THURSDAY, MAY 11, 1911.

THE RADIUM TREATMENT OF DISEASE.

Radium: its Physics and Therapeutics. By Dr. D. Turner. Pp. x+86. (London: Baillière, Tindall, and Cox, 1911.) Price 5*s.* net.

THIS is a small manual suitable for medical men, giving in a concise form an account of the physical phenomena of radio-activity and the therapeutic uses of radium. For the physical part of the book the writings of Profs. Rutherford and Soddy have been largely used, and for the therapeutic chapters reference has been made to the works of Drs. Wickham, Degrais, and Dominici. In addition, the author records his own observations founded upon a five years' experience of the use of radium as a therapeutic agent. The book is illustrated by a number of plates, including portraits of Prof. and Mme. Curie as frontispiece, and portraits showing various diseases before and after treatment by radium. These include rodent ulcer, nævus, port-wine stain, warts, papilloma, and spring catarrh of the eye.

The opening chapters deal with the physics of radium. They give a concise account of the conclusions to which physicists have come—without discussion. The characteristic effects of radio-activity are enumerated, including the power of affecting photographic plates, of producing fluorescence, of ionising the air, of producing heat and various chemical changes. The alpha, beta, and gamma rays are described, the beta and gamma rays being compared with the kathode and X-rays. In dealing with the nature of the gamma rays, the author writes as follows:—

"The nature of the gamma ray is disputed; at first considered, owing to their magnetic non-deflectibility, to be a pulse or wave motion in the ether, there are now philosophers who regard them as discrete particles, but electrically neutral (positive and negative united). The question, then, is not settled. At any rate, the gamma rays are always found in company with the beta, much as the kathode ray and X-ray go together. If the gamma ray is proved to be a particle instead of a wave motion, we may have to revise our views as to the nature of the X-ray."

The author might have gone further and said that we *shall* have to revise our views as to the nature of the X-ray, for the arguments in favour of regarding gamma rays as material particles refer even more forcibly to the X-rays. The methods of containing radium for therapeutic application are of great importance, the pure salt being so valuable (1 mg. at present costing 18*l.*) that the greatest care must be taken to prevent loss. An impure salt is usually employed, being mixed with barium salts, from which it is very difficult to separate. The bromide and chloride are hygroscopic and soluble, and must be kept in an air-tight receptacle. The radium is contained, for therapeutic purposes, either in (*a*) sealed glass tubes, (*b*) ebonite capsules, or (*c*) mixed with varnish and spread out on pieces of cloth or metal.

The alpha particles are so readily absorbed that they are not available for treatment by any of these methods, even the layer of varnish in the method (*c*) being sufficient to stop the alpha particles. For the treatment of superficial conditions the more readily absorbed soft beta rays are used, a comparatively short exposure being given. For a subcutaneous condition, where the skin is to be spared, a screen of aluminium of $\frac{1}{2}$ mm. thickness, or a silver screen of one-fifth of a millimetre is interposed, and a longer exposure given. For deeply-seated diseases a lead screen, varying in thickness from one-fifth to one millimetre, is interposed, and a prolonged exposure is given. In this case only the hard beta and the gamma rays will get through. When these metallic screens are used, account must be taken of the fact that the metals give out secondary rays, and that these might conceivably injure the skin. For this reason it is recommended that when a metal screen be used, a thin envelope of some non-metallic substance be placed next to the skin to cut off the secondary rays.

Radium emanation has been used therapeutically in various ways by inhalation, injection, in baths, and medicinally. Some natural waters are radio-active (Wiesbaden, Bath, &c.), and their efficacy may be in part due to this. Possibly the greater efficacy of mineral waters taken at their source, as compared with the same waters bottled and taken at home, may be explained by the decay of their radio-activity. The author refers to the present writer's method of using radium emanation enclosed in glass tubes; he points out that this use of the emanation is not, properly speaking, a use of the emanation itself, but only of its rays and of those of the active deposit, for none of the emanation can escape. It is not in any sense comparable to the use of the emanation by injection or other introduction directly into contact with the tissues. In the latter case the emanation tends to diffuse itself throughout the tissues. Wickham and Degrais have made extensive use of water rendered radio-active or actually containing dissolved radium bromide, and of emulsions of insoluble salts of radium in paraffin and vaseline for injection into tumours or beneath them, with the object of preventing their spreading deeply. Various properties of the emanation when used in any of these manners have been described. Thus it is said to increase the activity of digestive and other ferments of the body, to possess specific powers of dissolving urates; ferments which form and destroy uric acid being rendered more active by its use.

The efficacy of radium treatment is said to depend primarily on a selective destructive power, and it has been universally recognised that the rays possessing this selective action are the gamma rays and the hard beta rays, while the alpha particles are said to be universally destructive, destroying both the healthy and the diseased tissues. In the case of radium emanation or radio-active solutions, the whole of the radiation is available, and since the energy of the alpha particles is more than one hundred times as great as that of the beta and gamma together, it is clear that we are dealing here almost entirely with alpha radiation, for the effect of the beta and gamma radiation is relatively so small as to be negligible. No account is taken of this in the present book, but it

is surely of great importance; and if the special actions ascribed to radio-active solutions circulating in the body be borne out by future investigators, it is certain that we shall have to revise our assumption of the universal destructive action of the alpha particles. If we are able to do so, we may well find radium to be a far more valuable therapeutic agent than we have hitherto suspected.

After dealing with the treatment of non-malignant diseases, and with rodent ulcers which are locally malignant and yield readily to the action of radium, the true malignant growths are discussed, and a number of cases described in detail. Temporary benefit is experienced in a large proportion of the cases, the tumours become smaller, while the patient is relieved of much pain. A cure is occasionally obtained, but every case of malignant tumour that can be dealt with by the surgeon should be extirpated. Subsequent treatment with radium may be of the greatest value in destroying any cancerous cells that have escaped removal by the surgeon, and so the recurrence of the disease may be prevented.

Various rheumatic conditions have been treated with some success by radio-active earths. Comparing radium treatment with treatment by Röntgen rays, the chief difference is that the gamma rays of radium are far more penetrating than the X-rays, their effects being manifest on the tissues at a depth ten times as great as that of X-rays. Hence they are to be preferred for deep-seated affections. Radium rays are perfectly "constant" in quantity and quality, whereas X-rays are constantly varying in both these attributes. Hence a dose of radium rays can be measured with a precision that is wanting in the case of X-rays. Radium can be placed in natural cavities or buried in tumours, and left for an indefinite period, giving off its radiation all the time. The quality of the scars left after radium treatment is usually exceedingly good, and is certainly better, as a rule, than the scars left after X-ray treatment. Radium, again, is readily portable from patient to patient. The chief disadvantage of the use of radium is its extremely high price and the consequent risk of loss by breakage or accident. The chief advantage of X-rays over radium is the large area to which the X-rays can be applied.

In reviewing the present state of our knowledge of the therapeutic effects of radium, the feeling reached is that we are making our applications empirically in the hope of lighting, almost by accident, on some property of value in the cure of diseases which have hitherto baffled the physician's skill.

A. C. JORDAN.

ELEMENTARY ZOOLOGY.

An Introduction to Zoology. By Prof. R. W. Hegner. Pp. xii+350. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 8*s*. net.

THERE are some interesting distinctive features in this new introduction to zoology. Only a few types are studied (all of them Invertebrates); they are discussed so as to illustrate the principles of the science; the morphological aspect is not specially emphasised, but is coordinated with the physiological aspect (which, of course, includes the study of inter-relations and behaviour). From a mapping out of the subdivisions of the science (which admits of much improvement), the author passes to the characteristics of living organisms (where the autonomy of biology seems too easily surrendered to the mechanists), thence to the cell, and to the Protozoa. After an introduction to the Metazoa, which makes the significance of the transition admirably clear and introduces some exceedingly useful original diagrams, the book goes on to Hydra and other Cœlenterates, Unsegmented Worms, the Earthworn and Annelids, the Crayfish and Arthropods, the Honey Bee (which is admirably treated), and bees in general. Then follows a chapter on the history of zoology (entitled "Historical Zoology"), and the book ends with a terse consideration of the factors in evolution and related questions. There is a very useful bibliography, and a glossary.

The author shows a keen educative instinct (though the pemmican of the chapter on evolution is questionable); there is a marked freshness and individuality of treatment, and the assistance of a number of experts, who have read particular chapters, has secured an enviable freedom from mistakes.

Having expressed our admiration of the outlook and workmanship of Prof. Hegner's book, we may direct attention to what appear to us to be blemishes. (*a*) Since no complete physico-chemical re-description of any vital activity has as yet been given, it seems to us a great pity to give young students a prejudice in favour of mechanistic theories. (*b*) Being indifferent to the curricula of American Universities, we cannot reconcile ourselves to an introduction to zoology which practically (and advisedly, of course) ignores the Vertebrates. Especially in a book which is so praiseworthy in its recognition of the animal mind, kept by most "zoologies" at a distance, does it not seem a pity not to have included some Vertebrate with a "big brain" if only to contrast it with the bee's, which is on a different evolution tack altogether? (*c*) It is probably beyond the reach of human endeavour to write a text-book of zoology without mistakes, and it is with a full and lively sense of our own fallibility that we ask Prof. Hegner to justify his statement that an anus is present in Ctenophora. We are not very sure about the cœlom of Nemathelminthes either, but "morphology is not specially emphasised" in this book. Besides, what have first-year students to do with cœloms? (*d*) In looking up the glossary to find what "evolution" meant, we found it was "a theory of development" (see p. 291). But this definition is obviously meant to be the counterpart of that of epigenesis which is given a few lines higher up, whereas p. 291 deals with evolution in the ordinary sense. In a definition given of heredity—a very doubtful one to our thinking—a reference is given to a work in which the definition cited was within inverted commas, and obviously not that of the author of the book referred to. But excepting (*a*) and (*b*) these are small blemishes in a work which it has been a pleasure to read, and which deserves a career of much usefulness.

FOREST FIRES.

Incendies en Forêt. By A. Jacquot. Translated by C. E. C. Fischer. Pp. xv+278. (Calcutta: Superintendent Government Printing, India, 1910.) Price 14 annas, or 1*s.* 3*d.*

THE title of this book, "Incendies en Forêt," is somewhat misleading, as it is in the main a general treatise on the valuation of forest property, and forest fires are only partially treated, in so far as their occurrence necessitates a correct mode of appraisement of the damages caused by them.

The first chapter deals with French law in relation to the punishment of incendiaries, and the legal duties of forest officers. Very little is said about the important subject of the prevention of forest fires. We learn, however, that in France fire is only dreaded in the pine forests of the Landes, and in the broad-leaved forests of districts like the Maures and Esterel, where an arid climate prevails. In Provence the compulsory preventive measures are the maintenance of open rides along the borders of the forest, and the clearing away of brushwood in belts four yards wide on each side of the roads and paths throughout the forest. In the Maures and Esterel, but not elsewhere, the railway companies are obliged by law to clear, at their own expense, belts ten to fifty yards wide on both sides of the permanent way. These fire-lines are too narrow to arrest the progress of fire, but serve as bases from which counter-fires can be started.

