records of the finding of this abnormality appear to have been kept, and one can therefore only speculate as to how it was originally found.

It is well known that this particular species of dogfish is viviparous, the female giving birth to as many as half a dozen young at a time. In the dissection of the uterus of a gravid female, the young are found to be fully developed except for the possession of a yolk-sac, which in these cases takes on the function of a yolk-sac placenta, being in intimate contact with the wall of the uterus, which appears to be specially folded to receive the surface of the yolk-sac. At birth, the young is born fully developed, the yolk having been completely absorbed, the yolk-sac having shrivelled up.

In the 'Siamese twins', as is well shown in the accompanying photograph (Fig. 1), the umbilical cords are still present, each embryo being provided with one. One is struck by the position of these cords, which here have their exit in the neighbourhood of the pectoral girdle as opposed to the normal abdominal position. The integument and the muscles surrounding the bases of these cords were incomplete, so that a large opening was left for the exit of the cords, the cœlom thus being in direct communication with the exterior.

The fact that the umbilical cords were still visible externally—the yolk-sacs had apparently been broken off, for they are entirely absent from the specimen—leads one to the conclusion, based on the advanced state of development of the newborn young, that the twin was found during the dissection of the uterus of a gravid female.

FIG. 1.—'Siamese twins' (spiny dogfish).

A brief description of the external appearance of the abnormality may prove of interest. The anterior ends, as far back as the pectoral fins, are free, being attached to a single trunk and tail. Thus we find that there are a pair of pectoral fins to each free thoracic part, while the first and second dorsal fins are symmetrically developed in their normal positions. Spines are developed in front of each dorsal fin. The tail presents a peculiar appearance. The caudal fin is double, symmetrically developed about the median horizontal axis. The part corresponding to the ventral lobe of the caudal fin of a normal individual is twisted through a plane of 90° so as to lie in the horizontal instead of the vertical plane. This lobe of the caudal fin is also shown in Fig. 1. Along this side of the caudal region a deep groove is continuous from this fin up to a line through the posterior ends of the second dorsal. The other caudal lobe is entirely absent. The ventral fins are a single pair which has become displaced so as to lie laterally on one side of the trunk. Each on its inner surface has a well-developed clasper, while the single anus is also displaced and lies between the bases of the ventrals.

The two heads are apposed by their ventral surfaces, each being perfectly normal, the mouths and nostrils facing each other. The normal five pairs of gills are also present on each head.

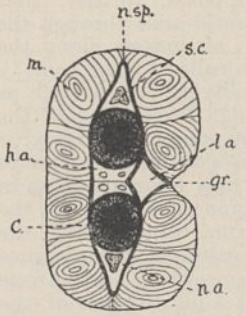

FIG. 2.—Transverse section along line A B of Fig. 1, to show duplication of the vertebral column, etc. *C.*, centrum; *gr.*, groove; *h.a.*, hæmal arch; *l.a.*, lateral arch; *m.*, myomeres; *n.a.*, neural arch; *n.sp.*, neural spine; *s.c.*, spinal cord.

It has not yet been possible to make a detailed dissection of the specimen, but a transverse section across the tail, just behind the second dorsal fin, shows that the vertebral column is double, each column appearing symmetrical about the median horizontal plane. A vertebra of each column consists of a centrum, the neural arches forming the neural canal in which the nerve cord lies and ending in the neural spine. On the side of the groove above referred to, there appears a single lateral arch with spine lying against the base of the groove, enclosing a lateral blood-vessel. The two centra are separated by a space bounded above and below by the centra, on one side by the laterally placed arch, and on the other by a sheet of cartilage. This space is divided by a horizontal membrane to form two hæmal arches in which the caudal veins and arteries run.

We hope to make a detailed dissection of the various

internal structures in the near future in order to examine the various parts and to ascertain which are duplicated and which single.

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The Past Cold Winter and the Possibility of Long-range Weather Forecasting.

MODERN meteorology has made notable advances in forecasting the weather of the next day, but when it attempts to predict the weather for more than a week ahead, the percentage of successes does not exceed fifty at the most. One reason for this failure is to be found in the refusal of the modern meteorologist adequately to take into account in the problem of weather prediction of direct terrestrial influences, such as that of the physical state of the surface waters of the oceans, even though he may be ready enough to take such an influence into account when dealing with one of those aerodynamical problems—for example, the life history of an Atlantic 'depression'—which he regards as lying within his particular province. Another reason is his neglect of the 'Polar Front' theory of Prof. Bjerknes, one of the greatest authorities on aerodynamics and hydrodynamics.

Prof. Bjerknes regards the polar regions as caps of cold air maintained largely in consequence of the local accumulations of ice and snow, offering a kind of cold circular wall facing the warmer winds of temperate latitudes. He considers that in conjunction with the strongly heated equatorial regions, they set up a circulation which brings warm air aloft from the equator to the pole, there to be cooled and to sink, weighed down by its increasing density, until it is absorbed into the polar cap; that these reservoirs of cold air at the poles are constantly discharging their accumulated air towards the equator along the earth, in accordance with 'impulses' supplied by the region of low barometer around the equator; that the trade-winds represent successful attempts on the part of such accumulations of polar air to reach the region of equatorial calms. He supposes, further, that the cyclones of the North Atlantic arise through the mixing of the cold and warm air-masses along the margin of the polar cap (the so-called 'polar front').

It is clear that a great simplifying theory such as this offers a basis for long-range forecasting of the weather in our latitudes. If we accept the theory, it is not difficult to see that the general character of the weather over long periods may follow changes in the extent and shape of the region of cold sea, for the polar caps must, in the long run, coincide with the regions of coldest water. For example, the presence of a tongue of warm water projecting into Arctic regions, such as the so-called Gulf Stream of the North Atlantic, will push this boundary back towards the pole, and cause contrasts such as are offered in winter by the cold climate of Labrador and the relatively mild climate of Iceland.

We may consider now whether the past severe winter cannot be connected with some modification of the normal temperature of the seas within the area of exceptional cold. The immediate cause of the severe weather has clearly been the persistence of northerly and easterly winds over Russia and Central Europe circulating round an 'anticyclone' or region of high barometer over Scandinavia and Finland; which anticyclone has generally been separated from the area of high pressure that normally covers Siberia in winter by a region of relatively low pressure over Russia. Now Prof. Witting found in the Baltic in the summer of 1927 a layer of cold water at a depth of about 10 fathoms, beneath the very warm surface water, heated by the sun, having altogether a volume much greater than that of a whole normal year's outflow from the Baltic into the North Sea, and having a temperature about 10° F. lower than the average. The surface waters of the Baltic are derived ultimately from the mixing of the river water with that finally ascending from such deeper layers, and this cold water might well chill their surface waters, and the air in contact with them, for two years or more, in accordance with the time that the water might be expected to take in passing away along the Norwegian coast.[1] Such chilling would cause the anticyclones which are so apt to form over Scandinavia to be more than usually persistent, as has been the case this winter. In this way the action of the cold water, which is far too small to produce directly a degree of cold such as has been observed, may do so indirectly through the agency of the wind, and the resulting accumulations of ice and snow will carry the process still further.

It seems clear that if the action of a single sea such as the Baltic can be so great, there is a great field open for international co-operation in the systematic study of the physical states not only of the Baltic but also of all the seas and oceans in and around Europe, including the Caspian and the Black Sea. This should be done once a year, if not twice, and the results should be published quickly, so as to be available for long-period weather forecasting. This was in fact the policy of the International Council for the Exploration of the Sea before the War. It is hoped that the remarks that I have made will show that permanently to abandon such a scheme may be to throw away the opportunities of saving millions of pounds that would be afforded by the prediction, in good time, of winters such as that of 1928–29.

W. J. PETTERSSON.

Refraction of Light Waves by Electrons.

IT is an established fact that wireless signals transmitted from any place are readily received at the diametrically opposite place on the globe. The explanation usually given of the phenomenon is that the ions in the Heaviside layer make the speed of propagation of the waves greater in that layer than in the ordinary air below and thus bend the waves round the earth by a process of refraction. Larmor has developed the mathematical theory of the refraction (*Phil. Mag.*, December 1924), and has shown that if c is the velocity of light in vacuum and c' in the presence of electrons, then c and c' are related by the equation

$$c'^{-2} = c^{-2}\left(1 - N \cdot \frac{e^2\lambda^2}{\pi m}\right),$$

where N is the number of electrons per unit volume, e and m are the charge (in e.m.u.) and the mass of an electron, and λ the wave-length. Assuming $\lambda = 10^5$ cm. for radio waves, calculations show that an electron density of 0·3 per c.c. is enough to produce the observed bending round the earth.

In the case of light waves, λ is of the order of 10^{-5} cm. This will lead to a large value of N in order that light waves may bend round the earth. If the refraction of light waves by electrons is to be observed in the laboratory, the curvature of the rays has to be much larger, and hence a still larger value of N will be required.

So far as we are aware, the bending of light waves by electrons has neither been attempted nor its possibility discussed. For some time past we have been

[1] The brackish water leaving the Baltic by the Oeresound and the Belts afterwards forms the 'Baltic current' along the west coast of Sweden and Norway.

experimenting to detect this effect, but before trying the actual experiment we thought it worth while to discuss if, under ordinary laboratory conditions, it is possible to obtain a sufficiently dense cloud of electrons to produce observable bending of a light beam. The results of our theoretical deductions are here set forth.

Langmuir has shown (*Phys. Rev.*, April 1923) that the density of space charge (ρ_0) at the surface of a plane hot surface is given by the equation

$$\rho_0 = 19260 \times i_0/\sqrt{T} \text{ e.s.u. per cm.}^3,$$

where i_0 is the saturation current expressed in amperes per sq. cm. of the hot surface at temperature T°K.

The density of space charge (ρ) at a distance y from the surface is also given by

$$\rho = \rho_0/(\sqrt{2} \cdot L_0 \cdot y + 1)^2,$$

where $L_0 = 4{\cdot}59 \times 10^5 \times T^{-\frac{3}{4}}\sqrt{i_0}$ cm.$^{-1}$, expressed in amp. A thoriated tungsten filament of diameter 0·155 mm. and containing 1 per cent ThO_2 gives an electronic current of about 20·5 amp./cm.^{2} at temperature 2300° K (cf. Langmuir, *Phys. Rev.*, October 1923). If we take a strip of thoriated tungsten giving this current at this temperature, then ρ_0 will be equal to 8232 e.s.u./cm.^{3}, and the density N of electrons at the surface of the hot strip is found to be $1{\cdot}724 \times 10^{13}$. Also, since $L_0 = 6258$ (approximately), the density (N) of electrons at a distance y is $1{\cdot}724 \times 10^{13}/(8850y + 1)^2$. The expression shows that the electron density decreases rapidly with increase of distance from the strip. This variation of density will produce a curvature in a beam of light passing over the surface of such a strip. Since, to a first order of approximation, the refractive index $\mu = c/c' = 1 - N \cdot e^2\lambda^2/2\pi m$, the curvature of the beam at a distance y from the strip will be

$$-\frac{d\mu}{dy} = \frac{e^2\lambda^2}{2\pi m} \cdot \frac{dN}{dy} = -\frac{4{\cdot}6 \times 10^{-5}}{(8850y + 1)^3},$$

for sodium light, $\lambda = 5{\cdot}8 \times 10^{-5}$, the negative sign indicating that the beam will bend away from the strip.

At the surface of the strip ($y = 0$) the curvature of the beam will be numerically equal to $4{\cdot}6 \times 10^{-5}$. If we assume that this curvature is maintained throughout the passage of the light over the whole length of the strip, say 10 cm., then the light beam, which on entering the electron atmosphere just grazes the surface of the strip at one extremity, will on emergence at the other extremity be shifted through a distance of $2{\cdot}3 \times 10^{-3}$ cm. from the surface. This shift will evidently be greater than the actual shift, since the expression for the curvature given above shows that it is not constant but that it diminishes rapidly with the increase of y—the distance from the strip. A more detailed calculation shows that the actual shift will be approximately equal to $7{\cdot}8 \times 10^{-4}$ cm. This shift, though small, should be detectable if suitable experiments can be arranged.

The smallness of the shift is due to the fact that the emitted electrons are mostly concentrated near the surface of the strip. At a distance of only 0·1 mm. the electron density falls to one ten-thousandth part of its value at the surface. A more favourable condition for bending the light beam will possibly be set up if the electron cloud is pulled upward by a positively charged plate held a few millimetres above the surface of the hot strip.

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April 11.

An Experimental Investigation of the Thermal Relations of Energy of Magnetisation.

THIS note is a first report of experiments undertaken for the purpose of determining the mechanism of the degradation of energy which accompanies magnetisation in ferromagnetic substances. The present experimental method consists in observing the change in temperature of a test specimen produced by a change in the magnetising force at consecutive intervals in a single cycle of magnetisation.

The test specimen is in the form of 106 bars of soft steel drill rod 1 mm. in diameter. The bars are so mounted as to form 8 coaxial, concentric cylinders, and the lengths of the cylinders are so determined as

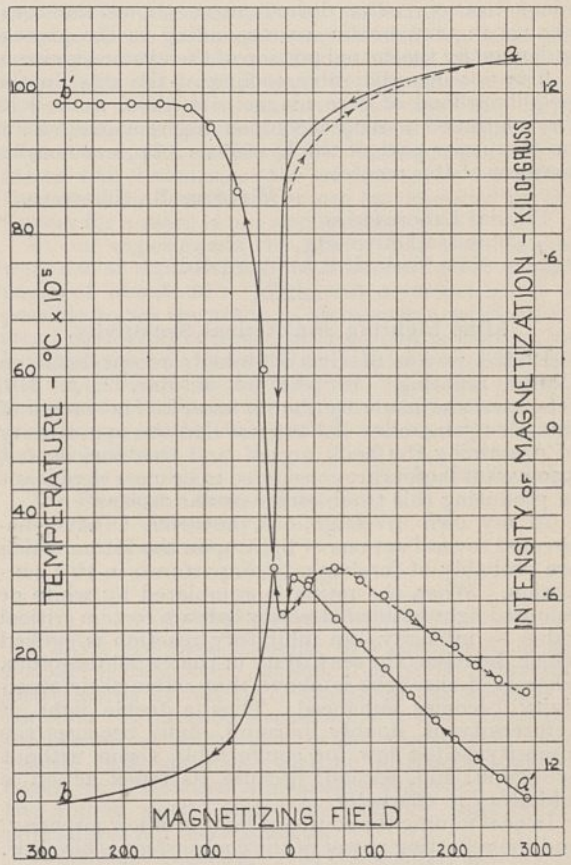

FIG. 1.

to give the aggregate the form of an ellipsoid of revolution the minor and major axes of which are 3·4 cm. and 60 cm. respectively. 106 copper bars of the same dimensions alternate with the steel bars in the structure. 106 thermocouples are constructed by connecting adjacent copper and steel bars alternately with 3 mm. lengths of No. 40 copper wire and No. 34 constantan wire. A coil around the centre of the ellipsoid permits the evaluation of the total magnetic flux in the specimen. The entire specimen is imbedded in rice powder and placed in an evacuated, silvered glass tube. Adequate thermal insulation isolates the latter from the magnetising solenoid in which it is placed.

The stability of the entire electrical and thermal system is indicated by a zero shift of 2 mm. per hour on a scale 6 metres from the thermocouple galvanometer. A measure of the uniformity of the magnetising field in the ellipsoid is obtained by connecting

half the thermocouples (associated with the inner bars) in opposition to the other half. In these circumstances a reversal of the full magnetising field, which produces a rise in temperature of the steel corresponding to a galvanometer deflection of 220 mm., yields a deflection of only 4 mm.

The results of the investigation are given by the accompanying curves (Fig. 1) where intensity of magnetisation and temperature are plotted against true magnetising field. Curve *ab* is the upper part of the usual 'hysteresis loop' for the steel. The dotted portion indicates the loop obtained when the impressed field is reduced to zero and then restored to its former value. The curve *a′ b′* shows the total change in the temperature of the steel at every stage in the process of demagnetisation and reversal of magnetisation. The dotted curve shows the total change in temperature corresponding to the process indicated by the dotted portion of the hysteresis curve.

The not inconsiderable cooling of the steel in the neighbourhood of zero magnetising field, as well as the continued cooling accompanying remagnetisation on the upper part of the hysteresis loop, are notable features of this record.

WALTER B. ELLWOOD.

Physics Laboratories,
Columbia University,
New York, U.S.A., April 10.

Mine Lighting and Retinal Sensitivity.

IN the review of Dr. Whitaker's recent book on "Mine Lighting" in NATURE of Mar. 2, p. 310, reference was made by the reviewer to the causes of miner's nystagmus. I have not had the opportunity of examining the book myself, and therefore do not know what factors are considered to be most significant in producing this troublesome ocular disease.

In my own investigations, however, I have discovered several actions of light upon the retina which are probably of fundamental importance in this connexion. When the retina is stimulated by white or coloured light with an intensity below a certain critical value—α intensity—an inhibitory reaction is evoked which depresses the sensitivity of the visual receptors, whereas if the light is above that value their sensitivity becomes enhanced. Thus a feeble light of α intensity is doubly harmful, first, because the intensity is too low for comfortable vision without eye-strain, and, second, because its reflex action is inhibitory in character.

In coal mining the source of light is of low intensity, and the reflecting power of the coal surface is also low. It can scarcely be doubted, therefore, that the intensity of light reaching the retina is below the threshold enhancing value, and thus it maintains the receptors in a much depressed condition.

The prevailing view of the visual functions of the spectrum has been to regard all colours or wave frequencies as factors contributing only to the formation of the white sensation. Undoubtedly they have this effect, but it is far from being the whole truth, or perhaps even the most important part of the truth. Each wave frequency is an energy stimulus of a distinctive physiological character the complete functions of which are yet unknown. I have found, however, that the enhancing power of violet light above the α intensity is about seven hundred times as great as that of yellow. Thus it follows that since violet contributes very little to the illuminating power of a light, its chief use when above α intensity is to act as a sensitiser of the retina for the reception of the illuminating colours, a function which it performs with extraordinary efficiency.

I have seen it stated that during the War the Admiralty found the ability to distinguish objects on the sea at night or in feeble illumination was much increased by previously stimulating the observer's eyes with violet or blue light. This is to be expected from the extraordinary enhancing power of violet light. Probably the same procedure would be beneficial wherever observations are to be made with weak light, such as in the use of the microscope or in counting scintillations, etc.

In mine lighting under present conditions, the lamp seems to have too low an illuminating power and is probably greatly deficient in the sensitising violet rays. On both accounts the retinal sensitivity is greatly depressed. Under such conditions visual acuity and luminosity contrast on which it depends are both diminished in value.

Possibly the miner's optical troubles could be diminished or even eliminated by obtaining an illuminant which will supply violet rays of the required intensity, and by raising the illuminating power of the light above the threshold enhancing value, which for white light appears to be about 0·25 metre-candle.

Possibly much improvement could be obtained even under present illuminating methods, if it is not impracticable, by preparing a quickly drying white material which the miner could smear over the coal face at which he is working, and so obtain the full benefit of such light as he possesses.

FRANK ALLEN.

Department of Physics,
University of Manitoba,
Winnipeg, April 16.

Variations in Sex Expression in *Ranunculus*.

WE have now been working on problems connected with andrœcial and gynæceal variation in *Ranunculus* for several years and wish to supplement the remarks by Mr. J. Parkin in his letter published in NATURE of April 13, p. 568.

Plants of *R. acris* and *R. bulbosus* with the stamens partially or entirely deficient in pollen production, and with correlated reduction in the size of the flowers, have long been known. There are many scattered references in botanical literature to this condition. Thus an interesting note on the subject was published in NATURE so long ago as 1878 (vol. 18, p. 588), and other references are given in Knuth's "Handbook of Flower Pollination", ii. 18, 24 (Engl. transl. 1908) and by Sorokin, *Genetics* (**12**, 59; 1927). Varying grades of 'femaleness' were noted by us at Kew in 1914 in three species of the genus, but the War and accumulation of work immediately after prevented experiments being carried out, though one of us mentioned their occurrence in a paper published in the *New Phytologist* (**18**, 254; 1919).

We have found all grades between plants with completely hermaphrodite flowers and those with no functional stamens. The occurrence of every possible intermediate has made the work of scoring extremely difficult and, to a certain degree, arbitrary. On the other hand, our method of scoring led to Whyte's interesting and important discovery of the time-factor as a cause of the appearance of hermaphrodite or unisexual flowers. Little purpose can be fulfilled by giving a Latin name to the composite group of sex variations.

Mr. Parkin, rather surprisingly, does not refer to the living plant he kindly sent us. This was a male plant, in that all its flowers were, and have each season remained, functionless on the female side. It is the most interesting buttercup we have yet seen and it has been used in genetical experiments to

produce generations not yet scored beyond the F_1. The flowers have an increased number of narrow petals and, in general appearance, recall those of *R. ficaria*, yet it is certainly *R. acris*. The plant has been multiplied vegetatively, and good specimens are preserved in the Genetical Herbarium at Kew. So far as we know it is the only 'male' *R. acris* plant ever recorded.

We are inclined to think that Mr. Parkin's suggestion that *R. acris* is in the incipient stage from hermaphroditism to gynædiœcism (or even to complete diœcism) is not improbable. We made a similar suggestion in a paper on the genetics of *R. acris* and *R. bulbosus* recently sent to press. Our field observations have proved that in some populations—widely scattered in England and Scotland—the percentage of female or intermediate forms is very much higher than one per cent, and in some counts it even approximated to fifty per cent.

Lastly, we wish to ask any reader observing sex forms or any abnormalities in any British species of *Ranunculus* to send us living specimens for genetical and cytological analysis.

E. M. MARSDEN-JONES.
W. B. TURRILL.

The Herbarium,
Royal Botanic Gardens, Kew, Surrey,
April 27.

The Arc Spectrum of Phosphorus.

THE arc spectrum of phosphorus has been investigated by Saltmarsh and by McLennan in the Schumann region, and the lines belonging to the fundamental transition $2M_2(M_2 \leftarrow\!- N_1)$ have been arranged according to Hund's theory by McLennan (*Trans. Roy. Soc. of Canada*, vol. 21, sec. 3; 1927).

The lines belonging to the second group of transition $2M_2(N_1 \leftarrow\!- N_2)$ lie, according to the horizontal comparison method of Saha and Majumdar, in the region ν 9400-10300-10800 (*Indian Journal of Physics*, September 1928, p. 72). Similarly, the lines due to the transition $2M_2(N_1 \leftarrow\!- O_2)$ have been located at 18000-20518.

The spectrum of phosphorus in the infra-red region has not yet been investigated, but as both silicon and sulphur are present in the sun, it was assumed that phosphorus should also be found. Taking the infra-red solar lines as given in the "Revision of Rowland's Preliminary Table of Solar Spectrum Wave-lengths," I located these lines with the aid of known differences $\Delta P_{1\text{-}2} = 151$, $\Delta P_{2\text{-}3} = 249$, in the regions predicted. The $4P - 4S_2$ lines and $4P - 4\bar{P}$ lines due to the transition $2M_2(N_1 \leftarrow\!- N_2)$ have been found at $\nu = 10555$ to 11095. Attempts are being made to verify the identification by taking a spectrum of phosphorus in this region.

The second group of lines, $2M_2(N_1 \leftarrow\!- O_2)$, were identified in a group of lines obtained by Geuter in the region λ4600-6000, and have been identified with a number of faint solar lines. The identification seems to be unmistakable.

I have thus obtained two successive members of a Rydberg sequence, and calculated the ionising frequency to be $\nu = 86521$, corresponding to a voltage of 10·68 volts. The ionisation potential of phosphorus is thus found to be slightly higher than that of sulphur, the element succeeding it in the periodic table. We have a similar case in nitrogen and oxygen.

The investigation thus establishes the presence of phosphorus in the sun.

D. G. DHAVALE.

Physics Department,
University of Allahabad,
Mar. 18.

An Optical Method for Analysing Photographs of α-Ray Tracks.

MR. L. F. CURTISS, writing in NATURE of April 6, describes a method for examining stereoscopic photographs of α-ray tracks taken by two cameras at right angles. The method which we have been using for some years for the measurement of the lengths and initial directions of emission of β-ray tracks (originally suggested to us by Prof. C. T. R. Wilson) depends on the same essential principle as that described by Mr. Curtiss, and our experience confirms his observation of its accuracy and convenience. We described the method in a paper on "The Ranges of Secondary β-rays" (*Phil. Mag.*, **2**, p. 1110; 1926) as follows: "The lengths of the tracks were obtained from the stereoscopic photographs by replacing the photographic plates in the cameras, illuminating them and tracing out the common image which coincides in space with the original track". We have also used the same method in an examination of the initial directions of emission of photoelectron tracks (*Proc. Roy. Soc.*, A, **121**, p. 612; 1928). In the case of observations with β-rays, since the track is not in one plane, the use of the translucent screen (as described by Mr. Curtiss for α-rays) is not applicable.

In our experiments the axes of the two cameras were not at right angles, but were inclined at a small angle of about 20°. With this arrangement it is possible to *see* the track in stereoscopic relief, if, instead of holding a screen in front of the camera, we look through one lens with the right eye and through the other lens with the left eye. In actual practice this greatly facilitates the measurement of the tracks. A fuller account of the method will shortly be published elsewhere.

J. M. NUTTALL.
E. J. WILLIAMS.

The Physical Laboratories,
The University,
Manchester.

Geotropism and Antennæ.

I HAVE just been listening to a discussion, at the Zoological Laboratory, arising from some interesting observations by Mr. G. L. Clarke on the tropisms of *Daphnia*. A question was asked as to the conceivable mechanism of geotropism in an animal very little heavier than water and with no air-bladder, and an expert in crustacean appendages suggested that, as the animal slowly sinks, fine sensory hairs on the appendages are bent upwards.

It has since occurred to me that, when passively extended, *Daphnia's* two swimming antennæ, branched and set with long fern-like bristles, will offer relatively great resistance to movement downwards through the water, a resistance on a long lever which must be met on the short internal arm of the lever by at least ten times the force in the muscle or ligament involved.

The actual stimulus for geotropy (positive or negative) might therefore be either an increase in tone of the lower muscles of the antennæ, or a decrease in tone of the upper muscles. If this hypothesis be considered plausible, we have an explanation why nauplii and copepods have evolved these two disproportionately long swimming-arms, in place of being content with the series of short equal paddles or cilia which suffice for so many other organisms. It is no longer remarkable that the most prominent swimming organ of the larva should be an important sense-organ in the adult decapod—for it has always been a sense-organ.

GEO. P. BIDDER.

Cambridge, May 1.

Science and the Classics.[1]

By Prof. D'ARCY WENTWORTH THOMPSON, C.B., F.R.S.

IT has been the rule from time immemorial, not the exception, for science and the humanities to go hand in hand. Aristotle the naturalist wrote of poetry; Plato was a lover of astronomy; Theophrastus the botanist was a master of rhetoric, whom even Cicero admired; Celsus the physician was an encyclopædic scholar after the taste and fashion of his age. When the humanistic tradition was at its height in the 'revival of learning,' Galen and Hippocrates were read by all. Linacre the physician helped to bring Greek into England, and was one of the great scholars of his time. Moreover our physicians have never lost but have richly inherited and enjoyed the classical tradition; Payne and Greenhill, Osler and Clifford Allbutt in our own time, were scholars after the manner of Haller and Boerhaave and Richard Mead and Sir Thomas Browne. Cuvier, busiest of men, wrote a commentary on the natural-history books of Pliny. Linnaeus himself could write of Nature with a scholar's pen and look upon her with a poet's eyes: the severe "Systema Naturae" was the work of one who fell on his knees when he beheld the sunlit gorse at Hampstead, and apostrophised mother Nature in words which sound like the echo of an Orphic hymn: "Natura, Filia Dei, rerum omnium Magistra, autodidactos, indesinenter laborans, nunquam festinans," etc.

If a man's mind be open to the influences of culture at all, he finds not a little of it within the range of his own profession, even though it be a technical one. My own science of zoology looks a very different thing at my age from what it did forty or fifty years ago. Around its bare facts have grown the stories and associations which travel, friendship, reading have supplied. Loose threads have woven themselves into a web. A fact discovered yesterday is balanced by the history of two thousand years. Knowledge is no longer something learned in the study, but that is imbibed during one's wanderings through the world; not something which is contained in a book or books, but which in all lands and languages is part of the living speech and daily business of men, part of the common birthright of mankind.

The faculty of weaving wider and wider associations around our work and thoughts, and of thus enlarging the horizon of our minds, is helped by that sympathetic attitude and spirit of which a broad education has laid the first foundations. But again, the Muses are often kindest to those who have worshipped little at their shrine. It is common nowadays for clever schoolboys to spend many hours of every day in a chemical laboratory, from the age (say) of fourteen: an age at which we were learning Greek, and Plato's young Athenians were playing on the lute. It might be supposed that our young chemists were laying up for themselves what Talleyrand called "une triste vieillesse." By no means. So wonderful a thing is a schoolboy, such a piece of work is a man, that our schoolboy-chemists are little the worse of their narrow and eccentric education. The learned chemist is still a learned man; in love and knowledge of the arts the chemists are scarcely beaten by the scholars. Not a few are steeped in the romantic history of their science, know what is to be known of ancient Greek and Egyptian chemistry, search out the medieval secrets of the poisoner, the alchemist, and the magician, and are versed in the Arabic and other recondite languages in which so many secrets are hid.

If it be an attribute or an end of culture to find something which shall take us out of our narrow lives, help us to forget the routine of our employments, and bring us in touch with the wide world, old and new, near and far away, to read history and poetry is a simple and time-honoured way; nor is there better history or poetry than that which the dead languages enshrine. Men who love these find them very helpful; they enable young men to see visions, they help old men to dream dreams.

A few months ago a scholar died, full of years and of honour, in whom science and the classics were very perfectly combined. Sir William Thiselton-Dyer was the acknowledged head of English botany; as botanist and gardener his influence went out into all lands, to the benefit of mankind, from the garden where he had the happiness to dwell; and all the while he was a true scholar, a Hellenist, acute, fastidious, and profound.

Thiselton-Dyer learned his Greek and Latin in a London day-school; so did I mine in Edinburgh —in that *Schola Nova* of Dunedin where my father had taught R. L. Stevenson and Andrew Lang and many another; had read the whole Aeneid through with them as beginners, and told them they were the first child-mariners who ever circumnavigated that noble poem. In seven years at school I never had a lesson in science, nor yet, I believe, had Dyer; but he and his companions, and I and mine, were botanists and naturalists in our teens. It was a Golden Age, when there were no scholarships to win, no examiners to satisfy. We had freedom to follow our bent, and leisure in which to teach ourselves.

If there was one school-book which Thiselton-Dyer loved more than another it was Virgil's "Georgics." Virgil never fails us, nor wearies us, nor does custom stale his infinite variety. The schoolboy thinks the "Georgics" an easy book; the old scholar knows it to be hard, finds in it *semper aliquid novi*, and is tantalised and fascinated by its difficulty. There is a line near the beginning about the "slow months" of the year, wherein Augustus found his heavenly habitation: "Anne novum tardis sidus te mensibus addas?" Halley the astronomer, coming to Martyn's help, explained the line by the brief statement that "Leo, Virgo, Libra, and Scorpio are really of slower ascension than the other eight signs of the Zodiack; to which Virgil no doubt alluded." But scholars

[1] From the presidential address delivered to the Classical Association, Cardiff, on April 9.

have been slow to accept an interpretation which seemed, as it seemed to Heyne, more subtle than poetic; and Conington declares that *tardus* "need be no more than a disparaging epithet, intended to exalt the power of Cæsar, who is to speed the year"! Dr. Fotheringham has given me a full explanation, on Halley's lines. The 'months' are signs of the zodiac, or the corresponding spaces which the sun travels over in a month. Owing to the obliquity of the ecliptic the signs, or the corresponding spaces of 30°, do not rise above the horizon in equal times. The calculation is somewhat technical, but the result is, briefly, that in the year 35 B.C. and the latitude of Naples, the four signs above-mentioned took each about 2½ hours to rise, while Aries and Pisces, at the other end of the scale, rose in about an hour and ten minutes. In other words, the signs round about the autumnal equinox took more than twice as long to rise as those about the vernal equinox; and the middle of the four 'slow months' lay precisely between Virgo and Libra or 'the Claws',—"Qua locus Erigonen inter, Chelasque sequentes, Panditur."

Dr. Fotheringham tells me another fact, which was quite new to me: namely, that what looks like, and is generally taken to be, a parallel passage in Manilius has an entirely different meaning: "Ne mirere moras, cum Sol adversa per astra Aestivum tardis attollit mensibus annum." This refers to the sun's 'anomalistic' motion, which is fastest at perihelion and slowest at aphelion; that is to say, in classical times it moved fastest in Capricorn and slowest in Cancer; and 'mensis' here means the monthly course of the sun. Now it so happened that the three signs in which the sun moved slowest, Gemini, Cancer and Leo, were precisely those in which (and in which alone) the zodiacal figures were depicted with the head or front towards the east. So Manilius frames the conceit that the sun moves slowly because these *astra* are adverse.

The naturalist, the botanist, and the astronomer, when they betake themselves to the classics, strive continually to interpret them: as generations of their kindred have been doing for five hundred years. Now and then a nail is set in a sure place; and the task continually advances, without ever coming to an end. Some day, but not yet, Greece herself will help us. Only of late has the botanist had a flora of Greece which he can depend upon; we are sadly ignorant of its fauna. We long especially for better knowledge of its vernacular names of beast and bird and plant and creeping thing, such as are proving of deep interest to the naturalist and the scholar in the multitudinous dialects of Italy.

The humblest task of the naturalist is the identification of species; but, both in biology and the classics, it lies at the root of the whole matter. If we do not know the flower of which a poet sings, we blur the outline of his picture and miss his most delicate allusions. You remember, in the "Oedipus Coloneus", how the clustering flowers of the narcissus, ὁ καλλιβότρυς νάρκισσος, spring up under the dew of heaven, and make the μεγαλαῖν θεαῖν ἀρχαῖον στεφάνωμα—the time-honoured garland of the Magnae Deae. My brother of our Greek chair brought me the passage only the other day, to ask me what flower νάρκισσος was; I told him (to begin with) that it was a *narcissus*, which is to say, a daffodil. But we may read, in the "Hymn to Demeter", how Proserpine was gathering narcissuses, when she, poor maid, "by gloomy Dis was gathered". I thought she had her little feet on the unbending corn, and poppies in her hair! How came she to be picking daffodils, when the autumn was come, and she must be stolen away and leave her earth-mother desolate and forlorn? The simple, pretty explanation is that we may find a tiny, late-flowering daffodil, Virgil's "sera comantem narcissum", growing in Greece and Italy, on the dry hills where there is no moisture but the dew; it flowers with the autumn crocus, Sophocles' χρυσαυγὴς κρόκος, and lasts until winter comes. Proserpine picked it with the last rose of summer and the crocuses, for her farewell nosegay; she took it down with her to Pluto's realm, and men call it her ἀρχαῖον στεφάνωμα.

Our daffodils have little or no perfume. But the old fifteenth-century traveller Busbequius, the same who brought the Constantinople Dioscorides to Vienna (which Sibthorpe went to Vienna to see), found our little autumn daffodil "miro odore fragrantem". When Proserpine picked her daffodil-nosegay, such a fragrant incense-smell went up that Heaven and earth and sea all laughed for joy:

κηώδει δ' ὀδμῇ πᾶς τ' οὐρανὸς εὐρὺς ὕπερθε
γαῖά τε πᾶσ' ἐγέλασσε, καὶ ἁλμυρὸν οἶδμα θαλάσσης.

We miss something, if we say that narcissus means a daffodil—and pass on!

One of my father's colleagues in Ireland was J. F. Davis, who edited the "Eumenides"; he was a very learned but eccentric man. Going home on one of my undergraduate vacations from Cambridge, I met Davis in a Galway street; who cried out from afar off—it was his only greeting: "*Can* you tell me what plant Pliny's *Cassia* really was?" It happened that a German scholar had lately declared: "Quid Cassiae nomine veteres appellarint, nunquam divinabimur." Now when Virgil and Ovid speak of cassia, along with thyme and rosemary, they mean marjoram, and it is so depicted in the Vienna Dioscorides. Martial's *Cassia*, which was burnt for incense on a funeral pyre, was the Semitic name of a sort of cinnamon, brought home from India by the spice merchants. Early commentators mix up the poisonous Italian spurge-laurel (a sort of *Daphne*) with both of these; and Pliny mentions them, all three. If I had known as much as this fifty years ago, I might have given Davis a partial answer to his question. But Pliny also mentions a kindred spice or drug, an evil-smelling spikenard from the Ganges, which he calls *Ozaenitis*: a word which one would never doubt came from ὄζειν, 'to smell', if one did not know that so obvious a *Volksetymologie* was almost certain to be untrue. This strange name and substance Thiselton-Dyer has ingeniously explained.