The bulk of the book deals with the valuation of forests at all ages and of all kinds, a difficult subject, treated carefully and with great detail. The author advocates what he styles the positive mode of valuation. The value of the land itself is estimated by comparison with similar land near at hand, and not by theoretical computations of its timber-producing capacity. The standing crop of merchantable trees is valued as they would be by a timber merchant, namely, by actual measurement of their volume and the price they would fetch in the local market. Young stock, of no actual sale value, is reckoned by discounting at the moment its estimated value at the time when it would be ripe for felling.

Many interesting facts and experiments are mentioned, especially with regard to thinning, which are worth the attention of British foresters. The author shows that thinnings properly executed in coppice—a practice never attempted in England—increase the final yield 50 per cent., and amply repay the small cost of the operation. He declaims against the dense stands of mature trees, which are common in high forests in Germany, alleging that these, although they show more stems, produce a less volume of timber. Thinning is much more drastic in French pine woods than in those of Germany. Pines are light-demanding trees, and heavy thinning secures to each individual the best conditions of light and nutrition, both height and girth increments being stimulated. Moreover, the thinnings yield a considerable revenue, often surpassing in value the final crop, and as this is available early, the rate of interest on the capital at stake is materially increased. Thinning is also necessary, where wind is dreaded, as it strengthens the root systems of the trees that are left. In Germany, it is usual to remove only the dead, decaying, and suppressed stems, whereas in France some of the dominant trees, though in full vigour, are removed. It is often believed that growth in height is stimulated by dense crops, whereas it has been proved by experiments that not only does thinning increase the diameter of the trees left standing, but it also increases their actual height, and improves the form of the stem, which becomes more cylindrical, with an enlarged canopy of foliage. The importance of dense woods at the outset is acknowledged by all, as by their shade the stems are cleaned of their branches, and timber free from knots is produced; but in the later stages of growth there is no doubt of the advantage of the system of judicious repeated thinnings. For oak and beech the effect is the same as for pine.

The disastrous effects of fire upon the soil of the forest is well illustrated by the author, who also enters at some length into the part played by the forest in lessening hailstorms in its vicinity, in improving farm crops by its shelter, and in preventing disastrous floods at a distance.

The book is remarkably cheap, only 1*s.* 3*d.*, and one cannot quarrel with the frequent misprints (*Cf.* p. 17, pendunculate for pedunculate, and holme for holm), and its occasional curious phraseology. It should be of great service in India, and can be read with profit by landowners and foresters in England. It is provided with eighteen pages of useful interest tables.

LIVING MATTER AND ITS FUNCTIONS.

The Evolution and Function of Living Purposive Matter. By N. C. Macnamara. (International Scientific Series.) Pp. xi+298. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1910.) Price 5*s.*

THE object of this book is to trace and explain the evolution of the functions of those elements of living matter which are essential for the manifestation of purposive, instinctive, and psychical phenomena. The book is divided into two parts; in the first the evidence is given which the author believes proves the gradual evolution of purposive action in protoplasm in the various classes of the animal kingdom, in the second the soundness of these conclusions is put to the test by giving in outline the leading characteristics displayed by the Irish Celts of County Clare—a long line of individuals who lived under conditions well adapted to show the power which their inherited qualities exercised on the actions of many successive generations and on the destinies of the race.

The author believes that protoplasm, even in the lowest living forms, exhibits characteristics which indicate the possession of purposive elements, and that these undergo evolution *pari passu* with those elements which constitute the structural parts of the organism. The author holds that even among the

Protozoa the response to stimuli exhibited by their protoplasm is not simply one of reaction to external stimuli, but is of such a nature that a *purposive* function seems to be postulated, and that protoplasm, even in very lowly forms, as undoubtedly is the case in higher ones, is able to store impressions—possesses, in fact, the rudiments of a memory. From the undifferentiated condition, the next step forward is the development of a rudimentary nervous system, such as occurs in the sponges, then the development of well-marked nervous tissue, its aggregation into ganglionic masses, and eventually the formation of a definite though simple nervous system is traced through the invertebrates, and, finally, the progressive evolution of a nervous system through the vertebrates, culminating in man with his elaborate psychical processes.

Although some would hold that the response of protoplasm to external stimuli is simply one of reaction, we think that the author's view of purposive action in addition is borne out by the facts cited, and that this is inherent in protoplasm, just as the tendency to variation appears to be. With regard to the second part of the book, we are not in a position to criticise its historical accuracy, but it makes interesting reading. The emotional and instinctive qualities displayed by the Irish Celts depends, according to the author, on their hereditary characters rather than on experience and on intellectual acquirements. The book is pleasant and instructive reading, and though here and there not altogether free from error, on the whole is a simple and well-developed exposition of the subject of which it treats.

ANIMAL PSYCHOLOGY.

(1) *L'Evolution de la Mémoire.* By Henri Piéron. Pp. 360. (Paris: Ernest Flammarion, 1910.) Price 3.50 francs.

(2) *Vorlesungen über Tierpsychologie.* By Prof. Karl Camillo Schneider. Pp. xii+310. (Leipzig: W. Engelmann, 1909.) Price 8 marks.

(1) M. PIÉRON'S book is a new addition to that excellent and deservedly famous series, the "Bibliothèque de Philosophie scientifique," and is quite worthy of its place. Its subject is, to say the least, a difficult one, being dependent on the careful interpretation of vast quantities of scattered observations and researches made by students of comparative psychology during quite recent years; but M. Piéron has produced out of this material, some of which is furnished by researches of his own, a volume which is not only compact and thoroughly sound, but also readable.

In an excellent introduction, he criticises certain definitions of memory that have been held in the past, and shows by the help of numerous and interesting examples the continuity, the complete lack of hiatus, in the succession of phenomena commencing with the inorganic memory shown in viscosity, hysteresis, &c., through biological memory, heredity, adaptation, &c., to psychological memory, which is frequently alone allowed the designation memory. The presence of consciousness in psychological memory is important, but not of that essential significance which the more metaphysically-minded among the psychologists are so fond of attributing to it. This is quite clearly shown in researches on the memorising of nonsense syllables (Ebbinghaus) where the curve representing the number of repetitions necessary for completely learning series of varying lengths is found to belong to the same type, to have the same mathematical equation, as that representing monomolecular autocatalytic reactions in chemistry, viz., $\log x = Kt + b$.

The contrast, in fact, is not between subhuman and human memory, but one between memory as it is for the individual himself as he enjoys it in consciousness, and memory as it manifests itself objectively both in himself and in his fellow-man.

The author proceeds to consider the phenomena more in detail, commencing with an interesting description of the "persistances rythmiques" displayed by both plants and animals. In the case of the latter, the best examples are given by marine animals, which live on the seashore and reproduce in their organic functions the rhythm of the tides. The rhythm persists when the animals are removed to a new, non-rhythmical environment, although an observer has found that this is not the case with young individuals that have not experienced the tidal rhythm. Piéron has some interesting comments and criticisms to make on the whole problem.

There follows a clear and concise account of the modern experimental methods of research employed to investigate the processes of adaptation and the formation of habits in animals, and the important researches of Thorndike, Hobhouse, Yerkes, and others are usefully summarised. A chapter on "sensory memory," full of experimentally determined results, completes the part of the volume allotted to subhuman psychology.

The last hundred pages of the book deal with specifically human memory, and summarise in small space an enormous number of experimental investigations. The author points out that the laws of rate of learning and forgetting admit of identical mathematical expression for animals and for men, for the different forms of sensorial and motor memory, &c. The curves correspond to the same general mathematical formula, viz., $y = A/K - B^x$. The non-correspondence of memory and intelligence is noted, and pathological modifications are adequately treated. With a useful chapter on the utilisation of memory, and a conclusion, written in more speculative mood, the book ends.

(2) Prof. Schneider gives in his series of published lectures a very full and decidedly original account of the subject-matter of animal psychology. Regarding the physiological mechanism of the nervous system as capable of producing summation of stimuli only, he finds himself forced to assume an active and efficient "Psyche" to explain most of the phenomena of his science. "Die Psyche assoziiert die einzelnen Eindrücke, die dabei ihre Selbständigheit wahren (Assoziationsorgan), während das Gehirn sie sum-

miert und dabei die einzelnen in ihrer Sondernatur vernichtet (Summationsorgan)" (p. 292). Final causes are postulated. "Ohne Berücksichtigung von Finalia ist ein Verständnis auch der einfachsten Amöbenhandlung unmöglich." His account of instinct, therefore, is through and through teleological. The ends pursued are not to be explained from experience, on one hand, nor are they explicable in terms of organisation as a product of evolution. They can only be accounted for in terms of an "Allgemeinbewusstsein," or "Weltvernunft," an absolute consciousness. Kant and Hartmann are referred to more than once, nor is Hegel omitted. Those men of science to whom metaphysics is anathema, and those (a class comprising much the same people) to whom it is a *terra incognita*, will reject much of the book as unsound. For others the book will be found full of suggestions and new points of view.

WILLIAM BROWN.

SCALE MOSSES.

The Liverworts, British and Foreign. By the Right Hon. Sir Edward Fry, G.C.B., with the assistance of Agnes Fry. Pp. viii+74. (London: Witherby and Co., 1911.) Price 2*s.* 6*d.* net.

IT is a pleasure to welcome the little volume on liverworts, to which scale mosses, as well as the more familiar Thallose forms, like Marchantia, belong. Sir Edward Fry has long been known as one who takes a keen interest in mosses, and this new little book on an allied group of plants will appeal to those amateurs who like to know something at first hand of the less easily studied objects of nature. In truth, the liverworts are fascinating plants, for they stand at the parting of the ways where the higher forms branch off from the lower series of primitive groups. They are, however, not easy to study, for they need a keen eye to detect them, and they are, many of them, very difficult to identify.

The authors have done good service in giving a popular and attractive account of the family. The variety of forms, no less than the suggestive differences in their organisation, pointing as it does towards higher vegetative development, will commend the group as a whole to the attention of many who may have avoided it on account of the difficulties which have to be surmounted in making a first acquaintance with the plants composing it.

When the book is critically examined there are not unnaturally points in which one may differ from the authors. The affinity between Calobryum and Monoclea is really artificial, and they are not generally regarded as closely related. Recent work indicates that the former is more naturally placed near Haplomitrium, whilst a considerable difference of opinion exists as regards Monoclea, some considering it as near the Marchantiaceæ, others as belonging to the Jungermanniaceæ in the wider sense.

As regards the origin of elaters, probably the Riccia-Corsinia series affords a better clue than the more specialised Anthocerotaceæ, but it may perhaps be argued that this is, after all, rather a matter of opinion than of proven conclusion. We feel inclined, however, to take exception to the comparison between the stomata of the grass-like sporophyte of Anthoceros and those of the thallus of Marchantia, which belongs to the other—the gametophyte—stage in the life-history. The similarity between the two organs is very slight, and although they perform the same function the mode of origin is quite different in the two cases.

But these are small matters in a book which is written for the amateur rather than for the professed botanist, though the latter will also find it worth reading. There are a few misprints which might be corrected—one of them, Trichcolea for Trichocolea, occurs several times—when a new edition is called for. In the meantime, we can congratulate the authors on having written an interesting little book on a difficult series of plants.