If we enlarge our knowledge of ancient geography by the help of Greek and Arab geographers, we may

follow, with delight and wonderment, the old trade routes known to Sindbad the Sailor, and to Solomon the King. The Periplus of the Red Sea leads us by one of these straight to the ancient city of Ozene, an entrepôt of the spice merchants. It has changed neither its name nor its commerce; it is the rich city of Ujjain, in Gwalior, the busy centre of the Indian opium trade. Dyer had the acumen to detect that *Ozaenitis* was spikenard from Ozene; just as in Dioscorides, *Mossulitis* was *Cassia* from Mossylon, the ancient haven hard by Cape Guardafui where the spice-merchants landed their costly bales —the "aromaticae species quas mittit Eous".

When Carlyle was old he wished they had taught him the constellations when he was young, and "made him at home in the starry heavens"; and I too wish I had learned as a child to read the picture-book of the sky. It is an infinitely noble and exalted theme. It was the first art which grew into a science in the hands and minds of men. Some say it gave mankind a first glimpse of the divine; by man's soul and by the stars of heaven Sextus the Mathematician declares that Aristotle found his way to God; and it is written that the firmament showeth his handiwork. The Greeks covered the sky with fairy-tales—"fabulis Graii complevere caelum," said Martianus Capella; and Quintilian declares that no man can understand the poets if he be ignorant of astronomy—"nec si rationem siderum ignoret, poetas intelliget".

On the threshold of this delightful study we are met by the cardinal fact that the panorama of the heavens is continually but very slowly changing; so that the heavens of which Aratus tells are not our heavens, and Homer's pictures of the sky, though they are exquisitely true, are no longer to be seen by mortal men. For the heavens have their Great Year, in which each month of the twelve is 2000 years long, and a single day is threescore years and ten. Some hold this to be the true theme of the Fourth Eclogue. The Great Year, the Old Year, is drawing to its close when "Ultima Cumaei venit iam carminis aetas"; and anon, when "incipient magni procedere menses", the Great Year begins anew. The Great Year and the precession of the equinoxes by which it is explained are doubly and trebly interesting to the classical scholar. Its discovery is commonly attributed to Hipparchus, and constitutes his title to immortality; this is a crucial argument of those who hold that the Greek genius was alone capable of transmuting crude barbarian knowledge into true science and wisdom. But the Assyriologists have lately found that this palmary discovery was made, at least essentially, two hundred years before Hipparchus, by Kidinnu, Pliny's Kidenas, of Sippur in Chaldea; and the Babylonian astronomer has his place henceforth among the greatest of men.

Ulysses leaned on his long oar and watched the Pleiad and Boötes and the Bear—Boötes who sets so tardily, and the Bear who turns and turns about, and glares upon Orion, and never dips his feet in Ocean's stream. But we who know that the Bear never sets in our northern sky, are surprised to find him setting like other stars, and by no means ἄμμορος ὠκεανοῖο λοετρῶν, when we go to the Mediterranean or the Aegean. It is many a day of the Great Year since the Bears went dry-shod over the Aegean; but to tell just when they last did so is a simple matter, in the art or science of astronomical chronology. The Bear was ἄμμορος λοετρῶν ὠκεανοῖο in the Mediterranean about 800 or 900 B.C., and for some centuries before. Homer tells us that on the night in question Boötes, Orion, and the Pleiad were all visible together; and we may take it for granted that they formed a notable configuration, the place and season of which men were accustomed to observe. Ulysses was *navigating* by the stars; but why mention so many stars for such a simple thing? We glance nowadays up at the sky, find the Pointers, and follow them to the Pole-star in a moment. But in Ulysses' time there was no pole-star, nor had there been one for hundreds of years!

Greek mariners steered by the Great Bear, and Tyrians by the Little Bear, but both alike were makeshifts, for neither Bear stood at the pole and neither could stand still. Only in some particular position would either of them give the true north, and that position must be defined by other stars. Suppose Ulysses out a-sailing one October night, about a thousand years before the coming of our Lord; a little before the dawn he saw Arcturus and the Pleiad, balancing one another as it were, one hanging above the eastern horizon, the other over the west. Down in the south-west Orion was shining, the Bear was watching him with his two bright eyes; just then these two eyes (which we call the Pointers) lay one to one side and one to the other of the meridian; and the Bear himself, body and tail, stretched away into the north-east from this meridian line. Ulysses looked at the Pointers and knew he was facing to the north; he then kept the Bear on his left hand, in the position in which *it then was*, and so steered to the south-west. He was on his course to Scheria.

The distinction between science and the classics vanishes away when we come to history, archæology, or folklore, wherein the object of our study is mankind. Andrew Lang and a few others began to show us, a generation ago, how there was a science in the homeliest words and things, and the spirit of history in a game, an incantation, or a toy. In the "Pharmaceutria" of Theocritus we used to think the magic bird and magic wheel mere witchcraft, superstition, moonstruck madness—nothing more. Then came Andrew Lang and the others, to show the wealth of meaning in these unconsidered things. We have learned that the wheel still hums in the little hands of a Sicilian child; and that a kindred wheel roars its dull note in the hidden rites of the Australian bush. It thundered in the horrid feasts of Cretan Zagreus; it sounded amidst the roll of drums, as in darkest Africa, for Rhea and Bendys and Cotytto. Jason had it of Aphrodite, to bewitch Medea. The Sicilian calls it a cicada; the Greeks knew it by a bird's name. All the Orphic mysteries, and who knows what more out of the dark religions of the

East, lie behind the story of the girl who sat under the Lady Moon a-singing: "Turn, wheel, turn, and fetch my own lad home to me."

When my father was writing of the dead languages, a dead civilisation had been but recently revealed; the chance-directed efforts of a traveller had shown the world that Nineveh and Babylon were "seats of tranquil learning and treasured science before ever a fleet had sailed from Aulis, or the eagles had promised empire to the watcher on the green Palatine". More than once since then has discovery repeated herself, raised up the ghost of empires which had gone down into the pit, and called from sepulchral palaces the long procession of the dead. To learn what Greece had of her science, her religion, her mysticism, her genius, her language, and her blood, from the civilisations by which her own was encompassed and preceded, is to my mind the greatest puzzle of history, the noblest problem for the scholar. Were I a younger man I should want above all things to know Egyptian, Assyrian, and Hittite, and all the rest of that pre-Hellenic apparatus of the scholar which the last century has half-revealed. I have been dreaming all my life of the riches of this Promised Land; a few grapes have been brought me from Eshcol—but I am come no farther than Mount Abarim.

When the wind blows from Assyria, it brings not only odours but also stray whispers to our ears. We remember how in the comedy of the "Birds" the two Athenians who pass by the hoopoe's dwelling on their way to the building of Cloud-Cuckoo-Town, come laden with basket, earthen pot, and myrtle-twigs:

"Trudging along with basket, pot and myrtle,
To find some quiet easy-going spot,
Where we may settle down, and dwell in peace."

The scholiast, with the ignorance of his kind, explains this paraphernalia as so many useful implements for scaring away the birds. But now we learn that in an Assyrian text, from the library of King Assurbanipal, precisely these three things, a box (or basket), an earthen pot, and a myrtle spray are named, in the self-same order, as sacred utensils, to be used in connexion with *the founding of a city*. Such is the ray of light thrown by modern archæology on a single and apparently insignificant line!

"Caput inter nubila condit"—"her head is muffled from our sight"—was said of antiquity, as also of fame; and scholarship, like science, has her secrets to discover and her mysteries to explore.

Whether we be taught science or the classics in our boyhood is not the last word of all. But whichever of the twain it be, let us so learn it as to love it, and so love it that we may love it to the end:

ἃ δ' ἂν μάθῃ τις, ταῦτα σώζεσθαι φιλεῖ πρὸς γῆρας.

Science and the classics! The one says (in Wisdom's words): They that eat of me shall yet be hungry. And the other says: They that drink of me shall yet be thirsty. And both alike continually enlarge our curiosity, and multiply our inlets to happiness.

The South Africa Meeting of the International Geological Congress.

THE High Court of geological opinion met for the first time in 1878 at Paris, with a membership of 310. Since that year there have been thirteen meetings, held at intervals of three years or so, at various capitals or other centres in Europe as well as in North and Central America; the long interval of nine years which separated the twelfth meeting in Canada during 1913 from the thirteenth session at Brussels in 1922 was due to the War and its aftermath.

The present century is witnessing a remarkable extension—in theory and practice—of the principle of internationalism in many branches of human endeavour; of this the pages of NATURE afford ample evidence. For the geologist extensive travelling is indispensable, and this is reflected in the steady growth in the number of those attending the sessions of the Congress; the record gathering of 742 geologists, representing some forty different nationalities, is a striking testimony of the extent to which world co-operation has grown in this science.

For its fifteenth session, the Congress meets during the last week of July and during August of this year in South Africa at the invitation of the Government of the Union, with its headquarters at Pretoria. The practical support from the Government as well as from the mining industry at Johannesburg and Kimberley, from municipalities and other public bodies and from various generous friends, has made it possible to arrange an attractive programme. This is the first occasion on which the Geological Congress has met in the southern hemisphere, and the exceptional opportunities which South Africa offers for the study of many fundamental problems of geology will make a strong appeal throughout the geological world. Though the Union of South Africa is not yet known with a degree of detail comparable with that reached in some older countries, where geological investigation—both official and private—has been carried on for much longer periods, enough has been accomplished to allow one important function of the Congress—the examination of the outstanding geological features of South Africa—to be carried out with profit and interest to the visiting members. Unfortunately, the great distances involved make heavy demands on the geologist's time and purse, but the efforts of the organising committee have met with a considerable measure of success, so that substantial concessions have been granted by the steamship lines and the South African railway administration.

The first main object of the Congress—to take stock of recent advances in geology—has, in accordance with the excellent practice established at previous meetings, enabled certain subjects to be placed in the foreground of the discussions. The

important results that this excellent policy promises may be illustrated in the classic symposium on the origin of crystalline schists, which makes the *Comptes rendus* of the London Congress in 1888 such a valuable record to the student of rock genesis. Almost all the special topics set down for the meeting in South Africa clearly reflect several of the particular features in which the geology of that country deserves the special attention of the Congress: Magmatic differentiation, pre-Pleistocene glacial periods, the Karroo System, its stratigraphy, palæontology, and world distribution; to these, rift valleys, the genesis of petroleum, and the geological work of micro-organisms have been added by special request.

Probably nowhere in the world are the phenomena of magmatic differentiation more superbly displayed in extensive outcrops than in the unique igneous complex of the Bushveld, a petrographical province covering more than 16,000 square miles of country and including rocks that range from granite through norite and various ultrabasic types to massive segregations of almost pure magnetite and chromite, frequently alternating with bands of that remarkable group—the anorthosite. Needless to say, this almost inexhaustible field of study long ago attracted the attention of the South African geologists—of whom Molengraaff, State geologist of the former South African Republic, was the first to recognise the genetic connexion between various members of the Complex. By 1922 the more systematic survey of the Bushveld had advanced sufficiently to induce Prof. R. A. Daly to organise a Shaler Memorial Expedition to South Africa, with the special object (amongst others) of examining what Daly and Molengraaff describe as "the largest and most remarkable igneous complex yet mapped".

South African geological literature has been enriched by two most valuable contributions from the members of this expedition; in the first Prof. Daly and Prof. Molengraaff discuss the structural features of the Bushveld Complex (*Journal of Geology*; 1924), while in the second (*Bull. Geol. Soc. of America*; 1928) Daly gives a brilliant analysis of the petrographical and chemical aspects revealed by the major phases of the Complex. The long excursion after this summer's session of the Congress, specially devoted to the Bushveld, follows closely the route traversed by Daly and his friends, and the membership already secured promises not only valuable and profitable results, but certainly also a stimulating experience for the South African geologists concerned. It need scarcely be said that the curious occurrences of primary deposits of platinum, for which the Complex is gradually assuming great economic importance, including those strange and unique vertical 'tubes' of dunite, are not to be overlooked on this excursion.

Since the days when Sutherland in 1868 first recognised the glacial origin of what is now firmly established as the Dwyka conglomerate, the study of pre-Pleistocene glacial periods has made great strides, both in South Africa and in the other continents, where Permo-Carboniferous glaciation is in evidence, and a special excursion will give a glimpse of the stupendous glacial activity which has left us with the remains of ground moraine spread over more than 17,000 square miles, and demonstrate the superb striated floor, etc., of this Dwyka conglomerate, for which the Kimberley neighbourhood has become so justly famous, that one might call that region the glacial geologists' National Park.

Apart from the Permo-Carboniferous, South African geologists have recognised four other pre-Pleistocene glacial periods, all of which are older than the Dwyka. In this recognition the late Geological Commission of the Cape of Good Hope has taken the principal part. One of these can be traced in the glacial conglomerate of the Table Mountain sandstone of the Cape System in the Cape Peninsula, etc. Another is found in the Lower Witwatersrand System in the Heidelberg area, while a third is reflected by the tillite, in the Griquatown Series of the Transvaal System (N.W. Cape and Central Transvaal). The fourth period is that of the Numees Series in Namaqualand. An examination of the majority of these glacial deposits is included in the programme of excursions and no doubt will furnish much material for interesting and helpful discussion.

No apology is needed for selecting for discussion at a meeting in South Africa the stratigraphy, palæontology, and world distribution of the Karroo System, which is *par excellence* in that sub-continent, covering approximately one-half of the Union of South Africa, with its rich reptilian fauna and instructive fossil flora, with which geologists have become familiar through the researches of Broom, Haughton, Du Toit, and others. It is to be hoped that the palæontologists will not miss examining the exceptionally fine type collections of Karroo fossils which form a recognised feature of importance in the South African Museum at Cape Town. The Karroo stratigraphy, etc. (including the profuse sills of dolerite), with some of its organic remains, will receive special attention on the Cape-Kimberley, Port Elizabeth, and Durban-Zululand excursions, the first named also covering good fossil localities of the (Devonian) Bokkeveld Series of the Cape System.

A discussion on rift valleys is most appropriate to the venue of this Congress; it is obviously a branch of tectonic geology of far more than local interest, and its inclusion by special request on the part of those closely identified with this line of research is to be welcomed—no less than the offer by one of the latter to invite a symposium on this subject by means of an illustrated lecture.

For the second main object of the Congress—a study of the geology of the country visited—the organising committee has evidently felt—and we cordially endorse its view—that in a country relatively so little known to geologists outside South Africa, a large and varied series of excursions would make a special appeal, and a study of the programme shows that in this respect the fifteenth Congress should certainly constitute a record, since the twenty-two excursions extend from Cape Town in the south, northwards to Elizabethville in the

Congo, and from Lüderitzbucht on the Atlantic to Durban on the Indian Ocean, forming a network of journeys that cover an area one-third the size of Europe! Yet this comprehensive programme is so skilfully worked out that every member has an opportunity of taking part in a large proportion of the excursions. These range from half a day to twelve days—and they study not only the taste but also the purse, while their scientific success should be assured when one glances at the names of the leaders. Among the outstanding geological features to be visited are the Victoria Falls (with their fascinating physiographical history), the Bushveld Complex, the Karroo, the Great Eastern Escarpment of the Drakensberg at the Devil's Kantoor (the magnificent scenery of which has made this a classical spot for studying the tremendous physiographic contrast in the relationship between the Central Plateau and the coastal belt), the Zululand Cretaceous Beds, and the unique Vredefort Dome, where a central granite is surrounded by a girdle of sediments showing an inversion of the succession through thousands of feet of thickness, and associated with an almost incredibly intense metamorphism. Through the published work of Molengraaff, Hall, and Nel, much detailed information on these extraordinary phenomena is available. Of the various occurrences of alkali rocks, the programme provides a visit to the Franspoort bodies near Pretoria, the alkali-granites and canadites round the Vredefort Dome, as well as the Pilandsberg (with its remarkable ring inclusions)—the largest alkali mass yet examined in detail, which has recently been described by Shand (*Transactions of the Geological Society of South Africa*; 1928).

Economic geology naturally has a prominent place in the programme: the Kimberlite diamond pipes of Kimberley and the Premier Diamond Mine (whence came the largest diamond on record), the Witwatersrand with the world's most important goldfields, the primary platinum deposits of the Bushveld, the remarkably rich asbestos mines near Barberton, the rare chromite occurrences in the Bushveld Complex, the ore deposits and peculiar desert geology of South-West Africa, including the mineralogists' well-known hunting ground of the Tsumeb lead and zinc mines, and last, though certainly not least, the copper-bearing regions of Northern Rhodesia, now recognised as a most important asset in the mineral resources of the British Empire.

The Congress has also begun the practice of setting aside for special study the world's resources in certain types of ores—for example, iron, coal, pyrites—and the resulting volumes remain a handsome testimony to the foresight of the Congress. No happier choice could have been made for the South Africa meeting than the subject of the "Gold Resources of the World".

The recent publication by the Geological Survey of the Union of a map on the scale of one in a million, also the latest volume (written by some members of that Survey) in the well-known series of the "Handbuch der regionalen Geologie", dealing specifically with the Union, will be much appreciated by visiting geologists in particular. For those who may want to take in a wider field there is the admirable volume by Du Toit on "The Geology of South Africa".

The almost simultaneous meeting in South Africa of the British Association, under the presidency of a distinguished geologist, Sir Thomas Holland, and the useful measure of co-operation with the Congress, arranged for at Johannesburg and Pretoria, will render 1929 a memorable year in the history of geology, while the gathering of the world's geological clans in that sub-continent may well repeat the truth of the well-known phrase "Ex Africa semper aliquid novi". A. L. H.

Obituary.

THE MAHARAJ RANA OF JHALAWAR.

THE announcement in NATURE of April 20 of the death of the Maharaj Rana Bhawani Singh of Jhalawar while again on his way to Europe recalls the fact that, of those with whom he was associated in previous visits, too many would not have been here to welcome him. He would doubtless have missed especially Sir James Dewar at the Royal Institution, Prof. A. D. Waller at the Physiological Laboratory in the top story of the University of London, Sir Archibald Geikie, president of the Royal Society at its 250th anniversary, which the Maharaj Rana attended as a delegate from India; and besides those, Miss K. Stephen, principal of Newnham, in 1912, and the presidents of the meetings of the British Association, Sir William Herdman at Cardiff in 1920, Sir Edward Thorpe at Edinburgh in 1921.