REFRACTORY MATERIALS AND PRODUCTS.

Fabrication et Emploi des Matériaux et Produits réfractaires utilisés dans l'Industrie. By Prof. A. Granger. Pp. iv+378. (Paris Ch. Béranger, 1910.) Price 15 francs.

THE scientific study of firebricks, furnace blocks, crucibles, and other refractory products is one of increasing importance. The progress of metallurgy, of glass-making, of pottery—even the development of the domestic firegrate—demands scientific, as opposed to rule-of-thumb, knowledge of refractory materials and how they may be best applied to the requirements of different industries. Although many excellent refractory products are made in these islands, the scientific study of the subject as a whole has received but little attention as compared with that given to it in Germany, France, and the United States. A few years ago Dr. J. W. Mellor, of the Pottery Laboratory at Stoke-upon-Trent, endeavoured to set up a committee for the study and standardisation of firebrick and refractory materials, and his work is now being carried on, we believe, by a committee of the Iron and Steel Institute, but it appears likely that some considerable time must elapse before we have an English text-book dealing with the subject as fully and as concisely as this French work.

Mr. Granger is well known as the professor of ceramic technology in the school attached to the State porcelain works at Sèvres, and in all his works one recognises the hand of the teacher who finds it necessary to compile a text-book for his students. This is at once the strength and weakness of such a volume. With the usual logical accuracy and perspicacity of a French writer, the author gives an excellent review of his subject. He treats of every variety of refractory material, fireclays, chromite, magnesia, and aluminous products, including the newest materials prepared for electric furnace work.

The book contains a series of excellent illustrations of the various forms of machinery especially adapted for the treatment of fireclays, &c., and the chapter on kilns and methods of firing, which are of extreme

importance in practical work, is excellent. The illustrations of gas-fired kilns, on pp. 81–4, should prove of great value to the English manufacturer, who, so far, has made little use of continental improvements in methods of firing.

The chapter dealing with pyrometry and pyroscopes is also well done, and the discussion of the value of the "Seger" cone is singularly clear and accurate.

We can cordially recommend the work to all who are interested, either as manufacturers or as users of refractory materials, and it would be a still greater pleasure to note the appearance of an English work as comprehensive in scope and plan.

WILLIAM BURTON.

BACTERIOLOGY: GENERAL AND SPECIAL.

(1) *Agricultural Bacteriology, Theoretical and Practical.* By Prof. John Percival. Pp. x+408. (London: Duckworth and Co., 1910.) Price 7*s.* 6*d.* net.

(2) *A Text-Book of General Bacteriology.* By Prof. W. J. Frost and Prof. E. F. McCampbell. Pp. xvii+340. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 7*s.* net.

(3) *Die Eisenbakterien.* By Prof. Hans Molisch. Pp. vi+83. (Jena: Gustav Fischer, 1910.) Price 5 marks.

(4) *The Sources and Modes of Infection.* By Dr. C. V. Chapin. Pp. ix+399. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1910.) Price 12*s.* 6*d.* net.

(1) WE have read this book with much interest. The plan of it is well conceived, and it will serve not only as a useful text-book on agricultural bacteriology, but also as an excellent introduction to general bacteriology for those who are non-medical and do not wish to specialise in the medical and pathological side of bacteriology.

In the opening chapters a general account is given of the bacteria, their physiology, morphology, and classification, and the methods employed in isolating, cultivating, and studying them. Fermentation and enzyme action are then briefly discussed, including putrefaction. Next an excellent account is given of the bacteriology of soil, of nitrification and denitrification, and of the fixation of nitrogen, and, finally, the bacteriology of manure, milk, cream, butter, and cheese is dealt with. Considerable space is rightly devoted to milk and milk products, and the subjects of the sources of bacteria in milk, the fermentations occurring in milk, the filtration, cooling, pasteurisation, and sterilisation of milk, milk and its relation to disease, milk standards, cream and cream ripening, the bacterial content, flavour, and defects of butter, and the ripening of cheese are adequately described. A final chapter is devoted to the yeasts and moulds. Throughout the book series of excellent practical exercises for the student to work out are attached to all the sections. A few errors appear which will need correcting in a future edition. The *B. lactis aërogenes* is described on p. 10 as Gram positive, on p. 275 it is correctly stated to be Gram negative; on pp. 46–7, dealing with the neutralisation of culture media, it is stated that most bacteria grow best when the medium contains 1 per cent. of free normal acid; this, however, is true only when phenolphthalein is used as an indicator, and such media are alkaline to litmus. On pp. 96–8 the term "proteose" has been substituted several times for "proteolytic enzyme," entirely obscuring the meaning, and on p. 116 "nitrogen peroxide" appears in place of "hydrogen peroxide." The book is clearly printed, and contains a number of appropriate and well-executed illustrations.

(2) The authors state that there is no work in English on the subject of general bacteriology with the exception of the translation of Fischer's "Vorlesungen," and have attempted to supply this want in the present volume. On the whole the matter is presented in a readable and accurate form. The preliminary chapters dealing with the history of bacteriology might have been somewhat extended with advantage, and the omission of any mention of Lister's work on the lactic fermentation seems unpardonable. The chapters summarising the structure and composition of the bacterial cell and the morphology and classification of the bacteria are excellent. The methods employed in bacteriology and the general physiology of the bacteria are detailed at some length, and in the final portion of the book the biology of specialised groups of bacteria are briefly described. We think the authors have succeeded in their endeavour, and have produced a book which will be of considerable service as a general introduction to bacteriology.

(3) This is a monograph on a group of micro-organisms of considerable biological and practical interest. A majority are thread-forming species, and differ essentially in this respect, and also in the fact that they form conidia, from the true bacteria. They live in waters containing iron and have the capacity of "attracting" the iron from its solution and of depositing it around them as ferric hydroxide, which stains them brownish-red in colour. Ulitmately the organisms die, sink to the bottom of the water, and cause the reddish-brown colour so often seen at the bottom of streams and ponds. It has been suggested that some of the iron-ore deposits have been formed by the activity of "iron bacteria" living in the warm waters of an ancient sea. They also cause rusting of iron pipes and conduits and masses of their growth sometimes mechanically obstruct the flow of water in pipes. Prof. Molisch has collected in this monograph the descriptions of the known species; and with the attached bibliographies, illustrations, and plates, and details for their investigation, it forms a valuable survey of the group.

(4) Although this subject is dealt with in works on medicine, epidemiology, and bacteriology, and a special work on it might be considered superfluous, a perusal of its contents has convinced us that Dr. Chapin has compiled an extremely useful summary. The life of disease germs outside the body and the conveyance of infection by contact, fomites, air, food and drink, and insects, are fully considered. An im-

portant chapter deals with "carrier" cases, and considerable stress is laid on this mode of the spread of infective diseases. The limitations to the value of isolation for the prevention of the spread of infectious diseases are critically discussed, and the conclusion is reached that isolation is of far less value than was formerly believed. Bacterial and protozoal diseases are both dealt with, and full references are given to the literature.

R. T. H.

CHEMISTRY FOR MATRICULATION.

(1) *A Class-Book of Chemistry.* By G. C. Donington. Pp. xi+399. (London: Macmillan and Co., Ltd., 1911.) Price 3*s.* 6*d.*

(2) *Chemistry for Matriculation.* By Dr. G. H. Bailey and H. W. Bausor. Pp. viii+548. (London: W. B. Clive, 1910.) Price 5*s.* 6*d.*

(1) MR. DONINGTON'S volume is a very interesting attempt to combine a practical course on modern lines with a descriptive text-book. The arrangement of the matter is distinctly original and has been carefully thought out. Discussion of more abstract topics, such as the atomic theory, Avogadro's hypothesis and valency, is postponed to a late stage in the book, while no chemical formula appears until p. 283. The preference thus given to a more descriptive treatment of the science is all to the good in an introductory class-book of this kind. In the early chapters the author deals very appropriately with the physical operations and physical properties which are used in the purification and characterisation of individual substances, such as solution, crystallisation, distillation, determination of melting points and boiling points, measurement of volume and density of gases. The first topics of a definitely chemical nature to which the reader is introduced are "acids and alkalis," "neutralisation," "rusting" and "burning," "active and inactive constituents of air," "elements and compounds." It must not be supposed that this descriptive treatment involves the suppression of the quantitative aspect of chemical changes. On the contrary, the author contrives in the earlier part of the volume to introduce the pupil by the way to the fundamental quantitative facts of chemistry.

While the general arrangement of the subject-matter is excellent, it may be doubted whether the author attains his object of providing a basis for teaching by research methods. With this in view, each topic is, as far as possible, introduced by the suggestion of experiments to be carried out by the pupil, these leading up to the solution of various problems. The paragraphs, however, in which appropriate experiments are indicated are followed by an authoritative description of all the facts bearing on the question. Various experiments, for instance, relative to the nature and cause of iron rusting are suggested, and the results obtained are supposed to enable the pupil to answer such questions as "Does iron rust in dry air?" "Does water *only* cause iron to rust?" "Is the rusting of iron a chemical or a physical change?" The correct answers, however, are supplied in the descriptive paragraphs which follow, and it is plain that the replies given by the pupil under such conditions cannot be unprejudiced.

The selection of practical exercises is excellent, and the course has stood the test of actual experience. The illustrations include portraits of such pioneers as Priestley, Lavoisier, Davy, and Faraday.

A curious error is the spelling of Avogadro's name throughout as Avagadro.

(2) The second volume under review belongs to the "University Tutorial Series," and is based on Dr. Bailey's earlier work, "The New Matriculation Chemistry." The authors aim at a combination of the heuristic and didactic methods of teaching, and practical exercises for the pupil are accordingly interwoven with the text.

The book begins with an introductory course in which "special care has been devoted to the treatment of the Laws of Constant and Multiple Proportions, Avogadro's Hypothesis, and the meaning and use of Chemical Formulæ and Equations." There is much, however, in the discussion of these topics that is open to criticism. Thus, for instance, Avogadro's hypothesis is described on p. 141 as a "law," the word molecule is used in different senses without any explanation, atomic weights are tabulated and used before the idea of "equivalents" is introduced, and hydrogen is taken as the standard of atomic weights. According to the preface, the book aims at providing a course of fairly detailed study in chemistry, and yet no information is given as to practical methods of deducing atomic weights from equivalents; there is, for instance, no reference to Dulong and Petit's law.

The choice of practical exercises to be performed by the student is not always wise. Dropping a piece of sodium about the size of a pea into water, and demonstrating the low ignition point of benzoline, are experiments which in the hands of beginners might have unpleasant consequences, while such exercises as the preparation of ethylene and the conversion of yellow phosphorus into the red variety are not suitable for the matriculation student.

J. C. P.

OUR BOOK SHELF.

Trattato di Chimica Inorganica generale e applicata all' Industria. By Prof. E. Molinari. Terza edizione. Pp. xvii+924. (Milano: U. Hoepli, 1911.) Price 16 lire.

WHEN the first edition of this work appeared in 1905 its many excellent and novel features were commended in the full review which was published in NATURE of February 29 of that year. That these qualities were widely appreciated is shown by the fact that a second edition was called for within a year, and a third edition is now being issued. The present edition contains a very large amount of new matter, above 200 pages having been added to the text, fifty-six of which belong to the general introductory section, and deal with such subjects as mass-action, equilibrium, dissociation, and the phase rule. That the revision of the special section has kept pace with the march of modern industrial development is shown by the very thorough alterations which have been made

in the text, owing to the introduction of new processes, for example, under such headings as the manufacture of liquid carbon dioxide, steel, cements, superphosphates, the fixation of atmospheric nitrogen, &c.

The revision here has been thorough, and many new illustrations, mainly photographs, have been added. The older statistical data, which formed so novel a feature of an elementary treatise of this kind, have been brought up to date. It is pleasing to note that the few misstatements pointed out in the review of the first edition have been rectified. A few misprints of names still occur, *e.g.* Rooseboom for Roozeboom (p. 870), "Lothian, Bell," (as two names) for Lothian Bell (p. 876), Gulber for Guldberg (p. 127), but such misprints are more or less inevitable in view of the very large number of proper names employed, and is not a serious blemish. The work is undoubtedly written by one with a full knowledge of his subject, and will prove useful to a large public, especially to chemical students, engineers, or others interested in the later developments of inorganic chemical industry; in it theory and practice are admirably blended. W. A. D.

Dizionario di Merceologia e di Chimica applicata. by Prof. V. Villavecchia. Terza edizione. Vol. i., A–M. Pp. xii+1558. (Milan: U. Hoepli, 1911.) Price 15 lire.

THE present volume is the third edition of a dictionary of commercial articles, produced in all the various branches of applied chemistry—in the widest sense of the term—ranging from such natural products as minerals and metals, fruits and seeds, oils and fats, through all the branches of applied chemistry upward to the most refined chemical, pharmaceutical, and alimentary preparations. Each article represents a concise monograph on the subject of which it treats. In addition to the Italian synonyms, the French, German, English, and Spanish equivalents are given. Each monograph details the origin, the description, and preparation for the market of the article; it describes the commercial qualities, characters, properties, composition, the adulterants frequently found therein, the most characteristic tests for purity, and the uses of each article. Then follow statistical data, information about market values, and, finally, data concerning specifically Italian conditions, such as import duties and imposts, and references to the Italian pharmacopœia.

The reviewer has selected at random a number of subjects with which he is specially familiar, and has found the information concise, trustworthy, and ably presented. This work must perforce interest the Italian student in the first instance. The fact that the present volume of 1558 pages, from Abelmosco (musk seeds) to Mussena (Massena), appears in its third, much enlarged edition, testifies to its usefulness to the Italian reader.

Annual and Biennial Garden Plants: Their Value and Uses, with Full Instructions for their Cultivation. By A. E. Speer. Pp. xx+256. (London: John Murray, 1911.) Price 7*s.* 6*d.* net.

THERE appears to be no lull in the demand for books on gardening if one may judge from the voluminous output of this class of article. It would seem scarcely possible nowadays for anyone not to be able to grow flowers, so clear are the directions and particulars given in numerous manuals. The book before us deals entirely with annual and biennial plants in the form of a glorified nurseryman catalogue. By de-describing it in this way, however, it is not sought to detract from the merits of the work, though it may be remarked in passing that the numerous illustrations, six of which are in colour, are so far inferior to those in the catalogues of our leading seedsmen that they might have been omitted with advantage.

The few pages of introduction give with admirable conciseness the essentials of garden craft for the particular class of plants of which the book treats. The rest of the book is a descriptive catalogue, arranged in alphabetical order, of the various species and varieties of annual and biennial garden plants. The author is to be congratulated on having given in nearly all cases the country of origin and date or introduction of the various plants mentioned, though in this connection the fact that *Tropaeolum minus* was introduced from Peru in 1596 might have been recorded, as it is one of the earliest known introductions to this country from South America. He is also careful to give the natural order of each plant and synonyms, as well as the derivation of the generic name in every case, so that for these features alone Mr. Speer's book deserves a place on the shelf of every garden-lover's library.

Full details as to the procedure to be adopted in the sowing of seeds and subsequent treatment of the seedlings are given at the end of the account of each genus.

Paints for Steel Structures. By Houston Lowe. Fifth edition, revised. Pp. 115. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1910.) Price 4*s.* 6*d.* net.

THIS is a new edition of Mr. Lowe's book, and gives a popular description of the present-day knowledge and experience as to the painting of iron and steel structures. The best method of painting such structures has been for some time attracting the attention of chemists and others in the United States, where a large amount of experimental work has been done, and some very curious and interesting results have been arrived at. Mr. Lowe is familiar with these various experimental tests, and has brought the results together in a convenient and popular form in his little book. There are, of course, a great many interesting chemical problems lying behind the question of the painting and rusting of iron and steel structures, which cannot yet be considered as having been solved, and therefore much that can be said in a book of this kind is tentative. On the other hand, the experience gained by experimental tests, although sometimes difficult to explain scientifically, is of value to the practical man, and guides him as to what it is best to do.

The book, therefore, can be recommended to architects and engineers who have to deal with the painting of iron and steel structures, as they will get a great deal of information in a simple form which will assist them in drawing up specifications for such purposes. A. P. L.

Chemistry of Food and Nutrition. By Prof. H. C. Sherman. Pp. viii+355. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1911.) Price 6*s.* 6*d.* net.

THIS is a useful book; it contains numerous data on the properties, composition, and calorific value of the principal articles of food, and an up-to-date description of the scientific principles on which a dietary is constructed, and how it can be adapted to the varying needs of the organism. The author has a clear way of putting his points, and has exercised much judiciousness in not overwhelming his readers with too many arguments on disputed points; he has carefully selected his authorities, and the quotations he cites are apt and sufficient. On the controversial subject of the amount of protein necessary for an adult in the day he carefully splits the difference between Voit and Chittenden, and places the amount at 75 grams. The book is well worth careful perusal. W. D. H.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

The Racial Problem in Nubia.

IT has been objected that the sketch of the history of Nubia given in the article on "The Unveiling of Nubia" in NATURE, April 27, p. 283, does not agree in every particular with the accounts given by Mr. Firth in the sixth Bulletin of the Archæological Survey of Nubia, p. 8, and by me at the Sheffield meeting of the British Association and in several lectures during the past year.

It must be remembered, however, that the notice in NATURE was a review of the published account of the results obtained by Dr. Reisner during the first season's work of the Archæological Survey, and it did not come within the scope of the reviewer's task to describe the attempts that have been made during the last three years to throw further light upon the significance of the facts set forth in Dr. Reisner's report.

It may prevent such misunderstanding, however, if a brief statement is made of the bearing of recent investigations upon the meaning of the facts brought to light in Nubia. It is not without significance that the archæologists, studying in Nubia the handiwork of the ancient people, and the anthropologists, as the result of the examination in England of the remains of the Nubians that have been sent over here, have arrived quite independently and without collusion at the same interpretation of the significance of the story the pottery and the bones respectively have to tell.

Mr. Cecil Firth's statement of the views of the archæologists will be found in the sixth Bulletin (*op. cit.*).

The working hypothesis that I set up last summer, when all the facts derived from the study of the human remains were being collated for the first time, is not only borne out by the archæological evidence, but has been found to be in full accordance with all the facts which further detailed study of these ancient Nubian remains has brought to light.

It is now quite clear that in pre-dynastic times there were scattered throughout the Nile Valley, not only in the territory we call Egypt, but also much farther south, many groups of people linked to the pre-dynastic Egyptians by the closest bonds of affinity, and also sharing with them a common cultural inheritance. Until the beginning of the period of the Pyramid-builders no difference can be detected either in the physical characters of the people or their achievements on the northern (Upper Egypt) or the southern (Lower Nubia) side of the First Cataract. But as the marshy territory of Egypt was drained, and the extent of its rich habitable land was thus increased ten-fold, there was a movement of population from the barren country above the First Cataract into the more fertile north.

But when the proto-dynastic Nubians emigrated into Egypt their place in Nubia was taken by the next member of the group of peoples that were scattered serially throughout the Nile Valley like beads on a string. As the result of the first season's work in Nubia, the only obvious explanation of the state of affairs revealed in these Nubian graves of the time of the Ancient Empire—the B-group of the archæologists—was found in the hypothesis that the original population of Nubia became tainted with negro blood and fell away from the high standard of culture and technical skill attained by their forefathers. The facts then available did not justify any other explanation. But in the light of the fuller knowledge now in our possession, it is evident that the B-group people were not the direct descendants of the A-group or pre-dynastic Egyptian population of Nubia, but the next bead on the string; in other words, they were members of the southern community of kindred people, next in order in the Nile Valley south of Nubia; and there is no reason to suppose that they had lost any cunning possessed by their ancestors, but rather that they had not kept pace with their northern brethren in the advance of the latter in the paths of civilisation. The evidence for this view is abundant and manifold in kind. I need mention only one fact here—the almost complete absence, among the human remains of the B-group people, of pure negroes, while the whole population is very definitely more negroid than the Egyptians, can only be explained on the hypothesis that the process of admixture took place farther south.

After the time of the Ancient Empire, the next bead on the string—the C-group of the archæologists—was moved north into Nubia. These Middle Nubians, as we call them, were also obviously akin to the pre-dynastic Egyptians, and their burial customs and pottery were clearly derived from the same source as those of the Egyptians: but it is equally certain that the two populations, the Egyptians and the Middle Nubians, had developed along divergent lines. Moreover, the undoubted specialisation of the physical characters of the people, no less than of their arts and customs, was emphasised by the introduction of an exotic African element into the C-group people. They became more definitely negroid than either the A- or the B-group peoples, and their pottery exhibits, no less clearly than their bones, the influence of the negro.

Mr. Firth summarises the archæological statement in these words:—"The theory tentatively advanced in the second annual report that the C-group people represent a later wave (greatly modified by Negro influences) of the same race which founded the Pre-dynastic culture of Upper Egypt, is based on certain affinities in burial-custom and pottery-making, and requires the confirmation which a careful examination of the physical character of the human remains can alone give." The human remains have supplied this confirmation, and they did so before we were aware of the fact that Mr. Firth was asking for the support of the evidence they afford.

His further statement that "the connection between the B- and C-groups does not seem to be very close and a comparison of the two would suggest an independent origin of the C-group" may seem to suggest that there was a much wider hiatus separating the Middle Nubians (C-group) from the earlier inhabitants of Nubia than there was to divide the two groups (A and B) of the latter the one from the other. There can be no doubt there was a much greater contrast between the C-group culture than separated those of its forerunners in Nubia: but it is equally certain that the B-group people, interposed both in time and locality between the A-group (distinctively Egyptian) and the C-group (distinctively Nubian), were much more strongly influenced culturally by the higher civilisation of the former than by that of the latter. Thus the Archaic Nubian (B-group) culture has the appearance of being the direct offspring of the Archaic Egyptian (A-group), but the people themselves form a unit as distinct from its forerunner (A-group) as it is from its successor (C-group).