The Maharaj Rana's first visit to Europe in 1904 furnished material for a book of travel pictures, published in 1912, when he came to England for a long stay with a suite of court officials in attendance, among whom, the Pandit Shyam Shankar was indefatigable in providing opportunities for the acquirement of knowledge of the West and the diffusion of knowledge of the ways and customs of the East.

Meteorology was one of the sciences that caught the Maharaj Rana's attention. He became a familiar figure at meetings of the International Commissions for Maritime Meteorology and for Weather Telegraphy which were held in London in September of that year. It was an interesting time, because telegrams from Iceland, wireless telegrams from ships, and an international code for gale warnings were on the agenda papers. The Maharaj Rana acknowledged the courtesy of the Commissions by a stately dinner, at which, with other novelties, the members with their ladies were initiated in the parting ceremonies of garlands and attar of roses.

A visit to Cambridge in the same year provided the experience of luncheon and the gardens at Newnham College, with an exchange of civilities

between potentate and student by the aid of hand cameras: then dinner in a college hall and the cultured serenity of the combination room, so impressive as to suggest that two or three years at an English university would form the proper completion of the education of the heir to a throne. In 1920 that idea found expression at Oxford. Kumar Rajendra Singh, recently married to the daughter of the Maharaja of Vizianagram, went to Christ Church, and the Maharaj Rana enrolled himself at New College. Apart from a short return home in 1921, he lived in Oxford for two years; but he was always to be found at the lectures of the Royal Institution. The British Association, the Royal Sanitary Institute, the Royal Aeronautical Society, and again, whatever was going on at the Meteorological Office, engaged his attention, including another meeting of the International Commission for Weather Telegraphy. His part in the many scientific meetings which he attended was mainly to listen and appreciate. Conversation was favoured as a mode of expressing himself, rather than writing or speechmaking; in that and in his letters he was invariably alert and precise.

The *Times* of April 15 gave a striking account of the character and achievements of the Maharaj Rana as a ruler. Others will cherish the remembrance of a genial and enthusiastic student of Nature and art. As a Rajput his traditions and reminiscences were of military prowess and achievements with the bow. As one condoles with the new Maharajah on the loss of his father, it is impossible not to wonder what would happen if the Indian princes betook themselves to the conquest of the secrets of the Nature that surrounds them; if they should turn their swords into tuning-forks and their arrows into sounding balloons. NAPIER SHAW.

SWEDISH zoology has sustained a serious loss in the death of Prof. Nils Johan Teodor Odhner, which occurred at Stockholm on Oct. 29, 1928. Prof. Odhner was born at Lund in 1879. Graduating at the University of Uppsala, he became lecturer in zoology at that University. In 1914 he was nominated as professor of zoology in the University of Oslo (Norway), and four years later he became *Intendant* of the department of invertebrates in the State Museum of Natural History in Stockholm. Prof. Odhner's zoological work consists principally of systematic and faunistic papers on the Trematoda, upon which group of animals he had been for many years a leading authority. He also devoted some time to the study of certain groups of Crustacea. His activities were not, however, confined to zoological research. His wide social interests and energetic contribution to the intellectual life of his country are manifested by the various official positions which he occupied—as a delegate to the League of Nations, president of the Sweden-Finland Foundation, and vice-secretary of the Swedish Academy of Science. As a speaker and writer he contributed much to the popularisation of his own branch of science.

WE regret to announce the following deaths:

The Right Hon. the Earl of Rosebery and Midlothian, K.G., K.T., F.R.S., Chancellor of the University of London, who was elected to the Royal Society in 1886 under Statute 12, which permits of the election of persons who "either have rendered conspicuous service to the cause of science, or are such that their election would be of signal benefit to the Society", on May 21, aged eighty-two years.

M. Emile Chaix, professor of physical geography at the University of Geneva, aged seventy-four years.

News and Views.

THE most important legislation affecting the welfare of migratory birds, since the Migratory Bird Treaty Act of 1918 between the United States and Canada, was passed by the U.S. Senate on Feb. 11, and signed by President Coolidge on Feb. 18. This was the Norbeck-Andresen Migratory Bird Conservation Act, which has been fought for eight years in eight sessions of Congress, and finally succeeded when the matter of a Federal license, to which objection had been taken, was omitted from the Bill. The Act is a direct sequel to the Migratory Bird Treaty of 1918, for it was found that, useful as that Treaty had been, much of its potential value seemed likely to be lost if provision could not be made for a system of refuges or sanctuaries in the areas traversed by the birds in their migratory flights, and on their wintering grounds. The purchases of such reserve areas demanded large sums of money, and it was to meet this outlay that the Federal license, which proved to be the stumbling-block of the original Bill, was proposed. The difficulty of finance has been removed by proposed State grants. Although the Act makes no appropriation, it authorises a schedule of appropriations amounting in all to some eight million dollars, and settling down after ten years to an annual sum of 200,000 dollars. The first year's sum of 75,000 dollars is to be devoted to a survey of the area to determine the places best suited to become bird-refuges, and, this completed, the selected areas will be purchased and henceforth guarded by an appropriate staff. The American Game Protective Association, which has strongly advocated the proposals of the bill in its bulletin, *American Game*, is to be congratulated on the success of its campaign.

A SPECIAL type of rubber made by the Expanded Rubber Co., Ltd., Wembley Park, and marketed under the trade name of 'Onazote', which appears to have many uses in science and technology, has recently been mentioned in the Press. Onazote is essentially a very spongy form of rubber prepared by vulcanisation under high gaseous pressure, which is sometimes as high as a hundred atmospheres. During the cooling process the pressure is gradually reduced, with the result that the occluded gas expands, forming pockets of air enclosed in thin rubber membranes. Onazote can be prepared with a variety of physical properties by suitably varying the process of preparation. In particular, it can be produced in a hard

form not unlike ebonite in external appearance, and in a soft pliable form. In each case the fine cellular structure is of course retained.

THE material has a remarkably low specific gravity of the order 0·076 to 0·102 (that is, it weighs 4½-5 lb. per cubic foot), and the hard variety is stated to be practically impermeable to water. The soft form combines low density with high resiliency, and tests indicate that after the removal of the compressing load the sheets return practically at once to their initial thickness. As may be conjectured from its physical nature, onazote has a very low thermal conductivity. The value of this constant as measured on a sample at the National Physical Laboratory is 0·00008 gram-calories per square centimetre per second for 1 cm. thickness and 1° C. difference in temperature between faces. It is suggested that the material may have a variety of uses. Its lightness and non-absorbent properties render it suitable for life-belts and floats, and its resiliency suggests its possibilities in making shock-absorbers, cushions, and allied articles. It is also claimed to be of use as a sound absorber for making silence cabinets and improving the acoustics of buildings. The hard variety has electrical properties akin to ebonite but without the brittleness of ebonite.

THE problem of distributing the white population of the British Commonwealth in the most efficient manner as between all its parts, is the object of the various schemes of Empire settlement which are included in the Report of the Oversea Settlement Committee for 1928 (London: H.M. Stationery Office, Cmd. 3308). Among the many problems on which the report touches is that of the checks on this desirable redistribution of population. These are many, and include, in Great Britain, the industrial habits and townward bent of the population and its unfitness and unwillingness to settle on the land; the upward tendency of the standard of living; the effect of schemes of social insurance which tend to anchor population and decrease its mobility; and the fact that the spirit of emigration becomes evident when the population is prospering and not in times of adversity. In the Dominions, there are also certain factors that check the flow of population from the home country. The call for population does not necessarily bear relation to the conditions in Great Britain and the need for emigration. The Dominions want mainly agricultural workers and, among women, domestic workers, while the need for emigration is chiefly among the industrial workers. The growing tendency of all the Dominions to make a more and more vigorous scrutiny, in the interests of racial fitness, of all who wish to enter the territory, reduces further the flow of emigrants from Great Britain.

THE first conversazione this year of the Royal Society was held on May 15 in the Society's rooms at Burlington House. As usual, there were numerous exhibits and demonstrations representing recent developments in many branches of science, as well as instruments and photographs of historic interest. Atomic physics does not easily lend itself to large-scale demonstration, but Prof. G. P. Thomson showed photographs from his work on the diffraction of electron waves, and Messrs. Adam Hilger, Ltd., included in their exhibit one of Dr. Jean Thibaud's X-ray grating spectrographs for soft X-rays. Applied physics exhibits included an instantaneous visual direct-reading radiogoniometer (Radio Research Station, Slough). Physiological apparatus included a moving iron oscillograph recording sensory nerve action currents (Mr. Bryan Matthews), and a portable electrocardiograph (Cambridge Instrument Co., Ltd.). Recent biological work was represented by exhibits of 'breaking' in tulips from the John Innes Horticultural Institution, plants toxic to insects (Rothamsted Experimental Stations), and several exhibits from the British Museum (Natural History). Prof. W. A. Bone and Mr. R. P. Fraser showed some remarkable photographs of flame propagation in gases, Sir Robert Hadfield specimens of various special steels, the Anglo-Persian Oil Co. an apparatus for the visual examination of oil being cracked under pressure, and so on. Twice during the evening Dr. R. G. Canti gave a kinematograph demonstration, consisting of consecutive series of photomicrographs, of living tissue cultivated *in vitro*. The film showed the processes of cell growth in the normal and malignant tissue: out-wandering of fibroblasts and wandering cells; the various stages of cell division including migration of the chromosomes; cell degeneration; phagocytosis. The last part of the film, which dealt with the fibroblast of the chick embryo under dark ground illumination, showed the internal structures of the cell.

AT the Friday evening meeting of the Royal Institution on May 10, Prof. A. E. Boycott gave a fascinating account of the genetics of the mode of twist of the shell in *Limnæa peregra*, and illustrative collections were also on view at the Royal Society soirée on May 15. In the majority of species of snails the twist of the spiral is dextral, but in a few it is normally sinistral. In many of the normal dextral species sinistral varieties occur, and vice versa; and these unusual forms occur either as odd sporadic specimens or else as an established component of the population. *Limnæa peregra* is normally dextral, and its sinistral variety is very rare—less than a dozen sporadic having been recorded. In four ponds in England the population of dextral snails included a small proportion (5 per cent or less) of sinistrals. Four of these sinistral individuals were used for experimental breeding work. It was found that sinistrality is a simple Mendelian recessive which is inherited according to the usual plan, save that any change of twist imposed by crossing is delayed for one generation. The snail inherits not its own twist but the twist of its offspring, and segregation is by broods and not by individuals. All inheritance in *Limnæa* is, however, not maternal. Albinism was found to be a simple Mendelian recessive, transmitted in a straightforward fashion. Sinistrality and dextrality are characters of considerable importance, for the reason that in the Helices, which are incapable of self-fertilisation, copulation is impossible between the two forms. The peculiar inheritance of shell twist

is due to the fact that this character is determined at the first division of the egg, soon after the entrance of the sperm, and the form of the division is determined by the constitution of the egg and the sperm does not effect it. Albinism, on the other hand, is a character which is not expressed until much later in development, by which time the contribution of the sperm has become effective.

THE speech delivered recently by Sir Robert Hadfield, as chairman of Hadfield's, Ltd., contained many points of special importance and showed the advances which the steel firms of Great Britain, including his own, are making. In connexion with the attempts now being made to foster a better spirit between employers and employed, it is of special interest to note that, so long ago as 1894, Sir Robert presided at a well-attended meeting of employers and labour representatives in London, when a body was formed to which the name of the Industrial Union of Employers and Employed was given. The body had objects in view of a similar nature to those now being formulated by the Melchett-Turner conference, and met with strong approval from many men of a more far-seeing character. Sir Robert remarks that, "Had the employers at that time taken the matter with the same heartiness, and given the same support rendered by the labour representatives to myself (the president) and the Council, I fully believe that this work would not have come to an untimely end and would have proved of great national benefit. I believe that the organisation then proposed would have gradually grown in importance and that much of the trouble since experienced . . . might have been largely avoided."

IN speaking of scientific research in Great Britain generally, and especially of research with a possible technical bearing, Sir Robert Hadfield made the following important observation: "It is most advisable that research work should be fostered in the various universities of Great Britain. . . . Whilst we all recognise the splendid work done by the National Physical Laboratory, which is an exceedingly important organisation, these local centres must not be overlooked when monetary grants are being allocated. It is usually the local centres which best know the needs of the particular locality concerned. There is no reason why subventions or grants, whether from Government headquarters in London or locally, should not be freely handed over to our various local universities, thus locally stimulating and encouraging research, which is more than ever important nowadays." Interesting remarks were also made concerning the growth of the induction melting of metals and the new heat-resisting steels. The advance made in the latter connexion is indicated by the example given of a steel heated to a temperature of 1200° C. for 21 hours which, after that very drastic treatment, was scarcely scaled at all.

ON Tuesday, May 14, the Prince of Wales formally opened the North-East Coast Exhibition at Newcastle-upon-Tyne. This great industrial exhibition, representative of the life and work of the north of England, has been organised and built in less than two years on a commanding slope on the Town Moor, and will remain open until October. Prominent features are the Palaces of Engineering and Industries, where the Tyneside manufacturers have made good use of the opportunity of showing the manifold activities of the industrialist corner of England. The Prince of Wales, who went to the Exhibition after opening the new department for mining research at Armstrong College, congratulated the promoters on the general lay-out; its aim, he said, "is to revitalise existing industries, to discover how they should be adapted, and, if necessary, improved". Scientific discovery linked with industry is well represented in the president of the Exhibition, Sir Charles Parsons, and it is in this direction that we must look for the adaptations and improvements visualised by the Prince of Wales and for new methods and new industries to enable the British Empire to maintain its place in the world's markets.

THE Federation of Lancashire and Cheshire Museums, founded in January 1928, has issued a first annual report, which summarises very briefly the aims and accomplishments of the Federation. The object is the practical one of a more efficient museum service as between museums themselves and as between museums and the public, and the experiment will be watched with keen interest in the hope that it may contribute to the solution of the difficulties and staleness of the smaller local museums. The means adopted have been periodical meetings of museum curators and members of their committees, where subjects of practical interest are discussed, and a scheme for the donation, exchange, or loan of specimens between the federated museums. Twenty-three, out of a possible of thirty-eight museums in the two counties, have joined the federation, the meetings were reasonably well attended, and the exchange scheme has been made use of by thirteen museums. There can be no doubt about the excellence of the federation idea; time will decide whether the museums themselves are enthusiastic enough and energetic enough to make it a success.

THE Imperial Bureau of Soil Science, one of the eight Bureaux the formation of which was recommended by the Imperial Agricultural Research Conference of 1927, commenced work on May 1 at the Rothamsted Experimental Station. Sir John Russell, Director of Rothamsted, is also the Director of the Bureau, and Dr. A. F. Joseph, lately Sudan Government Chemist, has been appointed deputy director. The functions of the Bureau include the collection and distribution of all research work of importance on soils to the British Empire, the assistance of research workers in the prosecution of their investigations in whatever ways it can, the bringing together of workers from different parts of the Empire (either by correspondence or in conference) interested in the same subjects, and to supply information generally which may facilitate the work of soil experts in the development of agriculture. It is hoped that before long the Bureau will be in close touch with all soil investigators

of the Empire, both at home and abroad, and that by means of information-circulars and other methods, the results of studies carried on in one part of the Empire will be made available for all. Arrangements will also be made to supply information dealing with soil investigations in foreign countries, the results of which, owing to language or other difficulties, are not readily available.

THE Bohemian Academy of Sciences has recently issued its *Bulletin International* for 1926, containing in its 628 pages résumés in English or French of the papers communicated to the Academy during that year. These communications number nearly fifty, and cover the whole field of mathematical and natural sciences and medicine, and many, especially those dealing with biology, are illustrated with photomicrographs and other well-executed illustrations. This is particularly noticeable in the three coloured plates accompanying Dr. V. Breindl's studies of plasmodium, those with Dr. J. Wolf's investigation of the genesis of collagen fibres, and those of Prof. B. Němec and Dr. Milovidov on bacteria in plant and human tumours. There is a posthumous contribution from Prof. J. V. Daneš on the limestone physiography of the United States of America, and among a number of other geological papers are several by Dr. Petrbok on the stratigraphy of the Palestine palæolithic (the first containing 108 figures). In mathematics, Dr. V. Trkal has given a contribution to the dynamics of the neutral helium atom, whilst the *Bulletin* also contains Dr. Sobotka's deductions of certain polar properties in conic systems. Chemical science is represented by papers on the radioactivity of potassium and rubidium (Miss Petrova), adsorption by colloidal carbon (Dr. Podroužek), the electrolytic estimation of bismuth (A. Jilek and J. Lukas), and a study of the pyrrolones (R. Lukeš).

THE only railway line laid across South America is the one joining Valparaiso and Buenos Aires, traversing both Chile and Argentina. It provides an overland connexion 840 miles long between the Pacific and Atlantic Oceans. It skirts the extinct volcano of Aconcagua in the Andes, and its maximum altitude is about 10,500 feet. The section of the railway from Los Andes to Mendoza is called the Transandine Railway. It is laid for a combined rack and adhesion service and has a metre gauge. The operation of this railway was rendered very difficult in winter by snowfalls, often 20 feet deep, and by avalanches of rocks. This necessitated extensive protective works and galleries. Owing to the soft coal used, thorough ventilation of the galleries was also necessary. This, and the fact that the coal used had to be raised to an altitude of nearly two miles against gravity, induced the directors of the Transandine Railway, which belongs to a British company, to adopt electric traction. This enabled an increase in the speed and weight of the trains to be made. As the freight consists mainly of cattle from Argentina to Chile, and perishable fruit in the opposite direction, the increase in weight and speed has many advantages. A full technical account of this railway is begun in the *Brown Boveri Review* for April. This company, in conjunction with the Swiss Locomotive and Machine Works at Winterthur, constructed the combined rack and adhesion locomotives which are used. These are the largest locomotives of this type that have ever been built. The brakes required for these locomotives are quite as important as the driving gear. The brakes for the adhesion driving wheels are of the Westinghouse compressed-air type. When the emergency rack brake is used the automatic brakes on both locomotive and train are applied simultaneously. The braking force on the rack sections at the wheel tread is 32 tons. The total continual electrical braking capacity is 456 horse-power.