There is a considerable mass of evidence to suggest that, just as the B- and C-groups represent successive waves, respectively, *circa* 3000 B.C. and 2000 B.C., which moved northward in the Nile Valley, the early pre-dynastic people in Egypt were largely reinforced, perhaps about 4000 B.C., by a precisely similar wave or rather concentration of the scattered primitive Nilotic people in the most desirable part of the Nile Valley.

In these notes I have attempted to suggest the present trend of our investigations without doing more than merely hinting at one out of a multitude of varied kinds of evidence indicative of the northerly trend of the Hamites in the Nile Valley, leading to a concentration in Egypt.

G. ELLIOT SMITH.

Manchester, April 29.

Inheritance of Row-numbers in Maize Ears.

IT is well known among maize-growers that the number of rows of grain on an ear of maize varies from 8 to 24, or even more, according to the breed; also that in the same breed the number may vary within certain limits, *e.g.* 8, 10, or 12 in some breeds, 12, 14, 16, or 18 in others and 18, 20, 22, or 24 in yet others. In some breeds the range of variation is even greater than I have indicated, while in others it seems to be more closely limited. In some breeds an ear carrying more than 8 rows is considered untrue to type, but I am not aware that any

South African grower has yet succeeded in fixing the number of rows in any breed to such a degree that *no variation* occurs in that respect.

In the course of a series of breeding experiments I am conducting, which are not yet completed, I have met with the following interesting case.

Thirty-three plants of "Arcadia" sugar-maize, each of which bore two well-developed ears, were studied as regards number of rows. On 21 plants the number on the upper ear was different from that on the lower, while on 12 plants the number was the same on each ear. Of the 21 plants on which the number of rows differed on the two ears, 13 had a larger number on the lower than on the upper, while 8 had a smaller number on the lower than on the upper. The distribution of rows was as follows:—

Class	Upper ear	Lower ear	Number of plants	Number of plants in each class
As many rows in lower as in upper	12	12	8	—
	10	10	3	—
	8	8	1	12
More rows in lower than in upper	10	14	1	—
	10	12	6	—
	8	12	3	—
	8	10	3	13
Fewer ears in lower than in upper	12	14	1	—
	12	18	4	—
	10	8	3	8
				33

Summary.

8	8	1	—
	10	3	—
	12	3	7
10	8	3	—
	10	3	—
	12	0	—
	14	1	13
12	8	0	—
	10	4	—
	12	8	—
	14	1	13
			33

The total number of ears producing any given number of rows was as follows:—

Rows	8	10	12	14	
Ears	11	23	30	2	Total 66

The "Arcadia" is a white sugar-maize obtained from a cross between a normally 8-rowed "Black Mexican" and a white flour-corn normally bearing a larger number of rows, but I do not know that either was pure bred, for row numbers and no subsequent selection in this line had been made.

It is generally supposed by maize-growers, in this country at any rate, that the number of rows is a definite, heritable character. Results obtained by crossing two other breeds, an 8-row and an 18-row (each believed to be pure as regards this character), have this year produced irregular results in the F_1 generation, for which I have not yet been able to account. However, the case described above seems to indicate that the development of rows is, within certain limits, a vegetative character depending in part on seasonal conditions and on food supply. This view is strengthened by the fact that this is the first year in which I have noticed 14-row ears in this breed, all the parent ears for two or three generations having been 8-, 10-, or 12-rowed (so far as I am aware). At the same time, there is ample indication that, within certain limits, row-numbers are inherited in the maize plant, but it is doubtful whether any South African strains are yet sufficiently pure-bred for this character to demonstrate the point with absolute certainty.

JOSEPH BURTT-DAVY.
(*Government Botanist.*)
Department of Agriculture, Pretoria, April 17.

Absorption Markings in "K" Spectroheliograms.

IN a letter published in NATURE of March 30, Mr. Buss suggests that the evidence derived from some spectroheliograms taken by M. Deslandres at Meudon conflicts with that which I obtained from the Kodaikánal daily series.

There is no such "divergence of evidence" in reality. The dark marking shown on our plates of March 21, 1910, and described as vague and ill-defined, is doubtless much more clearly seen in the plates obtained with the Meudon high-dispersion spectroheliograph, which isolates the central absorption line K_3.

With the dispersion available in the Kodaikánal instrument, the K_3 line is about half the width of the camera slit, and photographs taken with the slit exactly central on K integrate the light of the absorption line and of the side components of the emission line K_2. As the dark flocculi or absorption markings seem to be entirely due to variations in intensity in the narrow absorption line, it is rather a matter for surprise that in our photographs they should be so clearly defined in many cases. In the original negatives taken on March 21, 1910, in addition to the broad, ill-defined shading already mentioned, there are clearly seen all the curious linear markings so beautifully shown in M. Deslandres' K_3 plate of this date, and I can find no appreciable differences in the contours of the markings.

With regard to the disappearance of the enormously extended marking between March 25 and 26, had Mr. Buss read the paragraph in my article referring to this with ordinary attention, he would not have suggested that the absence of the marking on the plate of March 26 was due to imperfect adjustment of the spectroheliograph slits. Very possibly the disappearance shown by our plates was not absolute, and K_3 or $H\alpha$ plates taken on the same day would have shown the marking, but if so the reduction in intensity compared with the previous day would have been marked.

The theory apparently advocated by Mr. Buss, that the absorption producing these markings takes place above the prominences, receives no support from our visual or photographic observations, and his remarkable observation of a dark flat cloud hovering over the bright prominence at each successive appearance east or west seems to be unique! No trace of so extraordinary a feature can be seen on any of our numerous photographs of this prominence.

J. EVERSHED.
Kodaikánal Observatory, April 18.

Calendar Reform.

MAY I trouble you with one or two observations on the excellent article which appeared in NATURE of April 27.

Referring to the application of the principle of the *dies non*, or the setting aside of a day annually not included in the weekly enumeration, the author of the article says "the week can boast a most ancient lineage uninterrupted by the slightest break." Is this certain? I find Dr. Hale in his "Chronology," vol. i., p. 67, says:—"If the year of the Crucifixion was A.D. 31, as is most likely, it follows from an eclipse of the moon in Pingre's tables, April 25, at 9 afternoon, that the Paschal full moon that year fell on March 27, which in the calculations of Newton, Ferguson and Lamy, and the computation of Bacon is reckoned *Tuesday*," &c. I might adduce other reasons for doubting if the continuity of weeks has been uninterrupted. It must be remembered that for some time, at any rate, throughout the Roman Empire the odd day in leap year was treated as a literal—not merely as a legal—*dies non*, being regarded as part and parcel of the day preceding.

Nevertheless, I agree with the author that prejudice in this matter cannot be disregarded.

But no such objections can be stated to the proposal to apply this principle to the *months*, *i.e.* to treat the 365th and 366th days as without the monthly enumeration, and to equalise so far as possible the lengths of the months so as to give four quarters of 91 days, or 13 exact weeks.

It is hopeless to suggest that the present arrangement of months has any scientific or religious sanction or advantage.

I hope shortly to present to the public more fully the arguments in favour of this really non-contentious part of

the proposal, to which in the first instance I think the reform should be confined.

Astronomers are apt to ask, *Cui bono?* But though the advantages of such a simplification would to them be small, they would be enormous, innumerable, and universal to the lawyer, the statesman, the banker, broker, &c.—indeed, to public business, commerce, and education in all civilised countries.

If without infringing any scientific principle or violating any religious symbolism benefits so general can be conferred so easily, I feel sure that scientific men will not stand in the way. Indeed, many of them are in the forefront of the movement.

What we want is a simply natural and naturally simple scheme. I am afraid that suggested by your correspondent—very ingenious as it is—is for that reason unsuited for general use. ALEX. PHILIP.

The Mary Acre, Brechin, N.B.

FROM Mr. Philip's letter it appears that he, at all events, is conscious of the grave difficulties in the way of interrupting the continuous succession of the days of the week. It would be idle, therefore, to argue this point further, or to insist in greater detail on the importance of what Laplace called "peut-être le monument le plus ancien et le plus incontestable des connaissances humaines" (la semaine).

The date of the Crucifixion depends on questions relating to the Jewish, not the Christian, calendar. Now it seems incredible that the Hebrew communities have failed to maintain the order of the Sabbath without a break. If this be granted, the only deduction to be drawn from Mr. Philip's argument is that the Crucifixion did *not* occur in the year 31; which, indeed, according to the most recent chronological view, is most highly probable.

Mr. Philip's argument in favour of equalising the months will be received with interest when it appears. When, however, it is realised that the suggested change will not give us a fixed calendar, it may be doubted whether this minor adjustment, free from objection as it may be, will be found to have the necessary driving force behind it to secure its adoption. H. C. P.

A Zenith Rainbow.

AN interesting rainbow was visible from the Bruges-Ostend canal here at 4.30 p.m. on April 17, in fair weather, almost due west.

The sight at once evoked the expression that the bow was inverted. It was clearly visible for several minutes, and subtended an arc of about 20°.

On shielding the eye from the direct light of the sun, this arc was seen to extend much farther, and formed part of a circle with the zenith as apparent centre, the radius of the circle being estimated from 10° to 15°.

The inside of the bow was violet, the colour following the usual order to red; the intermediate colours were, however, not characterised by the sharpness often seen in the ordinary rainbow.

The state of the sky at the time was misty near the horizon, but otherwise brilliant with high fleecy clouds, with a light wind from N.N.W.

The bow was backed by a thin broken cloud, which presented a "curtain" formation as far as the angle of the sun.

No rain was observed to fall at the time or during the day. No primary or secondary bow was visible, which, among other things, excludes the idea of the bow observed being a tertiary one.

It would be interesting to know whether this type of bow is of frequent occurrence. K. C. KREYER.

7 rue des Lions, Bruges, Belgium, April 18.

IT appears from Mr. Kreyer's description that the phenomenon observed was the upper arc of contact of the halo of 46° radius. The altitude of the sun was about 24° at the time, so that the height of the point of contact would be about 70°, and the centre of the arc, accepting your correspondent's estimate of 10° or 15° radius, would be at an altitude of 80° to 85°. The phenomenon is described by Pernter as the most beautiful of all halo phenomena, and it occurs often when no trace of the 46° halo is visible; the colours, with the exception of the violet, are definite and brilliant, with the red towards the sun. The violet seen by your correspondent is more rarely present. The cloud with "curtain" formation was probably cirro-stratus, and would be formed by the ice crystals which give rise to halo-phenomena.

The bow observed is not of frequent occurrence (about seventy had been observed up to 1883), and it is interesting to have a record of it. E. GOLD.

Meteorological Office, South Kensington,
London, S.W., April 27.

Daylight Saving!

THE following aspect of the Daylight Saving Bill does not appear yet to have been noticed.

A man who is accustomed to rise at 9 a.m., lunch at 1.30, dine at 7.30, and go to bed at 11.30 will naturally object to turning out of bed an hour earlier on a dull, grey, cold April morning. So, when the clocks are put forward, he will consider that the change is only nominal, and will continue to follow the old hours, rising at 10, lunching at 2.30, dining at 8.30, and going to bed at 12.30. When, however, the clocks are put back the weather is getting bad, and the pleasantest part of the day is after the blinds have been drawn and the gas lit; he will be glad of the extra hour's sleep in the dark morning, and the increased fireside comfort in the evening, and will be so accustomed to regard 10 o'clock as the time for getting up, 2.30 as lunch time, 8.30 as dinner time, and 12.30 as the time for going to bed, that he will certainly not want to go back to the old clock reckoning. Thus "daylight saving" will mean a saving of an hour's daylight in the dark winter months and a gain of an hour's gaslight.

"THE VOICE OF THE SLUGGARD."

DAYLIGHT AND DARKNESS.

WHATEVER may be thought of Mr. Willett's so-called daylight-saving scheme, it is impossible not to admire the persistence with which he pursues the idea, and secures support for it from city corporations, town councils, chambers of commerce, members of Parliament, and other people who are attracted by the advantages offered, and do not realise how unscientific the scheme is, or the gravity of the objections to the adoption of a variable standard of time-reckoning. We do not believe for an instant that the Government is likely to give facilities for legislation on the lines of the Summer Season Time Bill, however sanguine the promoters of the Bill may be As, however, a meeting at which the Lord Mayor presided, and the Home Secretary spoke, was held at the Guildhall on May 3, it is worth while to consider again some aspects of the proposals usually overlooked.

The promoters of the Bill have circulated a mass of literature, in which the advantages are emphasised and the objections disregarded. Among these communications is an article contributed to *Die Woche* by Dr. E. von Engel of Berlin, who supports warmly the proposition of accommodating the standard meridian of Greenwich to that of Berlin or Mid-Europe. We have no doubt he is perfectly sincere in his recommendation. At the same time, the advantages of making the hours of business in England coincide with those in Germany is entirely in favour of the latter country.

In consequence of this renewed earnestness and vigour of the daylight-saving movement, it is desirable to express, concisely and decisively, some fundamental objections to a scheme which can be made to present so much that is agreeable. This is the more necessary because there is a feeling that scientific men are inclined to display a selfish regard for their own convenience, and a contemptuous indifference to

national requirements and economy. It is needless to say that such a view completely misrepresents the character of the scientific objection to the scheme. Let us admit, as fully as the most ardent of the supporters of Mr. Willett's scheme could wish, that the acceptance of his proposed legislation will do all that he demands for it: that it will give London 154 more daylight-using hours in the year, that it will reduce the lighting expenses in all industrial operations, that it will improve the health of the nation and be productive of other advantages. It is still incumbent upon the promoters to show that the machinery which they propose is the best adapted to the end in view, and that it will be effective. Our contention is that they have sought to effect the amendment they desire in an objectionable manner. Our lives, duties, business, and pleasures are not uniformly distributed throughout the hours of daylight. Then let us have a more systematic arrangement. What should be aimed at is a modification of our habits on judicious lines. It should be the business and the effort of Mr. Willett and his friends to cultivate a more enlightened public opinion, to persuade people to adopt more rational customs. He has tried to get a desirable result by a wrong method; we might say, by a disingenuous method.

Of course, it may be argued, as Dr. von Engel does, that "No society, however powerful, would be able to induce a universal movement for early rising for increasing our enjoyment of the sunlight." If not, why not? What has been the determining factor by which the conduct of life has been continually shifted later in the day? It is not impossible that the preference for the afternoon has been brought about by the necessity or convenience of regulating life not by light, but by heat. The heat meridian does not coincide with the light meridian, but is some two hours or more after it, and the day is arranged apparently so as to make available the greatest amount of heat. Mr. Willett asks us to disregard this effect. He does not seem to see, or at least does not admit, what is perfectly obvious to all who have given the matter sufficient consideration, that if more light is utilised in the morning, there is also a lower temperature to be encountered. To have to burn a fire in the early morning would be a very decided set-off to the use of less artificial light at night. But on this view we do not insist. We are content to make the point, that heat as well as light should be considered, and that its importance in the comfort of life cannot be neglected, as is shown by the social arrangements that obtain in other countries of Europe, as well as in the Tropics. But perhaps the promoters of the scheme for periodically changing the standard meridian contemplate also a seasonal variation of the thermometer scale. It would be just as reasonable for Parliament to enact that, in certain months, a temperature of, say, 60° should be called 70°, as it would be to agree that for a certain part of the year 6.0 o'clock should become 7.0 o'clock.

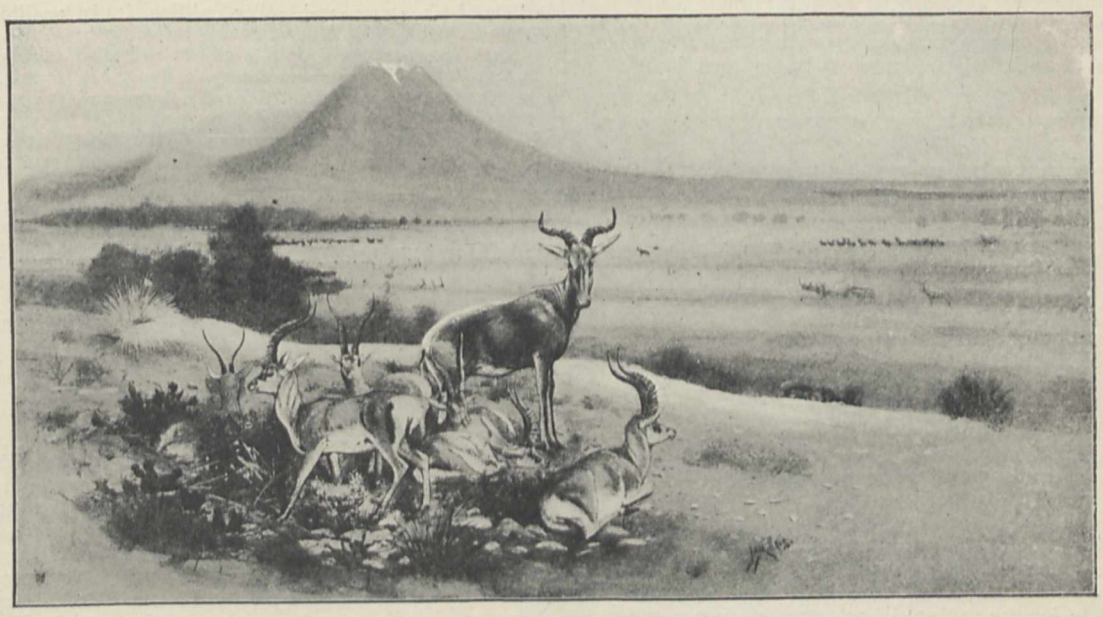
In his speech at the Guildhall, Mr. Churchill referred to some points upon which we have a few words to say. He mentioned that the agricultural population of the country already make full use of daylight hours in the various seasons, and that thousands of firms and offices (he might have included the Board of Education) have different working hours in summer and winter. A not inconsiderable number of people thus solve the problem in the most reasonable way by adapting their habits so that the best use is made of daylight. This would seem to provide an argument for urging similar action upon other sections of the community, but scarcely furnishes a reason for compulsory alteration of the clock upon days prescribed by Act of Parliament. It is only in a great city like London that individuals whose hours of work and leisure vary with the seasons can be said to suffer any difficulty or inconvenience because, as Mr. Churchill said, they are "out of contact with the customary time-table of the nation." There is no general time-table of life and labour followed in the United Kingdom as a whole. The "customary time-table" of London differs as regards evening meals and amusements from that of nearly all other cities in the kingdom, being an hour or more later than is usual in most provincial towns. If custom is to be considered in the scheme for the division of daylight and darkness, then London will require the clocks to be advanced by two hours to be placed in the same position as most places in the provinces where the clocks would be put forward for one hour.

It is also forgotten by the promoters of the scheme that the daylight hours of London and other places in the same latitude differ considerably from those of places farther north. At Aberdeen, Dundee, and Edinburgh, for instance, lighting-up time for vehicles in the present month is about 35 minutes later than in London, and next month it will be three-quarters of an hour later, that is, about 10.0 p.m. Scotland has, in fact, a natural extension of the daylight hours in the summer months without any need for legislation. At Edinburgh and all places north of it, there are not sufficient hours of darkness in May, June, and July for the normal eight hours of sleep required by men or women, and there would be no advantage in advancing the clocks by an hour from the third Sunday in April to the third Sunday in September. The 154 hours "more daylight" which Mr. Churchill says would be secured by the scheme "to the whole people of these islands," are already possessed by the people of Scotland between April and September. Why not suggest, therefore, that for certain months of the year the latitude of Edinburgh shall be the latitude of all other places south of it in the United Kingdom, instead of proposing that the longitude of Berlin shall be the longitude of Greenwich?

Another point referred to by Mr. Churchill was the ease with which the change of nine minutes from Paris to Greenwich time was effected recently in France. It is difficult to understand how this action can be held to afford any support to the scheme of "daylight saving." Our own view is that, as France has now adopted the Greenwich meridian as its standard for time-reckoning, it would be an unfriendly and injudicious act for us to abandon Greenwich time for German time during an arbitrary period of the year. France has now come into line with the international system of time-reckoning based on standard meridians beginning with the meridian of Greenwich and extending round the whole civilised world. These meridians are permanent standards at present, but if the principle of the daylight-saving scheme were accepted they would oscillate east and west on different dates, and hopeless confusion would be introduced in the place of a scientific system.

The fact that it is easy to advance one's watch by an hour when entering the zone where Mid-European time is kept, and to put it back an hour when leaving the zone, provides no argument for the alteration of the time of the United Kingdom twice a year. When you move fifteen degrees east you really do reach a longitude at which the time, as indicated by the sun's position, is an hour in advance of Greenwich time. Noon occurs nearly an hour earlier at Berlin than at Greenwich, whatever

standards of time are adopted, so it is natural to adapt one's watch to the new conditions when reaching Germany. By the daylight-saving scheme, 11.0 Greenwich time would be called 12.0 noon during the summer season; that is to say, the sun would be considered to have reached its highest point for the day an hour before it actually does so. Of course, we remember that there is a difference between apparent time and mean time, but the variation of the equation of time does not effect the affairs of everyday life. When, however, it is proposed that Parliament should grant powers to enable the people of the United Kingdom to pretend that during summer months noon at Greenwich corresponds to noon in the neighbourhood of Berlin, it is time the absurdity of the scheme was exposed. The scheme is unworthy of the dignity of a great nation, and if it were made compulsory by legislation, it would be a monument to national flaccidity. We cannot think that the Government will lend its support to proposals which involve more international consequences than the promoters are aware of, and would make us the laughing-stock of the enlightened people of the world.



Tora Hartebeest and Grant's Gazelles. From "The Encyclopædia of Sport."

THE NEW ENCYCLOPAEDIA OF SPORT.[1]

FROM a biological point of view two articles in this issue are especially noteworthy, namely, one on the Arabian horse, by the well-known breeder, Mr. W. Scawen Blunt, and one on grouse disease, by Dr. Shipley. The former stands as it was in the first edition, the author stating that he has practically nothing to add or alter. Its special interest lies in the fact that the author still maintains the theory that the Arab horse, in place of being a comparatively late importation, originally existed in a wild condition in the comparatively desert districts of Nejd and the central plateaus of Yemen. On the other hand, such historical evidence as exists does not indicate that the natives of Arabia were in possession of tame horses at a very early period, and this seems to weigh considerably against the idea of the former existence in the country of a wild race.