MANY accessions illustrating the historical development of the sciences were made to the Lewis Evans collection of the Old Ashmolean during the past year. They include a valuable series of perpetual calendars in various materials, a set of bronze facsimiles of previously unknown surgical instruments used in Pompeii in the first century, several important microscopes from the Crisp collection, and a refracting telescope of great historic interest, namely, the instrument used by the greatest of Oxford's astronomers, James Bradley, who himself lectured in the Old Ashmolean from 1729 onwards. The fifth Annual Report, for 1928, in addition to recording other gifts, directs attention to the need for treating the outer stonework of the building, which has not been refaced since 1679, and mentions a feature of the year which should be of great advantage to the development of the collections, namely, the foundation of a Society of the Friends of the Old Ashmolean. Previous to the annual meeting of this Society on May 4, Prof. D'Arcy W. Thompson delivered a public address on "The Hellenic Element in the Development of Science", to which reference was made in our issue of May 11, p. 732.

THE annual visitation of the Royal Observatory, Greenwich, will take place on Saturday, June 1.

AT the anniversary meeting of the Royal Society of South Africa, held on Mar. 20, the following officers for 1929 were elected:—*President:* Dr. W. A. Jolly; *Hon. Treasurer:* Dr. L. Crawford; and *Hon. Secretary:* Dr. B. F. J. Schonland.

THE Council of the Royal Meteorological Society has sent a message of congratulation and good wishes to the Society's honorary member, Prof. Hugo Hergesell, on the occasion of his seventieth birthday, which will occur on May 29. We understand that addresses of congratulation will be presented to the veteran director of the Lindenberg Observatory by learned societies and official bodies in Germany in recognition of his services to meteorological science and its application to aviation.

AN International, Colonial, and Maritime Exhibition is to be held in Antwerp next year in celebration of the Treaty of Belgian Independence. The British Empire will be well represented and the Treasury has sanctioned an expenditure of £100,000 on the exhibit.

The most important British shipping companies are to have displays in the British section, and manufacturers of equipment for ships, such as navigation instruments, etc., will be specially invited to exhibit.

AN International Photography Exhibition, to be held at Gothenburg on Oct. 15–31, is being organised by the *Göteborgs Handels- och Sjöfarts-Tidning*. No entrance fees and no charges for return of exhibits are made. A special section of the Exhibition will be devoted to scientific photography. Correspondence concerning this section should be addressed to Dr. S. E. Ohlon. The honorary secretary of the Exhibition is G. F. Ahlberg, International Photography Exhibition, Box 52, Gothenburg, Sweden.

TOWARDS the end of last year a British committee representative of some twenty-six engineering institutions and technical societies was formed to organise a party of British engineers to attend the World Engineering Congress to be held at Tokyo on Oct. 29–Nov. 22 and to secure papers for presentation at the Congress (NATURE, Jan. 12, p. 62). Seventy-six papers have now been contributed dealing with railway and river engineering, strength of materials, alloy steels, aircraft, petroleum technology, chemical engineering, coal cleaning, town planning, illumination and photometry, etc. It is anticipated that a party of thirty-five to forty representatives of British engineering theory and practice will attend the Congress.

THE Council of the Institution of Electrical Engineers has made the following awards of premiums for papers read during the session 1928–29, or accepted for publication: The Institution Premium to Mr. Johnstone Wright and Mr. C. W. Marshall; Ayrton Premium to Mr. L. G. H. Sarsfield; Fahie Premium to Mr. A. E. Foster, Mr. P. G. Ledger, and Dr. A. Rosen; John Hopkinson Premium to The Hon. Sir Charles Parsons and Mr. J. Rosen; Kelvin Premium to Mr. E. B. Wedmore, Mr. W. B. Whitney, and Mr. C. E. R. Bruce; Paris Premium to Mr. J. L. Carr; Extra Premiums to Capt. J. G. Hines, Mr. B. L. Goodlet, Mr. L. H. L. Badham, and Mr. W. Phœnix; Wireless Premiums to Mr. T. L. Eckersley, Capt. P. P. Eckersley, and Mr. A. B. Howe; Mr. R. M. Wilmotte and J. S. M'Petrie.

AN expedition for the study of the behaviour of the mountain gorillas of Belgian Congo is announced in a recent *Daily News Bulletin* issued by Science Service, Washington, D.C. The expedition has been undertaken jointly by Yale University and the Carnegie Institution of Washington, by special arrangement with the Belgian government. Dr. Harold C. Bingham of Yale, a psychologist who has already carried out extensive studies on the behaviour of apes in captivity, will be the scientific representative of the two American institutions. He hopes to establish close and sustained contact with groups of mountain gorillas, to follow their movements day and night, and to observe their traits of behaviour in relation to species and varieties, their manner of life, and their distribution. The expedition will leave the United States in June and proceed by way of Dar-es-Salaam to the head of Lake Kivu, whence a trek of a hundred miles will take the explorers into the gorilla country.

THE fortieth Congress of the Royal Sanitary Institute is to be held at Sheffield on July 13–20, under the presidency of the Right Hon. Earl Fitzwilliam, who will deliver the inaugural address on Monday, July 15. Sir Allan Powell, chairman of the Food Council, will deliver the Congress lecture, taking as his subject, "Some Aspects of the Food Problem", and Prof. W. W. Jameson will deliver a popular lecture. 750 delegates have been appointed by 430 authorities in the British Empire and other countries. Among the subjects arranged for discussion are: mental hygiene of the child and of the adult, health education, food hygiene, industrial welfare, smoke abatement, housing and regional planning, rivers pollution, and water supply. The Right Hon. the Lord Mayor of Sheffield, Alderman Harry Bolton, is the chairman of the local committee, and the Town Clerk, Sir William Hart, and the Medical Officer of Health, Prof. F. E. Wynne, are joint honorary local secretaries.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A headmaster of the Junior Technical Evening Institute, Shelburne Road, Holloway—The Education Officer (T.7), County Hall, Westminster Bridge, S.E.1 (May 29). A teacher of building subjects at the Municipal Technical School, The Gamble Institute, St. Helens—The Secretary for Education, 17 Cotham Street, St. Helens (May 30). An assistant lecturer in electrical engineering at the Bradford Technical College—The Principal, Technical College, Bradford (May 31). A full-time teacher in the Mechanical Engineering Department of the Lincoln Technical College—The Principal, Technical College, Lincoln (May 31). Temporary posts under the Department of Agriculture for Scotland, namely, two investigators and an indoor assistant for work in connexion with an inquiry into marketing live stock and other agricultural produce in Scotland—The Establishment Officer, Department of Agriculture for Scotland, Queen Street, Edinburgh (June 1). A woman resident lecturer in geography and mathematics at the Bangor Normal College—The Principal, Normal College, Bangor, North Wales (June 3). An assistant lecturer in the Mathematics and Physics Department, The Polytechnic, Regent Street—The Director of Education, The Polytechnic, Regent Street, W.1 (June 3). A lecturer in mathematics and a lecturer in physics at the University College of Swansea—The Registrar, University College, Singleton Park, Swansea (June 5). A principal of Brierley Hill Technical Institute, Stafford—The Director of Education, County Education Offices, Stafford (June 5). Research chemists at establishments of the Department of Scientific and Industrial Research—The Secretary, Department of Scientific and Industrial Research, 16 Old Queen Street, S.W.1 (June 6). A junior assistant (engineer) at the Fuel Research Station, East Greenwich—The Secretary, Department of Scientific and Industrial

Research, 16 Old Queen Street, S.W.1 (June 6). A headmaster of the Junior Technical School, Ashton-under-Lyne—The Education Office, 8 Warrington Street, Ashton-under-Lyne (June 8). Clothworkers' Research Scholarship in the Department of Textile Industries, the University, Leeds—The Clerk to the Senate, The University, Leeds (June 8). A lecturer in metallurgy and assaying at the Manchester Municipal College of Technology—The Registrar, Municipal College of Technology, Manchester (June 13). A lecturer in physics at Christ Church, Oxford—The Very Rev. the Dean, Christ Church, Oxford (June 14). A lecturer and demonstrator in the department of physics of the Royal Holloway College—The Principal, Royal Holloway College, Englefield Green, Surrey (June 15). A lecturer in engineering and practical mathematics in University College, Dundee—The Secretary and Registrar, The University, St. Andrews (June 15). Civilian education officers in the Royal Air Force Educational Service—The Secretary, Air Ministry, Gwydyr House, Whitehall, S.W. A junior assistant in the department of the War Department Chemist—The War Department Chemist, B.47 Royal Arsenal, Woolwich S.E.18. A chief field officer of the Rubber Research Institute of Malaya—The Secretary, London Advisory Committee, Rubber Research Institute of Malaya, 2 Idol Lane, E.C.3. A lecturer in mathematics at the Gordon College, Khartoum—The Controller, Sudan Government London Office, Wellington House, Buckingham Gate, S.W.1 (marked "Mathematics"). Junior research assistants under the British Cotton Research Association—The Director, British Cotton Research Association, Shirley Institute, Didsbury, Manchester.

Our Astronomical Column.

SOLAR STREAMS OF CORPUSCLES AND MAGNETIC STORMS.—Prof. S. Chapman discusses the motion of streams of corpuscles from the sun in *Mon. Not. Roy. Ast. Soc.* for March. He uses Prof. A. E. Milne's result that the Doppler effect will enable upward moving atoms to climb out of the absorption lines associated with them, and to be accelerated away from the sun. The acceleration diminishes as the distance increases, so that for the greater part of the journey to the earth's orbit the motion is nearly uniform. The time occupied is between one and two days, agreeing with the lag often observed after the passage of a spot over the central meridian of the sun before the arrival of the storm. It is explained that, while individual atoms are moving nearly radially, the stream as a whole is rotating with the sun and so overtakes the earth; magnetic storms therefore begin near the sunset meridian of the earth. It is estimated that the breadth of a stream when crossing the earth's orbit is of the order of 50 earth-radii, in which case it would take twenty-five minutes to sweep over the earth.

The difficulty of explaining how the corpuscles can penetrate so deeply into the earth's atmosphere as to give rise to low-level auroræ is dealt with. The suggestion that these auroræ may arise from induced currents due to the corpuscles at higher levels is considered not to account for the definite forms of the auroral rays; it is thought more likely that the extrapolation used to obtain the resistance of air at extremely low density is at fault.

FALL OF METEORITES INTO STARS.—The presence of certain wide diffuse absorption bands which are well marked in the spectra of some stars, especially those of early type, was recently attributed by Dr. H. Shapley and Miss C. H. Payne to meteoric matter near the stars. Later research, however, modified this view, and the glass of prisms or lenses was regarded as a more probable origin for these bands. The latter conclusion is supported by theoretical considerations published by Prof. H. N. Russell in the *Astrophysical Journal*, vol. 69, p. 49. It is shown that all meteorites (except abnormally large ones, more than 1 foot in diameter) will be completely volatilised before reaching the surface of the sun or a star. The gas thus produced will scatter an amount of light dependent on the ratio of radiation pressure to gravity, and in this way might account for a small fraction of the coronal luminosity. The total quantity of meteoric matter falling into the sun, however, cannot exceed 60 tons per second, and the maximum effective absorption produced (when radiation pressure nearly equals gravity) is not sufficient to produce the equivalent of a single narrow Fraunhofer line. It is concluded that meteoric matter cannot account for perceptible bands in the spectrum of any star which is not surrounded by extremely dense nebulosity.

THE SPIRAL NEBULÆ.—New methods of study of the spiral nebulæ are being evolved with great rapidity at Mt. Wilson. The March issue of the *Proc. U.S. Nat. Acad. Sci.* contains papers by Dr. E. P. Hubble and Milton L. Humason, in which the radial velocities are studied and found to constitute a new criterion of distance. Results for some of the brighter spirals had been obtained at Flagstaff many years earlier, and it was then found that there was a general tendency to motion of recession. With the 100-inch reflector it has been possible to extend the research to fainter objects, and there is now sufficient material to apply statistical methods.

It was found that those nebulæ which on other grounds were considered more remote gave larger motions of recession than those concluded to be nearer. A solution was then made of the sun's motion with respect to the system of spiral nebulæ, in which a K-term was applied (the term being derived from that used for the systematic outward movement indicated by stars of our own galaxy); this was assumed to be proportional to the distance of the object. The solution gave for the sun's apex the point R.A. 277°, N. Decl. 36°, velocity 280 km./sec., and K 500 km./sec. per million parsecs. Once this K term has been established, it can be used as a rough measure of the distance of remote nebulæ. The largest recessional motion so far detected is that of N.G.C. 7619, one of a small cluster of nebulæ on the border line between Pegasus and Pisces. This is receding with a speed of 3779 km./sec., which becomes 3910 when corrected for the solar motion found above. The distance estimated from the speed is 25 million light-years, which is in good accord with the estimates from diameter and brightness.

It is pointed out that, in de Sitter's cosmology, distant objects would show a recession increasing with remoteness; this is ascribed both to an apparent slowing down of atomic vibrations and to a general tendency of material particles to scatter; Dr. Hubble expresses the hope that observations extended to more distant objects may make it possible to evaluate the amount due to each cause.

Research Items.

MODERN VIEWS ON LIFE.—A reasonably stated view of the modern conception of life, by Prof. F. G. Donnan, appears in the May number of *Scientia* under the title "The Phenomena of Life". He points out that physiological investigation has shown much of the freedom and spontaneity of life to be more apparent than real. The living being neither destroys nor creates energy; it obeys the physical law of the conservation of energy. Nor is a living thing a magical source of free energy or spontaneous action; its life and activity are ruled and controlled by the amount of free energy in its immediate environment, and it lives and acts by virtue of this; that is to say, it obeys the so-called second law of thermodynamics. Yet there is more than this in life; the unit of living matter, the cell, builds up a whole which is greater than its parts. Whether the understanding of the specific finalistic manifestations of this whole will be explained on present-day hypotheses or may demand the hypothesis of some new form of energy, the understanding will ultimately consist in something that permits of exact measurement and of precise expression in mathematical form, even though for the latter purpose a new form of mathematics may have to be invented.

EARLY CULTURE IN TEXAS, U.S.A.—A recent examination of objects found in caves in the vicinity of El Paso, of which the importance lies in the indication of future lines of research rather than in actual results, is reported by Mr. F. H. H. Roberts, jun., in No. 7 of vol. 81 of the *Smithsonian Miscellaneous Collections*. Mr. Roberts first visited the caves some years ago while investigating the pictographs of the area, including those of the far-famed Hueco Tanks, an oasis, once a rendezvous of wandering bands of Apaches and travellers across the desert. Afterwards a large number of 'curios' were unearthed in the caves by two residents of El Paso. These, together with further finds from undisturbed portions of the caves, have been examined by Mr. Roberts in a recent visit. The pictographs in the caves belong to the group in the south-west to be attributed to the Apache, though a few of the older show Pueblo influence. Three of the figures are masked heads, and stepped structures on two of these may represent a framework similar to those of which actual fragments were found in the caves. The stepped form is comparable to Pueblo forms. Birds and snakes are readily recognisable, whether naturalistic or conventionalised. Among the objects of special significance found are woven sandals of fibre, spear shafts, curved clubs, a basket armlet with a crude setting of turquoise chips, abalone shell pendants, beads, and a few fragments of pottery. The sandals are of a characteristically south-western type. The spear-shafts, which are made of the flower stem of the agave, are coloured red and decorated with balls and streamers of agave fibre. Attached to them are small rods, similar to those found elsewhere, but the significance of which is unknown. The curved clubs are comparable to those of the Basket Makers' caves of north-east Arizona and south-eastern Utah. While it is clear that there is here an admixture of early and late, these objects indicate affinities with the Basket Makers, and it is suggested that the culture of the caves is the northern fringe of the Basket Makers culture of San Juan.

CURIOUS FUNCTION OF GUMS IN A PORPOISE.—The remarkably small size of the teeth in the porpoises of the genus *Phocœnoides* is well known. Gerrit S. Miller, having examined well-preserved specimens of the Alaskan species, *P. dalli*, is of opinion that the teeth are practically functionless and that their use as organs capable of grasping food has been taken by a curious development of the gums (*Proc. U.S. Nat. Mus.*, vol. 74, 1929). The gums are modified so as to form a set of secondary gum teeth, alternating with and surrounding the true teeth, which have come to lie at the bottoms of pits between the bases of the new structures, the size and hardness of which is such that they are undoubtedly capable of functioning as efficient grasping organs. The general condition shown in this toothed cetacean is similar to that of the early stages of development of the baleen plates of the whalebone whale *Sibbaldus*, where the true teeth have disappeared, and gum teeth, compressed along the axis of the jaw, and increased in height, have formed. The resemblances are so important that the author considers that the gum and dental structures of the Alaskan porpoise represent stages of development closely parallel to those through which the corresponding parts in the toothed ancestors of the whalebone whales must have passed.

ENCYSTMENT AND CONJUGATION IN *PLEUROTRICHA*.—Reginald D. Manwell (*Biol. Bull.*, **54**, 1928) describes encystment and conjugation in the hypotrichous ciliate *Pleurotricha lanceolata*, which has two macronuclei and two micronuclei. Encystment may occur at any time and appears to have no relation to periods of depression, to division, or to conjugation. Both macronuclei are extruded and only one micronucleus remains. It is uncertain whether the other micronucleus is always extruded or whether the remaining micronucleus is produced by the fusion of the two original micronuclei. From this one micronucleus the new nuclear apparatus is reconstituted, the process being complete by the time the ciliate is ready to leave the cyst. In conjugation there are three maturation divisions, an interchange of pronuclei and two, or rarely three, cleavage divisions. Of the four products of the second cleavage division one soon enlarges and gives rise to the new macronuclei of the ex-conjugant, one of the other products degenerates, and the remaining two form the new micronuclei. Reduction occurs in the second maturation division, the haploid number of chromosomes being probably twenty. "Conjugation appears to be not only an unnecessary part of the life cycle, at least as long as environmental conditions remain favourable, but is a very dangerous event, for 92 per cent of one hundred exconjugants died without further division, and only one per cent showed any indication of an accelerated fission rate," "and even in this case the daughter race died within a month."