The article on grouse disease, to which Dr. H. B. Fantham contributes the section on the coccidiosis of young birds, has been written specially for the present edition, and is therefore thoroughly up to date, although the author is careful to add that many of the inferences and conclusions referred to must be regarded as more or less provisional. This contribution, which is well and profusely illustrated, is thoroughly worthy of its author, but since Dr. Shipley's investigations into grouse disease have been already reported in NATURE, further mention is unnecessary.

The other articles on natural history subjects display that pleasing variety of treatment to which allusion was made in my review of the first volume. For instance, whereas Mr. Bryden, in the article "Deer" (which appears to have been compiled from the "Deer of All Lands"), treats his subject almost exclusively from a zoological point of view, the writers of "Elephant" confine themselves mainly or entirely to the sporting aspect of their theme, making no reference to the local races of the African species. On the other hand, in the article "Giraffe," Mr. Bryden does record most of the local forms of that species. Need of revision in the article last mentioned is evident from the repetition of the old statement (which was not true previous to the discovery of the okapi) that "the giraffe forms a distinct family of its own." Neither is Mr. Selous quite faultless when writing of the African elephant, since he repeats the old error of this species being "somewhat less in bulk and stature than either the mastodon or the mammoth." Nomenclature is also, as in the first volume, distinctly erratic, Mr. Bryden, in the article "Deer," denominating the Chilian guemal *Mazama bisulca*, whereas Mr. Hesketh Prichard, in the article "Guemal," calls it *Xenelaphus bisulcus*.

That the editor has endeavoured to bring the biological articles up to date is, however, quite evident, as, in addition to the already mentioned article on grouse disease, there is one, by Mr. Bryden, on the African forest-hog (Hylochœrus), a genus originally described in NATURE. In this effect he

[1] The Encyclopædia of Sport and Games. Edited by the Earl of Suffolk and Berkshire. A new and enlarged edition. Vol. ii. Crocodile Shooting—Hound Breeding. Pp. viii+448. (London: W. Heinemann, 1191.) Price 10s. 6d. net (abroad 12s. 6d. net).

may be said, on the whole, to have been fairly successful, for, in spite of slips and inconsistencies like those just referred to, the average sportsman will find practically all the information to be expected from a work of this nature in regard to most of the animals of which he may be in search, and as the work is essentially one for the sportsman, this is really all that can be legitimately demanded.

From first to last the volume is thoroughly well illustrated, both as regards plates in colour and text figures, some of the latter, as exemplified by the one herewith reproduced, being really exquisite.

As regards subjects other than natural history, the articles, so far as I am capable of judging, are all that they should be, and as most of them are written by experts, they bear the imprimatur of authority. Of those in which I am personally much interested mention may be made of Mr. Rawdon Lee's "Dogs," which contains precisely the sort of information suitable to those who are not specialists in canine matters. If the all-round lover of sport, in the widest sense of the word, is not thoroughly well satisfied with the volume as a whole he must be very hard indeed to please. R. L.

WHEATS AND FLOURS.[1]

REPRESENTATIONS having been made to the Local Government Board by various medical officers of health and public analysts on the growth of the practice of bleaching flour, and stress having been laid on the prohibition of bleaching in the United States of America, Dr. Hamill received instructions from the Board to make inquiries as to how far the practice obtains and to what extent, if at all, it is justifiable. In this report, after indicating the sources of supply, he describes the milling of wheat and grading of flour; then, after indicating what are the factors determining the quality of flour, he proceeds to discuss bleaching processes and their effect.

In roller milling the production of flour is a gradual operation. The wheat passes through a series of fluted, chilled, iron rollers, the product from each pair being sifted before passing to the next; at each stage the fragments of endosperm, as they pass through, are further reduced, and the flour separated out. It is possible for the miller either to collect in one portion the whole of the flour produced, the mixture obtained being termed a "straight run flour"; or he may separate it into two or more portions, the one being derived from the first two or three pairs, the other from the last pair, of rollers. Flour is arbitrarily graded into "whites" or "patents," representing the product from the first few rollers, and "households," representing the rest of the flour; a further subdivision is made when required. There is a difference in price of as much as 5*s*. or 6*s*. per sack of 280 lb. between the highest and lowest grades.

Millers in this country have to deal with wheats coming from all parts of the world, and some of them acquire great skill in so blending and milling the wheats at their disposal as to produce a flour of absolutely uniform behaviour in the bakehouse throughout the year; this is a matter of the very greatest importance to the baker, who has learnt to appraise the market value of flour from its baking qualities and appearance. For many years past the baker has had to satisfy the demand for a very white loaf, especially on the part of the operative classes.

Dr. Hamill might with advantage have considered this point in greater detail; the demand arises apparently in part from prejudice, dating from a period when cheap bread was very much adulterated and dark in colour; it is in part based on the fact that the whitest bread, as a rule, is the lightest in texture and the most digestible. Colour in bread is probably more a question of optics than due to the original colour of the flour—a yellow, strong flour will often make a whiter loaf than a weak, very white flour. The baker attaches importance not merely to colour, but to freedom from specks of offal or dirt. Stone milling has been almost superseded by the more complicated process of roller milling, because the latter permits of the more or less complete removal of bran and other undesired parts of the grain. As Dr. Hamill points out:—

"In stone milling a large, if not the greater, part of the germ is lost in the offal; only a portion finds its way into the finished flour.

"In both stone and roller milling it is possible to obtain a yield of flour representing anything between about 70 and 100 per cent. of the wheat milled, according to the amount of offal included in the flour. As a rule, the greater the amount of offal in the flour—*i.e.* the greater the percentage yield of flour obtained from the wheat—the darker is the loaf which it will produce. The colour of the loaf, however, depends not only upon the amount of offal which the flour contains, but upon the milling process adopted (stone or roller milling) and upon the colour of the wheat used (red or white). For these reasons different flours containing the same percentage (above 70 per cent.) of the total wheat may yield loaves varying very considerably in colour."

The question of the relative food value of different wheats or of the flour from different parts of the berry in no way enters into the consideration of its market value.

The bleaching of flour is effected commercially with nitrogen peroxide; it appears to be impossible to detect a bleached flour by mere inspection. Flour which has been badly dressed, containing particles of offal, is unsuitable for bleaching, as this only makes the specks more conspicuous.

Dr. Hamill concludes that bleaching produces no effect upon the baking qualities of flour. It improves the colour of the whole output of the mill and represents a pecuniary gain, since it gives the miller a larger percentage of high-grade flour. It is of assistance in maintaining uniformity in the appearance of flour, but at the same time it enables the miller to use cheaper wheats (*not necessarily of lower food value*). There is no evidence that bleaching enables good flour to be made from unsound wheat.

Flours are classed as strong or weak, according as they will produce large well-risen loaves or not. This property is in some way connected with the character of the protein of the flour, and it has been the subject of a great deal of experimental work within recent years. It is a well-known fact that the properties of colloidal substances, to which class the gluten of flour belongs, are profoundly modified by small quantities of electrolytes, and it has been found that the treatment of weak wheat during milling with small quantities of phosphates causes the flour obtained to be "stronger" than it would otherwise be. As a consequence, it is possible to make from weak British wheat a strong flour, the bread from which has the rich flavour characteristic of our flours. Seeing that bread of the type demanded throughout the country cannot be made without a considerable proportion of a strong flour, it would seem justifiable to conclude that the new invention will enable a larger proportion of British flour to be used in our bread, much to the advantage of the community—incidentally it should increase the value of British flour which

1 Reports to the Local Government Board.
(1) On the Bleaching of Flour and the addition of the so-called 'Improvers" to Flour: by Dr. J. M. Hamill.
(2) On the Chemical Changes produced in Flour by Bleaching: by Dr. G. W. Monier-Williams.
(3.) On the presence of Calcium Sulphate in Baking Powder and Self-Raising Flour: by Dr. J. M. Hamill.

to-day, on account of its "weakness," only commands bottom prices. Legislation in the direction suggested would thus put British wheat at a disadvantage.

Dr. Hamill does not accept this view, basing his objection partly on the ground that it is not desirable to make any additions to flour, partly on the fact that an originally low-grade weak flour is substituted for a high-grade one; finally, on the fact that since strong American flours contain more protein than weak British flours the food value of the bread is diminished. Here it is necessary to join issue with him. Bread is eaten as a source of carbohydrate and as a diluent to the concentrated fat and protein foods and not as a source of protein. Whether it contains half a per cent. more or less of protein is quite immaterial to the consumer.

It was clear to those who took part in the visit to Canada of the British Association that strong wheats will sooner or later have to give way to weak wheats wherever the two come into direct competition, on account of the much higher crop yields given by the latter. As a consequence, the character of our bread will change unless science in the meantime enables us to produce strong flour from a weak wheat. To cramp progress in this direction at the very outset would appear to be absurd.

It is at times stated on very inferior evidence that bleached flour is injurious to health; Dr. Harden's authoritative statement to the contrary which is recorded in an appendix to the report should settle this question finally.

The report of Dr. Monier-Williams on the chemical changes produced in flour by bleaching is full of valuable and suggestive matter. At the same time very many of his results are open to technical criticism, especially those of the experiments dealing with enzymes. It is obvious that much work remains to be done.

It is clear that the issues considered in the report are of great public importance, but the questions raised are so difficult and of such complexity that it is impossible to arrive at any final opinion on the evidence at present available. It is obviously necessary that the whole subject should be submitted to discussion from the chemical, the physiological, and the practical side, including the agriculturist, as well as the miller and baker. Dr. Hamill shows a very strong bias in the direction of forbidding any treatment whatsoever of flour, although he is unable to produce convincing evidence in support of his conclusions; seeing that his experience is very limited, it is to be hoped that the subject will be remitted to competent observers for full discussion before any steps are taken to introduce restrictive legislation.

Since the above was written, the members of the National Association of British and Irish Millers at a general meeting have adopted a resolution to the effect that wheaten flour sold as such without any qualifying designation should be the unbleached and untreated produce of properly cleaned and 'conditioned' wheat only." They ask the Government to appoint a Board of Reference, consisting of properly qualified experts, to consider thoroughly the whole question of bleaching and the addition of foreign substances to flour.

ORIENTAL SILVERWORK.[1]

MR. LING ROTH, who, in dealing with obscure chapters of anthropology and art, such as Tasmanians or Dayaks, or the brasswork of Benin, has already proved himself a good compiler, has now, in describing Malay and Chinese silver work, found a subject well suited to his powers. Few people, he remarks, have ever heard of Malay silverwork; South Kensington has only half a dozen specimens. The objects illustrated in this volume come from private collections made by officers who have served among the Malays, Messrs. Cecil and Leonard Wray, W. A. Luning, and Dr. C. Hose.