BITTER PIT DISEASE.—Some recent investigations on the apple disease known as bitter pit, with practical information as to the chief means by which it may be avoided, are described by W. M. Carne in *Australian Journal for Scientific and Industrial Research*, vol. 1, No. 6. The disease came into prominence in Australia about 1900, and since 1911 has received the serious attentions of many scientific workers. Carne has now been able to elucidate the problem to a large extent. Picking tests with a number of varieties showed that bitter pit develops chiefly, if not entirely, in stored fruit and is thus quite distinct from cork, another disease previously known as bitter pit, but which develops on apples while on the tree. True bitter pit disease is caused by picking the fruit before it is sufficiently mature, large fruit being more susceptible than small. Although if picking is postponed too long the danger of over-ripeness during

storage is incurred, some greater delay than has been usual hitherto in the picking of apples for export will be beneficial, as not only will the liability of the fruit to bitter pit be reduced, but also a high quality in flavour and appearance will be ensured. The correct date for picking can best be ascertained by means of the iodine method devised by Bigelow, Gore and Howard in 1905. The amount of starch in the apples as shown by the iodine reaction is definitely related to the amount of bitter pit disease, colour, and flavour afterwards developed after storage. The method of testing consists in dipping cut halves of freshly picked apples into an iodine solution (potassium iodide 1 gm., iodine 0·25 gm. per 100 c.c. water) for half a minute. After a short exposure to the air the distribution of the blue colour is noted. If the colour is almost or entirely absent the fruit is overmature for picking, but if scattered in small spots throughout the pulp outside the core line, the fruit can be picked with safety. On the other hand, large patches of colour in the flesh indicate the necessity for allowing the apples to hang longer. With practice other apples of the desired degree of maturity can be selected by eye. This procedure assumes that the fruit will be placed in cold storage within a few days from picking.

SOLANUM HYBRIDS.—An account of crosses between *Solanum utile* and pollen from the domestic potato has been given by Salaman (*Jour. Genet.*, vol. 20, No. 3). The cross was only a success in 25 per cent of the 52 attempts, and the reciprocal cross could not be obtained at all. Also, as a result of many trials, a single plant, indistinguishable from *S. utile*, was obtained by pollination with *S. chacoense*, and it bred true in the next generation. In the crosses between *S. utile* and the domestic potato several cultivated varieties were used as pollen parents, and with three exceptions giving the same result. In the F_2 and later generations, whole families were indistinguishable from *S. utile* in morphological characters, yet certain physiological and genetic differences can be shown by back-crossing, such as the presence of sterility and the incidence of disease. Some of these families, while showing the low cropping capacity of *S. utile*, are nevertheless carrying recessive genes for higher cropping, the inhibitory factors of *S. utile* being dominant. Other families were nearly, with some plants quite, indistinguishable from the domestic type. The inheritance of the differences in leaf characters and cropping are particularly described.

LEPTOCHILUS AND GENERA CONFUSED WITH IT.—Following the modern tendency in taxonomy to seek a phylogenetic arrangement for all groups of plants, E. B. Copeland (*Philippine Journal of Science*, vol. 37, No. 4, December 1928) has published a revision of the African, Indian and Oriental species of the genus *Leptochilus*. Six natural groups, each given generic status, are recognised. *Leptochilus* is retained as a small genus of epiphytic ferns ; the largest genus, *Campium*, consisting of terrestrial ferns with creeping rhizomes. This genus receives monographic treatment, fifty-six species—eighteen of which are newly described—being enumerated. The study of the whole group is complicated owing to the involved nomenclature, and much attention is devoted to the determination of the proper generic and specific names. The paper contains a large number of text figures showing details of frond venation in the species of *Campium*, and all new species and a number of old ones are illustrated by plates.

CONIFERÆ.—The identification of Conifers by means of their vegetative organs is the subject of an interesting paper which appeared recently in the *Scientific Proceedings of the Royal Dublin Society* (vol. 19, N.S. 19). The author, Mr. H. M. FitzPatrick, having in mind the difficulties that beset systematists when flowers and fruit are not available, has compiled a key to the genera and species of the Coniferæ, based on the morphology of the foliage. There are certain difficulties inseparable from such an attempt, not the least of these being the diversity of foliage in juvenile and adult forms of the same species. The nonconformity to type of recent introductions to cultivation, particularly species of *Abies* and *Picea*, create further complications. Such a scheme of classification, to fulfil its purpose, must of necessity be an artificial one. This does not detract, however, from its value for diagnostic purposes, and in its construction Mr. FitzPatrick has achieved a considerable measure of success. Leaf-shape and arrangement form the basis of the key to the genera, while its subdivisions rest on the prominence, or otherwise, of stomatal bands and midrib : the woody nature of the second-year twigs serve to distinguish the Abietineæ and Taxodium from all other Conifers. For the recognition of species special keys are introduced, following, more or less, conventional lines. In this connexion the use of variable features, pubescence for example, as specific indicators, though sanctioned by custom is open to question. The ultimate definition of the species is materially assisted by a series of brief descriptions of their individual characteristics, supplemented by numerous illustrations, some of which, however, are unfortunately lacking in precision. Notes on their economic uses and distribution form a useful adjunct to descriptions of the species. The paper concludes with a short bibliography.

GEOLOGICAL MAP OF MONT BLANC.—A geological map of the French part of the massif of Mont Blanc is being issued by Paul Corbin and Nicolas Oulianoff on the scale of 1/20,000. The first sheet (Servoz les Houches) appeared in 1927. The second (Chamonix) and third (Les Tines) sheets have now been issued, and each is accompanied by a descriptive pamphlet (Imprimerie-Librairie G. Jacquart. Price 20 francs). A general and detailed geological description of the massif is promised in due course. The maps measure nearly 14 × 10 inches, plus borders and legends, and the geological units and topographical base are clearly printed with excellent registration. The Quaternary deposits are coloured in clear pale tints, the older formations being given more vigorous colours so that they stand out clearly. The lithological composition of the crystalline rocks is indicated by overprintings of points and lines on the fundamental colours. In this way the major tectonic units are well brought out as well as the individual formations, sedimentary or igneous. The maps may be recommended not only to professional geologists, but also to those who may be holiday-making in the Chamonix district and wish to know something of the rocks that are there displayed.

THOLEIITES OF THE NORTH OF ENGLAND.—Continuing their work on the igneous geology of the north of England, Prof. Arthur Holmes and Dr. H. F. Harwood have recently published a detailed account of the Tertiary tholeiite dykes (*Mineralogical Magazine*, March 1929, pp. 1-52). Eight new chemical analyses are presented, and in addition to the Brunton, Talaidh, and Salen types already recognised by the Survey petrologists, Cleveland and Acklington types are distinguished, these referring typically to the rocks of the dykes well known under those names. Although the whole suite of dykes appears to converge to a focus in Arran, it is shown that there is a regional

change of direction, as the suite traverses the Southern Uplands, which carries it by way of Great Cumbrae and the Ayrshire coast into the Mull swarm of dykes. Many of the dykes carry anorthite aggregates, and Teall's original hypothesis to explain their presence is supported. A discussion of magmatic variation leads to the conclusion that differentiation by crystallisation and separation of the residual liquors was not the process responsible for the production of the different types of tholeiites. It is suggested that the variation may have been due to admixture with a Whin Sill type of magma of a quartz-ålkali-felspar eutectic formed from ' sial ' by long-continued contact with basaltic magma. This is a return to a long-despised conception first introduced by Bunsen to explain the igneous rocks of Iceland.

MEASUREMENT OF NILE DISCHARGE.—Over a period of more than twenty years, observations have been made with the view of the establishment of an automatic and accurate measure of the discharge of the Nile throughout the year. The last of four papers dealing with this subject is now published in Physical Department Paper No. 24 of the Ministry of Public Works, Egypt, in which Mr. D. A. F. Watt gives the final conclusions on the methods and the tables of results. It has been found that during the low stage of the Nile there is no significant difference between the results given by sluice measurements at Aswan and current meters, but that in flood time the current meters give results about five per cent too high, or even more at the top of high floods. Experiments with scale models which were described in a previous paper have been shown to be a useful means of interpolating results between the low stage and the floods when the discharge of the sluices is not known with the same certainty as at other times of the year. The important conclusion is that the discharge of the Nile at Aswan can now be measured with a high degree of accuracy by the means employed.

NORTH STAFFORDSHIRE COALFIELDS.—The Department of Scientific and Industrial Research has just issued as *Paper* No. 14 of the physical and chemical survey of the national coal resources a description of the coalfields of North Staffordshire (London : H.M. Stationery Office). This paper differs, and differs most unfortunately, from previous ones in the series, inasmuch as the special work which the Fuel Research Division of the Department of Scientific and Industrial Research is specifically supposed to perform, namely, the physical and chemical investigation of the coals of Great Britain, is entirely absent from the present paper. It contains merely a description of the North Staffordshire coalfield, such as is already obtainable elsewhere. Indeed, it carries our information no further, if so far, as do the *Memoirs* of the Geological Survey. It would surely have been better to wait until the physical and chemical investigation, which the Fuel Research Division is supposed to undertake, had been completed and then to publish this information in the way that has been done in the case of the other coalfields, rather than to adopt this piecemeal method of issuing information, which, although it may at first sight lead to an appearance of great activity on the part of the Fuel Research Division, really shows that the proper work of that Division is not being pushed as it should be.

HALL EFFECT IN NICKEL-STEEL ALLOYS.—Interest attaches to the Hall effect as exhibited by the nickel-steel alloys, since the rotations of the two components of these alloys are of opposite sign, and since, moreover, such alloys present peculiarities in their thermal and electrical conductivities which, according to the electron theory, are intimately connected with the Hall effect. In the issue of the *Rendiconti* of the Naples Academy of Physical and Mathematical Sciences for May–August 1928, Dr. Umberto Salerno communicates the results of measurements of this effect made with a series of steel-nickel alloys containing different proportions of nickel. The Hall effect observed exhibits the same characteristics as that of the ferro-magnetic metals, and is influenced to some extent by the nature of the secondary electrodes employed. The alloy known as invar shows a moderately high coefficient of rotation. In all the alloys examined asymmetry is revealed, this being most marked with the alloy containing 22 per cent of nickel, which is the least magnetic, and almost zero with that having 49 per cent, which is highly magnetic. The contribution of the steel to the Hall effect is more pronounced than that of the nickel, 80 per cent of which is necessary to cause reversal of the sign. The variation of the effect with the composition presents analogies with the corresponding variations of the specific heat, thermo-electric properties, thermal conductivity, and electrical resistance.

THE TRIPLE POINT OF WATER.—The usual specification of the zero of the centigrade scale of temperature in terms of the melting point of ice, although very convenient for most purposes, is somewhat unsatisfactory because of the difficulty of reproducing exactly the standard conditions of measurement. In particular, the effect of the air which dissolves in the water used is a little uncertain, and the German Physikalisch-Technischen Reichsanstalt has therefore had under consideration the advisability of replacing the present fixed point by the slightly higher triple point of water. A report of the experimental work that has been done in this connexion has been published by H. Moser in a recent issue (No. 3) of the *Annalen der Physik*. It has been found that the temperature recorded by a platinum resistance thermometer can be held constant to one ten-thousandth of a degree when it is controlled by a bath containing pure ice, water, and water-vapour in thermal equlibrium. Subsidiary measurements established that the freezing point was lowered by 0·0074° C. from this when the ice was in contact with air-free water at a pressure of one atmosphere, so that with an allowance of a further 0·0024° C. for the lowering of the freezing point when the water is allowed to dissolve air to equilibrium, in accordance with the Reichsanstalt specification of the zero point, the temperature of the triple point becomes + 0·0098° C. The triple point of water is at the present time the most nearly constant fixed point of the temperature scale.

ANALYSIS OF PHOSPHORIC ACID.—A detailed study of the determination of phosphoric acid as magnesium pyrophosphate is described by M. Ishibashi in the *Memoirs of the College of Science, Kyoto*, vol. 12, No. 1. The effects of the composition of the magnesia mixture used, of the acidity of the solution, and of the presence of various salts and acids, were examined, and the conditions for maximum accuracy determined. A method was developed for the quantitative precipitation of phosphoric acid as manganous ammonium phosphate, the formation of manganous acid being prevented by the addition of a small quantity of hydroxylamine hydrochloride. The manganese in manganous ammonium phosphate can be exactly titrated with potassium permanganate. In a third paper, a new gravimetric method is described for determining phosphoric acid as zinc pyrophosphate, and in this case the zinc may be titrated by an oxalate method.

The New Department of Zoology of the University of Edinburgh.

FOR many years past the accommodation in the Department of Zoology at Edinburgh has been inadequate to meet modern needs and to cope with the number of students studying the subject. In 1923 the late Mr. Laurence Pullar, of Bridge of Earn, visited the Department and was deeply impressed with the adverse conditions he found. Mr. Pullar, who had long been sympathetically interested in zoology, more particularly in those branches of it that occupied the attention of his friend the late Sir John Murray, made a donation of £20,000 towards the erection of new laboratories. His much-appreciated gift remained anonymous until shortly before his death in 1926. In the same year the Trustees of the Carnegie Trust for the Universities of Scotland, in their allocation of grants for the quinquennium 1925–30, set aside a sum of £18,000.

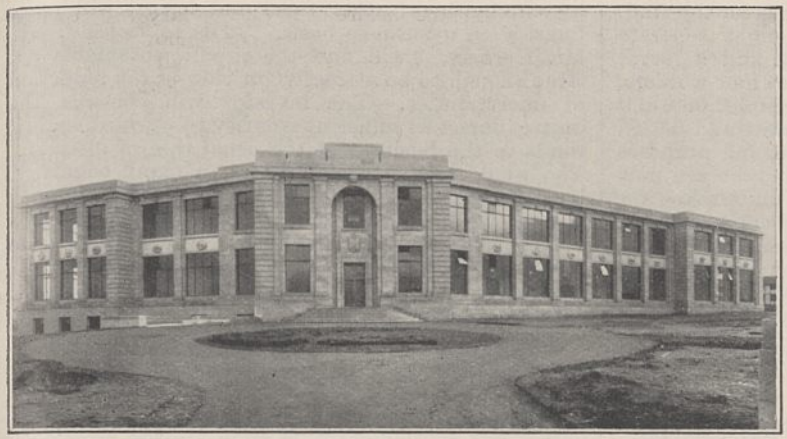

Photo.] [*Fran Cairdeis Inglis.*

FIG. 1.—The new Department of Zoology of the University of Edinburgh.

Prof. Augustus Trowbridge, of Princeton University, then director for Europe of the International Education Board, paid an unannounced visit to the Department in 1926 and inquired into its needs and financial position. As a result of this, and with his sympathetic co-operation, Prof. J. H. Ashworth was enabled to draw up a statement of the requirements. The Board saw its way to give £74,000 for the completion of a building, for equipment, endowment, and addition to staff and technicians.

Prof. Ashworth drew up sketch plans which were placed in the hands of Sir Robert Lorimer and Mr. J. Matthew, and work was commenced in June 1927. The building was formally opened by H.R.H. Prince George on May 15 last in the presence of the Vice-Chancellor, a large number of representatives of the national and civic authorities, and of zoologists from other universities. In his speech, Prince George referred to the traditions of the Department, the chair of which was founded in 1770, and to the importance of zoology and its many applications to the welfare not only of Great Britain, but of the whole Empire. The need for trained zoologists, particularly overseas, at the present time is great. The building is the second of a new group known by permission as the King's Buildings, and Prince George expressed his pleasure at learning that through the munificence of various donors, private and corporate, other buildings were soon to be erected on the same site, forming part of a scheme for the expansion of the University. He congratulated the architects upon their success in combining pleasing effect with utility.

After the opening, Prince George was invested with the honorary degree of Doctor of Laws, made a tour of inspection, and attended a luncheon in the Old University buildings. The University O.T.C. mounted a guard of honour.

The new building (Fig. 1) is of sandstone from the Blaxter quarry, and consists of a central part with a larger wing facing north and a smaller one facing north-east: its total length is 287 feet. It is two-storied for the greater part, but the fall of the ground allows of a well-lit 'basement' under the east wing. Between the large windows in the upper and lower stories are a number of panels with oval medallions about 4 ft. 6 in. long bearing representations of a series of animals. They are arranged in sequence and chosen to represent the main zoogeographical regions. They are the work of Miss Phyllis Bone, who also furnished for the lintels above the first floor windows smaller round medallions of three animals well known to ancient naturalists, the scarab, the crab, and the octopus.

Throughout the whole building the most emphasised feature is the provision of the maximum amount of light. The museum, which is for teaching purposes, is 55 feet long by 40 feet wide, with a 10-foot gallery along one of its long sides, under which is a well-equipped aquarium. The main museum is lit by a cupola and the gallery by an oblique roof light, and in both is a new type of glass devised by Sir Herbert Jackson in conjunction with Messrs. Chance. It is designed to exclude the ultra-violet and strong actinic rays, and at the same time provide a maximum transmission and diffusion of direct sunlight. The library is furnished with enamelled steel shelving, gallery, stair, and stack room, and has an initial accommodation of about 8000 volumes, which should

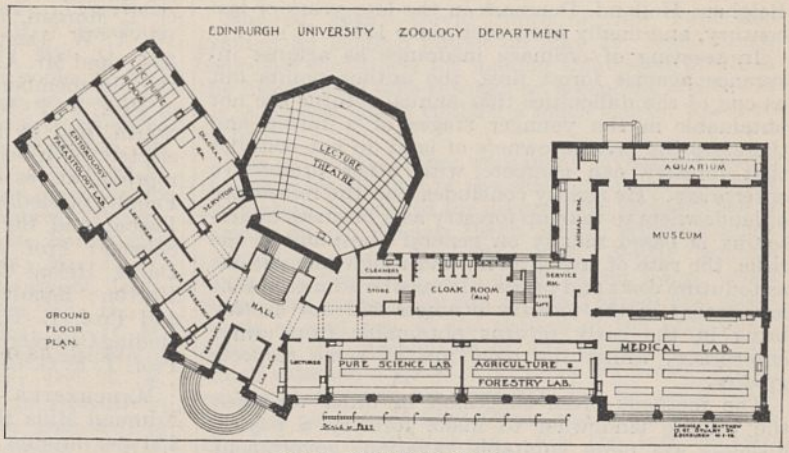

FIG. 2.—Plan of ground floor.

form an adequate reference collection. The large lecture theatre, occupying most of the central part, is of octagonal form, has a specially constructed diagram screen, and provides 318 separate seats; the two smaller theatres for advanced and post-graduate students each accommodate about 50. The laboratories and research rooms on the two wings are laid out as a series of units 15 feet wide by 16 feet deep, and the inclusion of several units gives laboratories of the sizes required for all the different classes. The Department has, besides the laboratories for the staff, technicians' rooms, workshop, etc., eight separate research rooms each for one worker, and a larger room which would accommodate two to four workers.

The total cost of the building has been £80,000, and it is felt that with its modern equipment and design it provides adequate facilities for teaching purposes and for the various lines of research that are now being carried on or are likely to be undertaken for some years to come. Two main objects have been kept in the forefront of all the designing; first, fitness for purpose, and secondly, the utilisation of standard units which permit of the maximum amount of interchange and therefore flexibility.

Forest Insurance.

IN *Special Bulletin* No. 179 (September 1928), issued by the Experiment Station of the Michigan State College of Agriculture, Mr. Paul A. Herbert discusses "Forest Insurance and its application in Michigan". The greater part of the author's thesis is devoted to the great forest problem in the United States of fires and fire protection, and the consequent higher rates demanded for insurance on forest property exposed, as is the case in America, to this peril. Mr Herbert cites the more or less successful efforts at forest insurance attempted in European countries, which had their origin in France and Germany in 1880, Norway in 1912, Finland since the Armistice, in Belgium, Holland, Denmark in the late years of last century, and finally in Sweden since 1919.

In treating of ordinary insurance as against insurance against forest fires, the author points out as one of the difficulties that annual returns are not obtainable in the younger stages of a forest, and therefore the private owners of land do not consider that forestry can compete with other productive enterprises. He rightly concludes that the reluctance of landowners to take up forestry as a business undertaking is based mainly on general questions of the risks, the rate of tree growth, and rough calculations as to future costs and prices. It may be admitted that investment in the forestry business will not usually bring in the early returns obtainable from other enterprises, whilst the risks are in some respects greater.

The methods often suggested in order to assist the private landowner to make forestry a paying business are more equitable taxation, government assistance, and better protective methods. These, coupled with an anticipated future increase in the price of timber and other forest produce, would, it is held, make private forestry a paying business. These factors would tend to decrease the cost of production or decrease the risk to which the invested capital is exposed.

On the subject of taxation of woods, the usual remedy suggested is deferred taxation on lands occupied by woods. The chief advantage of this method would lie not in reduced costs, but in reduced risks, and would allow the timber grower to estimate his future taxation in this respect. If any accident happened to the crop or impaired its value the taxes would automatically be reduced. Government assistance, the author considers, should be mainly confined to paying for research work which is beyond the power of the private owner to undertake; whilst the third remedy, protection, involves decreasing the risks and therefore improving the property from an insurance point of view.

The keynote of the author's discussion is the reduction of risk by effective protection, thus facilitating insurance of the property. Such insurance, by eliminating further risks and losses, will place forestry on a business basis. "The capitalist", says Mr. Herbert, "will find the profits obtainable are large enough to be attractive in view of the reduction of uncertainties. The investor will consider the insured forest as sufficient security to warrant lending funds to the business at the usual rate of interest." The whole crux of the business in many countries, both in the past and the present, is bound up with the methods in force in land taxation, which often do not sufficiently distinguish between land from which an annual return is obtainable and that from which the returns are deferred for long periods, as is the case in forestry.

University and Educational Intelligence.

CAMBRIDGE.—Dr. D. Stockdale, fellow of King's College, has been appointed University demonstrator in the Department of Chemistry.

LONDON.—The result of the Convocation elections to the new Senate of the University of London—a general election following the new Statutes—was announced at the meeting of Convocation on May 14. In the Science Faculty there were eleven candidates for five seats, the successful candidates being Dr. C. W. Kimmins with 1018 votes; Prof. F. G. Donnan, 934; Sir Philip Magnus, 889; Dr. R. H. Pickard, 847; and Mr. G. D. Dunkerley, 835. The unsuccessful candidates were Prof. Winifred Cullis, 806; Dr. G. T. Morgan, 783; Sir Llewellyn Smith, 544; Mr. W. A. W. Dagger, 426; Mr. T. Ll. Humberstone, 354; and Mr. A. E. Evans, 307. In the Arts Faculty the old members were re-elected, with the addition of Prof. T. P. Nunn. In Engineering, Mr. Roger T. Smith, and in Economics, Dr. W. H. Coates were elected, both being new members of the Senate. The representatives of faculties include the following:—Faculty of Medicine: Lord Dawson of Penn, Dr. H. L. Eason, and Sir Cuthbert S. Wallace; Faculty of Science: Prof. A. J. Allmand, Prof. L. N. G. Filon, Dame Helen Gwynne-Vaughan, and Prof. Frank Horton; Faculty of Engineering: Prof. S. M. Dixon and Prof. E. H. Lamb; Faculty of Economics (including Commerce and Industry) and Political Science: Prof. T. E. G. Gregory.

MANCHESTER.—Applications are invited for the Edmund Mills Harwood memorial scholarship, value £50 per annum for three years, at the Manchester Municipal College of Technology. Forms of application and all information are obtainable from the Registrar of the College. The latest date for the return of completed forms is June 15.

ST. ANDREWS.—The University Court has appointed Dr. Frederick Walker, at present assistant in geology, to be a lecturer in geology as from the beginning of the next academical year.

LIKE so many other professions, that of surveying grows more important, complex, and difficult. Old rules of thumb and hastily formed opinions can no longer be applied. If, among the surveyor's essential

qualifications, mathematics and a wide knowledge of central and local government are added to those divisions and subdivisions of his practical work, it becomes clear that the old method of apprenticeship is quite inadequate. Such points were emphasised by Mr. B. W. Adkins in a paper on the education of the young surveyor which he read, on April 8, before a general meeting of the Surveyors' Institution. Mr. Adkins showed how the system of examinations and other facilities of the Institution have met these changes and made it possible for the profession to be supplied with qualified practitioners. Tracing some present weaknesses, he said that if a boy leaves school at sixteen or seventeen and decides to be a surveyor, he finds that he cannot take the intermediate examination for several years. During the interim, although serving articles, he frequently loses the habit of study, since he is free from school discipline and has no immediate spur towards theoretical work. To meet this difficulty and to ensure continuity of study, the Institution has decided to adopt recommendations which will enable the future surveyor to take the more elementary part of the intermediate examination before the age of nineteen. Mr. Adkins considered, too, that the recent introduction of a compulsory preliminary examination will remedy other weaknesses such as bad spelling, indifferent English, and lack of accuracy and method. Mr. Adkins' belief in the work already done by examinations and their future possibility was very definitely expressed: "There have been numerous attempts to discredit the examination system. . . . I am confident that, if properly devised, a system of examination is the best method of inducing young men to acquire such knowledge as is necessary for their progress."

THE Committee of Award for the Commonwealth Fund Fellowships has made appointments to twenty-four fellowships tenable by British graduates in American universities for the two years beginning September next. These include: Mr. Eric Ashby (London) to Chicago, in botany; Mr. Geoffrey Crowther (Cambridge) to Yale, in economics; Dr. H. J. Emeleus (London) to Princeton, in chemistry; Miss G. H. Faulkner (Edinburgh) to Chicago, in zoology; Mr. W. L. S. Fleming (Cambridge) to Yale, in geology; Mr. V. S. Forbes (Cambridge) to California, in geology; Mr. J. N. Goodier (Cambridge) to Michigan, in structural engineering; Mr. A. Harvey (Durham) to California, in physics; Mr. R. C. Hinton (London) to Cornell, in economics; Dr. W. G. Humphrey (Oxford) to Harvard, in chemistry; Mr. W. R. Humphries (Aberdeen) to Columbia, in education; Mr. J. W. Maccoll (Glasgow) to California Institute of Technology, in engineering (aerodynamic); Mr. H. L. Puxley (Oxford) to Yale, in economics; Mr. D. M. Robinson (London) to the Massachusetts Institute of Technology, in electrical engineering; Dr. A. F. Skinner (St. Andrews) to Columbia, in education; Mr. E. T. C. Spooner (Cambridge) to Harvard, in medicine; Mr. A. J. Watters (St. Andrews) to Wisconsin, in organic chemistry; Mr. J. H. C. Whitehead (Oxford) to Princeton, in mathematics; and Mr. R. van de R. Woolley (Cambridge) to the California Institute of Technology, in astronomy. Fellowships tenable by candidates from the British Dominions include Mr. H. Barak (New Zealand and Oxford) to Princeton, in physical chemistry; Mr. H. V. Warren (British Columbia and Oxford) to the California Institute of Technology, in geology. The following have been appointed to fellowships tenable by candidates holding appointments in government service: Mr. Eric J. Bradshaw (Dublin) of the Geological Survey of India, Mr. R. M. Campbell (New Zealand) of the New Zealand Civil Service, Mr. A. H. Crane (Adelaide) of the Queensland Forestry Service.

Calendar of Patent Records.

May 26, 1733.—The patent granted to John Kay of Bury on May 26, 1733, covered the invention of the fly-shuttle, perhaps the most important improvement ever made in the loom. It revolutionised the weaving industry and rendered the power loom possible. But it left Kay a poor man. The last we hear of him is in 1766, when he appeared before a Committee of the Society of Arts, and he must have died soon after, probably in France, where he had tried to obtain the recognition that he failed to get in his own country.

May 26, 1798.—The principle of the hydraulic ram was first used for raising water by John Whitehurst of Derby, who applied it to a domestic water-supply in such a manner that every time the tap was turned on and off in the kitchen, a column of water was forced into a tank in the upper part of the house. Whitehurst sent a description of his apparatus to the Royal Society in 1770, but its value as a water-raising machine was not recognised until an improved self-acting type was invented by Joseph Michel Montgolfier and patented by him in France on May 26, 1798. An English patent was granted in the preceding year to Matthew Boulton acting as Montgolfier's agent.

May 29, 1624.—The first legislative enactment for regulating the granting of industrial monopolies was the Statute of Monopolies (21 Jac. I. c. 3) passed by the English parliament on May 29, 1624. The Statute was not, as has often been assumed, the foundation of the English patent law; it merely gave parliamentary sanction to principles which had long been accepted at common law. Its purpose was to prevent the Crown from granting oppressive monopolies, but in the famous Section 6 it exempted from the general prohibition the granting of patents for the encouragement of new inventions. This section is still in force.

May 29, 1849.—David Smith of New York was granted an English patent on May 29, 1849, for an improved shot-tower for making small shot, in which the fused metal falls through an ascending current of air, a process which enabled a much shorter tower to be used.

May 31, 1836.—There were many inventions before this date for the use of the screw propeller in steam navigation, but credit for its practical introduction is mainly due to Francis Pettit Smith, whose English patent is dated May 31, 1836. Pettit Smith's invention, first tried on a small 10-ton 6-h.p. vessel which was successfully run on the Thames and afterwards at sea, was, at the request of the Admiralty, fitted to the *Archimedes* of 237 tons and 80 h.p., which attained a speed of 10 miles per hour. Smith realised little from his invention, but he was given a civil list pension of £200 a year and in 1871 received the honour of knighthood. For the last thirteen years of his life he was the curator of the then Patent Office Museum.

June 1, 1869.—Thomas Alva Edison's first patent was granted in the United States on June 1, 1869, for an electrical apparatus designed "to record and register in an instant and with great accuracy the votes of legislative bodies," each member having a switch in front of him by moving which he could have his name impressed electrically under either the affirmative or negative votes. Edison's output of inventions has been enormous, the United States patent records showing that for upwards of forty years patents have been granted to him at the rate of about twenty-five a year, the greatest number in any one year being seventy-five in 1882.

Societies and Academies.

LONDON.

Geological Society, April 24.—**Robert Murray-Hughes**: The geology of part of North-Western Rhodesia, with petrographical notes by **A. A. Fitch**. The area lies approximately between lat. 14° and 17° S. and long. 24° and 30° E., and falls into three natural divisions, from west to east. The first is the flat, somewhat swampy country overlaid by the Karroo and Kalahari rocks; the second is the old peneplain-surface forming the plateau of Northern Rhodesia and underlaid by the Transvaal and Pretoria rocks, and those of the Swaziland System; and the third, a deeply dissected country overlaid mostly by the Swaziland rocks and drained by the Zambezi and Luangwa rivers. The rocks are described and correlated with the Transvaal and Pretoria Systems of the south. The covering of sand in the west, together with certain 'ancient laterites', is correlated with the Kalahari System. The principal structural features are: (1) North-east and south-west foliation caused by the intrusion of the Older Granites; (2) north-west and south-east fracturing caused by the intrusion of the Hook Granite; (3) graben faulting, which forms a part of the Great Rift Valley; (4) folding of the Karroo Beds.

Royal Anthropological Institute, April 30.—**J. H. Driberg**: Gala colonists of the sixteenth century. Analyses the varying incidence of Hamitic influence on the different Bantu tribes of the Lake region. Two immigrant cultures, the first of Gala origin *circa* 1600 to 1680, the second represented by the Bahinda dynasty and possibly referable to Lake Chad. Linguistic and cultural evidence for the Gala hypothesis. That the focus of this Hamitic culture lies to the west of Lake Victoria indicates that the immigrant route was via Mongalla and Wadelai. Traces of Gala influence are to be found among the Lerya, where it is linguistic, and among the Bari, where it is cultural, the present serf class representing the descendants of Gala invaders overthrown by a Bari rising. Nilotic and Nilo-Hamitic convulsions due to Gala intervention during the fifteenth and sixteenth centuries, as revealed by a comparison of Nilotic and Bantu genealogies. The southward expansion of the Gala towards the Tana valley, the inception of a militant policy against the Abyssinians, and their colonisation of the cattle-breeding countries round Lake Victoria, should all be correlated.

Society of Public Analysts, May 1.—**R. S. Morrell and S. Marks**: The determination of organic peroxides. A modification of Fahrion's method of determining the peroxide oxygen in oxidised linseed oil by measuring the iodine liberated from potassium iodide in the presence of sulphuric acid has been devised.—**J. W. Croxford**: Differential halogen absorption of oils and fats. Toms's bromine vapour method of determining the halogen absorption of oils gives rapidly the true iodine value of oils and fatty acids which require very many hours for complete absorption of the Wijs' reagent. Fatty acids and oils of the oleic acid series with the double bond adjoining the carboxyl group may thus be recognised. Iso-oleic acids formed in the hydrogenation of oils, and the petrosilinic acid of parsley seed oil, give similar results by the two methods, and have thus the double bond at a distance from the carboxyl group.—**W. R. Schoeller and C. Jahn**: A new method for the separation of small quantities of tantalum and niobium from titanium. The solution containing the oxalates is treated with sodium salicylate, which converts the titania into a stable crystalloidal sodium titanylsalicylate. The earth acids are then precipitated with calcium chloride, and finally precipitated with tannin.—**H. R. Ambler**: The analysis of small samples of gas. Apparatus for the analysis of small samples of about 1 c.c. of gas, in which rubber connexions are abolished.

DUBLIN.

Royal Dublin Society, Mar. 26.—**J. Reilly, P. J. Drumm, and C. Boyle**: The production of essential oils from Irish-grown plants (Part 5). Oil of dill.—**M. Grimes**: A study of lactose-fermenting yeasts found in milk, cream, and butter. The yeasts examined consisted of two types: Type *A*, similar to, or identical with *Torula lactosa*, Harrison, isolated from Canadian cheese; type *B*, similar to, or identical with *Torula cremoris*, Hammer, isolated from yeasty cream.—**J. H. J. Poole and A. J. Clarke**: The effect of strong electric and magnetic fields on the rectilinear propagation of gamma rays. Sir J. J. Thomson has suggested that, since electrons show some of the characteristics of very high frequency wave trains, very hard gamma rays may possess some of the properties of charged particles, and he conducted some trials on a possible bending of a gamma ray beam in a dielectric exposed to a large transverse electric field. His results, on the whole, were negative. The present paper describes further trials, not only with electric, but also with strong magnetic fields. No effect in either case could be detected.

EDINBURGH.

Royal Society, May 6.—**G. N. Hunter**: Colour sensitivity. In *Proc. Opt. Convention*, 1926, Dr. Houston described a new method of testing for colour blindness. The apparatus was purposely made insensitive by keeping the two colour patches under comparison 8 mm. apart. In the present research, these patches have been brought into juxtaposition, resulting in a great increase in colour sensitivity, estimated at 1000 per cent.—**E. B. Ludlam and R. B. Mooney**: The influence of air and moisture on the 'Budde effect' in bromine. The absence of expansion of pure dry bromine when exposed to light is explicable by calculating the rate at which the energy received can be taken up by the walls of the vessel: a film of moisture may prevent the re-combination of bromine atoms on the surface and thereby retain the energy in the body of the gas. Air present in the gas may facilitate transfer of energy and cause expansion. There is no evidence of re-radiation of energy.—**A. C. Stephen**: Studies on the Scottish marine fauna. The fauna of the sandy and muddy areas of the tidal zone. The density per unit area has been investigated. Parts of the Firth of Clyde (more than 3000 per square metre) and St. Andrews Bay, West Sands, are areas of exceptional abundance. The various species are not uniformly distributed over any beach, but either occur, or have their maximum density at, some particular level. On sandy grounds *Tellina tenuis* and *Nephthys cœca* predominate, on the muddy grounds *Cardium edule* and *Macoma baltica*.—**G. Redington**: Effect of diurnal periodicity on plant growth. By growing plants entirely in electric light, it is shown that a daily dark period is not essential, but with practically all the very diverse species grown, better plants were ultimately produced in 16 hours' light per day than in continuous light. Generally, poor growth was made in a light exposure of 8 hours' daily. The effect of the several physiological processes concerned upon the conditions obtaining at the apical meristem is considered in relation to cell formation and cell elongation.—**Margery Knight**: Studies in the Ectocarpaceæ (2). *Ectocarpus siliculosus*. Plants

collected from the Mediterranean coasts show a simple type of life history in which the plant body is haploid and reproduction is effected by the union of gametes produced in plurilocular sporangia. The dominant soma of the British plants is, however, diploid and the zoids from plurilocular sporangia on these plants are already diploid and germinate immediately into new plants; sexual reproduction is achieved by zoids from unilocular sporangia. Alternation of generations and sex differentiation are also discussed.—**Mary H. Latham**: Jurassic and Kainozoic corals from Somaliland. This collection of fossil corals from British Somaliland was made by Mr. R. A. Farquharson, Government Geologist, during his survey of the country in 1923–24. It includes Jurassic, Eocene, Oligocene, and one Pleistocene specimen. Most of the specimens are Eocene and were collected mainly in eastern Somaliland; but some specimens from Deberaweina in western Somaliland have been identified as Eocene. That district has not hitherto yielded Eocene corals. There are three new species of *Astrocœnia*, all of which have large corallites and greatly resemble *Stephanocœnia*, and a new species of *Cyathocœnia*. There is also a new genus, *Tubicora*, belonging to the *Goniocoridæ*. The Oligocene corals include new species of *Stylophora*, *Circophyllia*, *Favia*, *Orbicella*, *Columnastræa*, and *Porites*. The older faunas have Mediterranean affinities.—**Sydney Goldstein**: The asymptotic expansion of the characteristic numbers of the Mathieu equation.

PARIS.

Academy of Sciences, April 15.—The president announced the death of M. Gayon, *Correspondant* for the Section of Rural Economy.—**P. Séjourné**: The railway from Casablanca to Marrakech. The branch line for phosphates. This line, 245 km. long, was commenced in 1916; the discovery of rich phosphate deposits at Kourigha led to an alteration of the plans and the construction of a branch line 83 km. long (150 km. from Casablanca). Details of the phosphate deposits are given: these deposits are remarkable both as regards high percentage of calcium phosphate and quantity available.—**Emm. de Margerie**: Second report on the publication of the "œuvres géologiques de Marcel Bertrand".—**V. Romanovski**: Some new classes of orthogonal polynomials.—**M. de Franchis**: A recent theorem concerning quadrics.—**Hadamard**: Remarks on the preceding communication.—**Rolf Nevanlinna**: Remarks on the lemma of Schwarz.—**Lucien Féraud**: The Pfaffian systems of M. Birkhoff.—**G. A. Mokrzycki**: The maximum utilisation of commercial aeroplanes.—**Antonio Cabreira**: The theory of a terrestrial metric planosphere.—**Benjamin Jekhowsky**: The identification of the minor planets and the correction of their orbits from a single observation.—**J. E. Verschaffelt**: The equation of Van der Waals and thermodynamics. Reply to criticisms by V. Karpen.—**Quevron**: The increase in the sensibility of electrical measuring apparatus with pivots. The permanent magnet in the instrument is replaced by an electromagnet. The power required is 150 watts, giving a magnetic field of 4500 gauss. With this instrument it is possible to measure by direct reading 10^{-8} ampere or 10^{-5} volt. Possible applications are discussed.—**J. Cabannes**: The secondary radiations in light diffused by Iceland spar.—**H. Jedrzejowski**: The groupings of radioactive atoms.—**L. Wertenstein**: The β-recoil.—**André Chrétien**: The ternary system: water, sodium sulphate, sodium nitrate.—**H. Parent**: The existence in Provence of a shore line at 6 metres, of recent Quaternary age.—**Henryk Arctowski** and **Edward Stenz**: The origin of the dusts which fell in Poland between April 26 and 29, 1928. Proofs that the dusts which fell in Roumania and Poland on the above days originated in central Ukraine.—**Joseph Devaux**: The actinometric study of the penetration of the solar energy flux at the interior of some Pyrenees glaciers. When the solar radiations penetrate the mass of glaciers, with the ice at 0° C., the absorbed energy produces a partial fusion of the ice, especially at the surface, which becomes porous. This porous condition reduces the transparency of the ice to the rays, resulting in less penetration and less melting. This process the author terms the radiothermic defence of glaciers.—**Yossifovitch Mladen**: The mechanism of the separation of the perithecium in the Erysiphaceæ and the rôle of the fulcra.—**A. Maige**: The rôle of the cytoplasm in amylogenesis.—**Lucien Daniel**: The resistance to cold of the descendants of *Artemisia Absinthium* grafted on *Chrysanthemum frutescens*. New varieties of absinthe plants, produced from seeds resulting from grafting Absinthium on Chrysanthemum, have proved very resistant to cold. At the temperature of Rennes last winter ($-21°$ C.), numerous species regarded as acclimatised to the winter have been severely affected, but the Absinthe arising from the grafts have survived.—**H. Lagatu** and **L. Maume**: The leaf diagnosis and its degree of security.—**J. Vellard**: The properties of the cutaneous secretions of some tree frogs (*Hyla*) from the neighbourhood of Rio de Janeiro. The toxicity of these secretions is as frequent in the group of Hylidæ as in other species. The toxic characters vary greatly with the species.—**R. Fosse** and **A. Brunel**: The ferment producing allantoic acid by the hydrolysis of allantoin. Its presence in the animal kingdom. A ferment capable of giving allantoic acid from allantoin has been demonstrated in the frog and in several fishes.—**Georges Lakhovsky**: The sterilisation of water and of liquids by circuits in metal in direct contact with the liquid.

Official Publications Received.

BRITISH.

Stonyhurst College Observatory. Results of Geophysical and Solar Observations, 1928; with Report and Notes of the Director, Rev. E. D. O'Connor. Pp. xxii+50. (Blackburn.)

Journal of the Chemical Society: containing Papers communicated to the Society. April. Pp. iii+589-852+viii. (London.)

Imperial Institute. Annual Report, 1928, by the Director, Lieut.-Gen. Sir William Furse, to the Board of Governors. (Meeting, 19th March 1929.) Pp. vi+36. (London.)

Report of the Oversea Settlement Committee for the Year ended 31st December 1928. (Cmd. 3308.) Pp. 43. (London: H.M. Stationery Office.) 9*d*. net.

Reports of the Progress of Applied Chemistry. Issued by the Society of Chemical Industry. Vol. 23, 1928. Pp. 760. (London.)

Proceedings of the Royal Society. Series A, Vol. 124, No. A793, May 2. Pp. 242. (London: Harrison and Sons, Ltd.) 8*s*.

Transactions of the Royal Society of Edinburgh. Vol. 56, Part 1, No. 11: The Anatomy of a Fœtal African Elephant, *Elephas africanus* (Loxodonta africana). Part 3: The Contents of the Thorax and Abdomen and the Skeleton. By Dr. Nellie B. Eales. Pp. 203-246+6 plates. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 7*s*. 6*d*.

FOREIGN.

Japanese Journal of Botany: Transactions and Abstracts. Vol. 4, No. 3. Pp. iv+219-316+55-79. (Tokyo: National Research Council of Japan.)

Department of Commerce: Bureau of Standards. Research Paper No. 55: An Analysis of the Arc and Spark Spectra of Yttrium (Yt I and Yt II). By William F. Meggers and Henry Norris Russell. Pp. 733-769. 10 cents. Research Paper No. 56: The Precise Measurement of X-ray Dosage. By Lauriston S. Taylor. Pp. 771-785. 10 cents. (Washington, D.C.: Government Printing Office.)

Review of Legal Education in the United States and Canada for the Year 1928. By Alfred Z. Reed. Pp. iii+51. (New York City: The Carnegie Foundation for the Advancement of Teaching.) Free.

Department of Commerce: Bureau of Standards. United States Government Master Specification, No. 23c: Lamps, Electric, Incandescent, Large, Tungsten Filament. Supersedes F.S.B. No. 23b and Bureau of Standards Circular No. 13, 11th edition. Revision promulgated by the Federal Specifications Board on March 25, 1929. Pp. ii+12. (Washington, D.C.: Government Printing Office.) 5 cents.

CATALOGUE.

Eastman Organic Chemicals. List No. 20, May. Pp. 90. (Rochester, N.Y.: Eastman Kodak Co.)

Diary of Societies.

FRIDAY, MAY 24.

SOCIETY OF MEDICAL OFFICERS OF HEALTH (Fever Hospital Medical Service Group), at 3.—Dr. W. M. MacFarlane and others: Discussion on The Uses of Scarlet Fever Antitoxin.

LINNEAN SOCIETY OF LONDON (Anniversary Meeting), at 5.—Presidential Address and Presentation of Linnean Gold Medal to Prof. H. de Vries.

PHYSICAL SOCIETY (at Imperial College of Science), at 5.—Dr. Ezer Griffiths: A Hygrometer for Use in Timber Seasoning Kilns.—Dr. J. H. Vincent: Experiments on Magnetostrictive Oscillators at Radio Frequencies.—Demonstration of an Apparatus for Measuring the Thermal Expansion of Glass, by Prof. W. E. S. Turner.—Demonstration of the Flutter Model Aeroplane Wings, by R. A. Fraser and W. Duncan.

ROYAL SOCIETY OF MEDICINE (Disease in Children Section) (Annual General Meeting), at 5.—Dr. F. J. Poynton: Some Phases in English Pediatrics as viewed by a General Physician.

ROYAL SOCIETY OF MEDICINE (Epidemiology Section) (Annual General Meeting), at 8.—Dr. A. Joe: Puerperal Fever.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—F. J. Rennell Rodd: The Tuareg Tribes of Central Sahara.

INSTITUTE OF CHEMISTRY (Edinburgh and East of Scotland and Glasgow Sections) (jointly with Society of Chemical Industry—Edinburgh and East of Scotland and Glasgow Sections) (at Glasgow).—Prof. G. G. Henderson: Recent Research in the Terpene Series.

INSTITUTION OF WATER ENGINEERS (at Birmingham).

SATURDAY, MAY 25.

PHYSIOLOGICAL SOCIETY (in Physiology Department, University, Edinburgh), at 10 A.M. and at 2.—H. E. Magee, Prof. J. J. R. Macleod, and D. W. Auchinachie: Diffusion in Surviving Gut of Different Sugars.—J. McCallum and H. E. Magee: Effects of Diet and of Adrenalectomy on Movements of Surviving Intestine.—H. E. C. Wilson: A Note on Specific Dynamic Action.—C. M. Burns: (*a*) Influence of Ingestion of Mineral Acids on the Mineral Constituents of Tissues; (*b*) Influence of Parathormone on the Composition of Bone.—D. Burns: Action of Salts of Guanidine on the Vasomotor System.—H. Dryerre: (*a*) Effect of Administration of Calcium Chloride on the *p*H of Urine; (*b*) Calcium Metabolism in Relation to Lactation.—May Cameron: Differences of Structure between the White and Red Muscles of the Rabbit.—B. P. Wiesner: On the Mechanism of Controlling Changes in Ovarian Endocrine Functions.—A. W. Greenwood: On the Effects of Implantation of Cock's Testis into the Hen.—E. M. Robertson: On the Zondek-Ascheim Pregnancy Test.—L. Miskaja: The Effects of Implantation of Mouse Placenta on the Reproducing System of the Immature Female.—W. P. Kennedy: The Ganglion *cervicis uteri* and the Œstrus Hormone.—G. H. Ettinger: An Investigation into the Conditions of the Pulmonary Circulation of the Guinea-pig.—A. Fraser and Prof. J. J. R. Macleod: Glycogen and Lactic Acid in Mammalian Muscle after Death.—G. P. McCullagh, G. D. F. McFadden, and Prof. T. H. Milroy: Cutaneous Temperatures after Lumbar Sympathectomy.—Demonstrations:—A. C. White and C. P. Stewart: On the Estimation of Small Amounts of Soap.—A. C. White and A. J. Clark: Apparatus for the Estimation of the Oxygen Consumption of the Frog's Heart.—Y. Bogue: Electro-cardiograms from the Hen's Egg.—Prof. P. T. Herring: Secretion by the Cells of the Convoluted Tubules of the Kidney of the Skate.—J. D. S. Cameron: Secretion of Urea by the Cells of the Convoluted Tubules of the Kidney of the Dogfish.—Sir E. Sharpey Schafer: The Relation Between the Liver Cells and the Blood.—Prof. F. A. E. Crew: The Miniature Egg of the Domestic Fowl.—G. H. Ettinger: (*a*) Pitfalls Liable to be met with in Perfusion Experiments; (*b*) Peculiarities in Structure of the Pulmonary Arterioles of the Guinea-Pig, Ox, and Cat.—W. O. Kermack and W. Leiper: A New Method for Demonstrating and Measuring the Activity of Pepsin.—W. W. Taylor: Method of Determining Free and Bound Water.—A. R. Smellie: An Improved Type of Pump for Artificial Respiration.—J. Davidson: Selective Action of Senecefoline on the Liver Cell.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS (Associates' and Students' Section) (Annual General Meeting) (Newcastle-upon-Tyne), at 3.—H. S. Jackson: Mine Costs.

INSTITUTE OF CHEMISTRY (Edinburgh and East of Scotland Section) (jointly with Society of Chemical Industry—Edinburgh and East of Scotland and Glasgow Sections) (at Glasgow).

MONDAY, MAY 27.

VICTORIA INSTITUTE (at Central Buildings, Westminster), at 4.30.—Sir W. M. Flinders Petrie: The Materialisation of Old Testament History.

SURVEYORS' INSTITUTION (Annual General Meeting), at 5.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.—H. P. Adams: English Hospital Planning.

ROYAL SOCIETY OF MEDICINE (Odontology Section) (Annual General Meeting) (at Royal College of Surgeons), at 8.

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 8.30.—L. J. Robbins: A Journey in Central Siam.

TUESDAY, MAY 28.

ROYAL DUBLIN SOCIETY (at Ball's Bridge, Dublin), at 4.15.—Prof. J. Joly: A New Form of Needle for Radium Therapy.—Dr. W. R. G. Atkins and Dr. H. H. Poole: Photo-electric Measurements of Illumination in Relation to Plant Distribution. Part II.

ROYAL SOCIETY OF MEDICINE (Medicine Section), at 5.—Annual General Meeting.

ROYAL SOCIETY OF MEDICINE, at 5.30.—General Meeting.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—Secretary: Report on the Additions to the Society's Menagerie during the month of April 1929.—W. N. Blair: Observations on the British Shrew *Crocidura cassiteridum*.—Miss E. M. Brown: Notes on the Larval Stages of the Tompot Blenny, *Blennius gattorugine*.—Dr. C. Christy: On the African Buffaloes.—G. C. Robson: On the Rare Abyssal Octopod *Melanoteuthis*: a Contribution to the Phylogeny of the Octopoda.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Kinematograph Group), at 7.—Capt. G. I. Finch: A Crossing of Mont Blanc.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Mrs. M. Hasluck: Turkish Games.

WEST KENT SCIENTIFIC SOCIETY (at Wesleyan Hall, Blackheath), at 8.30.

WEDNESDAY, MAY 29.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—Dr. K. S. Sandford: The Pliocene and Pleistocene Deposits of Wadi Qena and of the Nile Valley between Luxor and Assiut (Qau).—Miss E. W. Gardner: Geological Researches in the Fayûm (Egypt), being a report on work done with the assistance of the Gloyne Outdoor Geological Research Fund.

EUGENICS SOCIETY (at Royal Society), at 8.30.—E. B. Ford: Recent Work on the Physiology of Genetics and its Bearing on Human Problems.

THURSDAY, MAY 30.

ROYAL SOCIETY, at 4.30.—Prof. O. W. Richardson and P. M. Davidson: The Energy Functions of the H_2 Molecules.—Dr. E. K. Rideal, C. P. Snow, F. I. G. Rawlins, and A. M. Taylor: Infra-Red Investigations of Molecular Structure. Part I.—C. P. Snow, F. I. G. Rawlins, and Dr. E. K. Rideal: Infra-Red Investigations of Molecular Structure. Part II.—Dr. A. Müller: The Connexion between the Zig-Zag Structure of the Hydrocarbon Chain and the Alternations in the Properties of Odd and Even Numbered Chain Compounds.—*Papers to be read in title only*:—Prof. O. W. Richardson and F. S. Robertson: The Emission of Soft X-Rays by Different Elements at Higher Voltages.—G. I. Finch and D. L. Hodge: Gaseous Combustion in Electric Discharge. Part III.—G. I. Finch and J. C. Stimson: The Electrical Condition of Hot Surfaces during the Adsorption of Gases. Part III.—J. M. Robertson: An X-Ray Investigation of the Structure of Naphthalene and Anthracene.—D. L. Chapman and W. K. Hall: A Study of the Catalysis by Silver of the Union of Hydrogen and Oxygen.—K. Majumdar: The Arc Spectrum of Chlorine.—A. E. Gillam and R. A. Morton: The Absorption Spectra of Halogens and Inter-Halogen Compounds in Solution in Carbon Tetrachloride.—K. R. Rao: The Arc Spectrum of Germanium.—R. H. Fowler and A. H. Wilson: A Detailed Study of the 'Radioactive Decay' of, and the Penetration of α Particles into a Simplified One-Dimensional Nucleus.—U. Nakaya: On the Emission of Soft X-Rays by Different Elements, with Reference to the Effect of Adsorbed Gas.—R. A. Frazer and A. J. Duncan: (*a*) On the Criteria for the Stability of Small Motions; (*b*) On the Numerical Solution of Equations with Complex Roots.—N. F. Mott: The Scattering of Fast Electrons by Atomic Nuclei.—L. J. Freeman: Further Investigations of the Spectrum of Ionised Nitrogen (N II).—G. C. McVitie: On Einstein's Unified Field Theory.—L. P. Davies: The Soft X-Ray Emission from Various Elements after Oxidation.

INSTITUTE OF PATHOLOGY AND RESEARCH (St. Mary's Hospital), at 5.—Prof. F. W. Twort: The Position of Ultramicroscopic Viruses in the Living World.

CHEMICAL SOCIETY (at Institution of Mechanical Engineers), at 5.30.—Prof. W. H. Perkin: The Early History of the Synthesis of Closed Carbon Chains (Pedler Lecture).

ROYAL SOCIETY OF MEDICINE (Electro-Therapeutics Section) (at Langham Hotel), at 7.—Annual General Meeting.

C.B.C. SOCIETY FOR CONSTRUCTIVE BIRTH CONTROL AND RACIAL PROGRESS (at Essex Hall, Strand), at 8.—Dr. M. Thomson: Sterilisation of the Unfit.

FRIDAY MAY 31.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. E. N. da C. Andrade: The Air Pump: Past and Present.

PUBLIC LECTURES.

FRIDAY, MAY 24.

BIRKBECK COLLEGE, at 5.30.—Prof. S. de Geer: Sweden and the North of Europe. (Succeeding Lectures on May 28 and 30.)

MONDAY, MAY 27.

ROYAL SCHOOL OF MINES, at 5.15.—Dr. C. J. Smithells: Minor Constituents in Industrial Metals and Alloys (Armourers' and Brasiers' Company Lectures—continued on June 3 and 10).

SIR JOHN CASS TECHNICAL INSTITUTE, at 7.—Dr. M. A. Matthews: Low Temperature Tar.

TUESDAY, MAY 28.

UNIVERSITY COLLEGE, at 5.30.—Prof. A. Brachet: Experimental Embryology. (Succeeding Lectures on May 29 and 31.)

WEDNESDAY, MAY 29.

UNIVERSITY COLLEGE, at 5.30.—Prof. E. D. Wiersma: The Psychology of Dementia. (Succeeding Lecture on May 30.)

NORTHAMPTON POLYTECHNIC INSTITUTE, at 7.—G. Patchin: Engineering Alloys (Armourers' and Brasiers' Company Lectures—continued on June 5 and 12).

THURSDAY, MAY 30.

LONDON SCHOOL OF ECONOMICS, at 5.—Prof. A. Aall: The Psychology of the Individual and of the Mass. (Succeeding Lecture on May 31.)

FRIDAY, MAY 31.

CHELSEA PHYSIC GARDEN, at 5.—H. V. Taylor: Supplies from the Vegetable Kingdom and the Public Health (Chadwick Lecture).