This scarcity of material is due to at least two causes. In the first place, so far as the Malay Peninsula is concerned, this phase of art is practically dead. The old rajahs and sultans, like the nawabs of Oudh and other Indian princes, amidst their ill-organised households and troops of retainers, used to keep in their service gold- and silversmiths, who worked only for their masters, and produced nothing for the market. With new tastes and wants suggested by contact with foreign culture, this condition of things has passed away. It must be said, however, that among the Malays the decay of the local crafts cannot be attributed to the introduction of European trumpery, though this seems to be the case among the branch of this people in Borneo. In the second place, Malays have a traditional respect for their old art products, and will not sell them except under extreme pressure of circumstances. In this connection Mr. Ling Roth might well have quoted the interesting account by Mr. W. W. Skeat of the magical powers ascribed to the regalia in Malay native

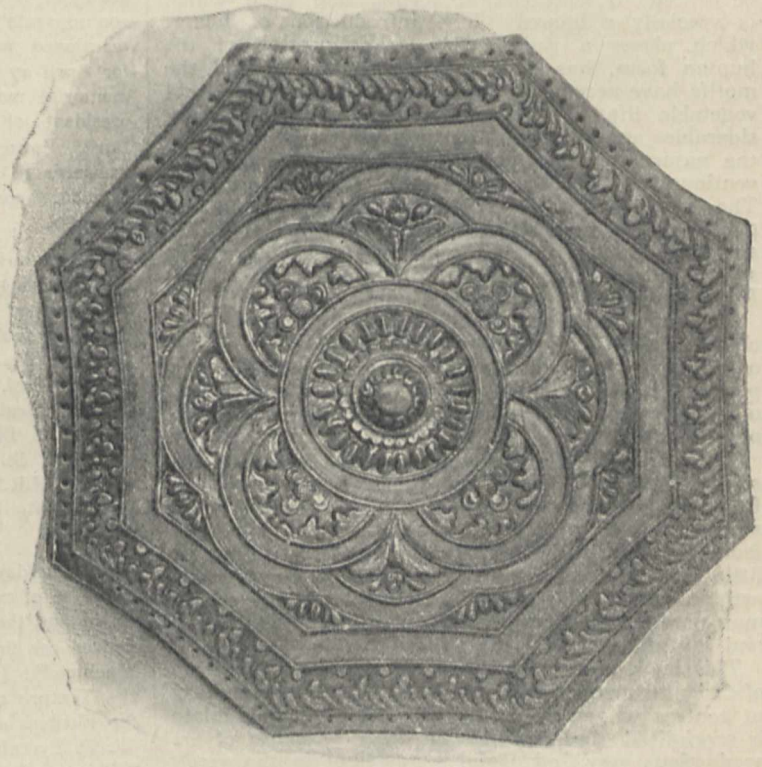


Fig. 1. Buntal (Octagonal Pillow-end Plate), diameter 4½ inches. Lotus pattern at centre. From "Oriental Silverwork, Malay and Chinese."

[1] Oriental Silverwork, Malay and Chinese. With over 250 original illustrations, a Handbook for Connoisseurs, Collectors, Students and Silversmiths. By H. Ling Roth. Pp. iv+300. (London: Truslove and Hanson, Ltd., 1910.) Price 21s. net.

courts, a feeling which has possibly extended to art work in the precious metals and has had the effect of checking its dispersal.

The problems of the origin and affinities of this school of art work have not been fully dealt with by the author, and the material available is scarcely sufficient to form the basis of a comprehensive examination. The Peninsula is inhabited by a very mixed population, and it has been the meeting-ground of more than one ancient civilisation. Of these the most powerful is clearly China, which now supplies numerous emigrants who form an important ethnical element. To the west lies India, to the east Java and Siam. Probably all these have contributed something to the general stock of form and design. But in addition there is undoubtedly much that is indigenous.

As regards decoration, we find nothing which can be traced to architectural forms, and little which is specially religious. The introduction of Islam, which places a rigid taboo on delineation of the human form, has had far-reaching effects, and the motifs have necessarily been largely drawn from local vegetable life. These, again, have undergone considerable modification, partly resulting from the the natural tendency in all such art to become conventional, and partly under direct Chinese pressure. The lotus design which frequently appears in the patterns, may have come from either China or India, and further study of the ornamentation will probably show that more has come from India than Mr. Ling Roth is at present prepared to admit.

The examples which he illustrates are chiefly small objects—boxes for holding tobacco, betel, lime, salves, or unguents, bowls and saucers, and the curious end-pieces attached to pillows, which, like many of the other objects, are ostentatiously paraded at wedding processions (Fig. 1).

The methods of manufacture, which are fully described by Mr. L. Wray, represent what is known in European art as repoussé, a thin plate of silver being placed on a lump of softened gum-resin and worked from the back by a series of punches. Graving is little used, and the results attained show considerable artistic skill. As is usual in Oriental art, the craftsman uses no fixed design and much is due to his taste and invention.

This book may be safely recommended to students of Oriental metal work, and to art classes, particularly at centres where the study of silver and gold plate is specialised, and designers in other branches of art productions may find useful suggestions in the excellent photographs with which it is illustrated.

NOTES.

IN *The Daily Mail* of Monday last, Sir Ernest Shackleton made an urgent appeal to the British nation on behalf of the Australasian Antarctic Expedition, which, it is hoped, will start in June under the command of Dr. Douglas Mawson. In his letter Sir Ernest Shackleton points out that Australasia has done much for south polar expeditions which have started from this country, and he asks for help, "from this side of the line and from Australians and New Zealanders who are gathering in London for the Coronation," towards the sum of 12,000*l.* needed to purchase a suitable ship, which has been selected by Dr. Mawson, and to enable the expedition to start in June. The Royal Geographical Society has already subscribed 500*l.*, as in the case of Captain Scott's expedition, and a committee has been formed in Australia to assist the explorers. As the result of the appeal, and the steps taken by *The Daily Mail* to bring it under the notice of people interested in exploration, the sum of nearly 9000*l.* had been subscribed by Wednesday morning, and there is little doubt that the whole amount required will be provided. Dr. Mawson proposes to take a monoplane with him for use during the expedition.

A COMMITTEE of the Geological Society has been formed to secure the means of providing a memorial to the late Prof. T. Rupert Jones, F.R.S., in aid of his widow and daughters. The late Prof. Jones was never in receipt of more than a very moderate income, and receiving only a small pension upon his retirement thirty years ago from the post of professor of geology in the Royal Military College, Sandhurst, he was unable to make any suitable provision for his family at his death, when his pension ceased. During his long life Prof. Jones was an ardent geologist and palæontologist, and the author of nearly 200 separate papers or other works, some of which were mentioned in our obituary notice published in NATURE for April 27 (p. 287). Subscriptions towards the proposed memorial may be sent to Prof. W. W. Watts, F.R.S., president of the Geological Society, Hillside, Langley Park, Sutton, Surrey, who has consented to act as treasurer to the fund. It is to be hoped that the committee's appeal will meet with a ready and generous response.

THE council of the Pharmaceutical Society has elected the following honorary members in recognition of their distinguished scientific work:—Prof. W. E. Dixon, F.R.S., professor of pharmacology, King's College, London; Dr. Adolph Engler, director, Botanical Museum, Berlin; Prof. Percy F. Frankland, F.R.S., president of the Chemical Society; M. Eugène Léger, late president Société de Pharmacie de Paris; pharmacien en Chef de l'Hôpital St. Louis, Paris; Lieut.-Colonel D. Prain, C.I.E., F.R.S., director of Royal Gardens, Kew; and Dr. Ludwig Radlkofer, professor of botany, University of Munich.

ON Tuesday next, May 16, Prof. F. W. Mott will begin a course of two lectures at the Royal Institution on "The Brain and the Hand"; on May 18 Dr. W. N. Shaw will deliver the first of two lectures on "Air and the Flying Machine": (1) "The Structure of the Atmosphere and the Texture of Air Currents," (2) "Conditions of Safety for Floaters and Fliers"; and on Saturday, May 20, Mr. W. P. Pycraft will commence a course of two lectures on "Phases of Bird Life": (1) "Flight," (2) "Migration." The Friday evening discourse on May 19 will be delivered by Prof. R. W. Wood on "Recent Experiments with Invisible Light," and on May 26 by Prof. Gilbert Murray on "The Greek Chorus as an Art Form."

THE provisional programme of the International Congress in Naval Architecture and Marine Engineering, to be held in connection with the jubilee of the Institution of Naval Architects in July, has been issued. On Monday, July 3, there will be a reception at the Royal United Service Institution. On Tuesday, July 4, the International Congress will be opened by H.R.H. the Duke of Connaught, K.G. The three following days, July 5, 6, and 7, will be devoted to the reading and discussion of papers contributed by Admiral Sir Cyprian Bridge, G.C.B., Sir Andrew Noble, Bart., K.C.B., Sir William H. White, K.C.B., Sir Philip Watts, K.C.B., the Hon. C. A. Parsons, C.B., Mr. S. W. Barnaby, Dr. S. J. P. Thearle, Mr. C. E. Ellis, Colonel G. Russo (*Italy*), Admiral Kondo, (*Japan*), Mr. Uchida (*Japan*), Count Shiba (*Japan*), Prof. Terano (*Japan*), Konsul Dr. O. Schlick (*Germany*),

Geheimrat Prof. Flamm (*Germany*), Prof. A. Rateau (*France*), and Mr. J. Johnson (*Sweden*). On Thursday, July 6, there will be a visit to the National Physical Laboratory to inspect the national experimental tank, and in the evening a banquet to the delegates and representatives.

THE death, at a very advanced age, of Miss C. C. Hopley, daughter of the late Mr. E. Hopley, of Lewes, a naval surgeon, has been recently announced. As regards natural history, the deceased lady, who took special interest in reptiles, of which she kept various specimens as pets, was best known as the author of a popular work on snakes, published in 1882. American birds likewise attracted her attention, and during the Civil War, when she was travelling to collect materials for a work on this subject, she was arrested and imprisoned as a British spy. Miss Hopley was for a number of years a contributor to *The Globe*, many natural history articles in that journal having been apparently written by her pen.

THE authorities of the British Museum are to be congratulated on having acquired, at an almost nominal price, the valuable collection of specimens illustrating the religion of Polynesia, which was long in the possession of the London Mission Society. Many of the specimens are unique, and it would now be quite impossible to form such a collection. Among the most remarkable objects are the great tapering idol of the national god of Raratonga, kept swathed in blue and white matting; Tangaroa, the supreme god of Polynesia, a wooden figure with small human-like objects sprouting from his eyes, mouth, and other parts of his body, typifying his creative power; and a head-dress of black feathers, which completes a mourning costume already owned by the museum. It would have been nothing short of a calamity if a collection of this kind had been dispersed, and the council of the London Mission Society, which has for some time entrusted the objects to the British Museum for exhibition, is to be commended for its liberality in transferring the collection to the nation.

IN reference to the proposal to appropriate a large portion of the ground at the back of the Natural History Museum to purposes other than those of that institution, it is pointed out in the April number of *The Museums Journal* that the Government does not appear to realise the imperative need for expansion which must occur at no distant date if the museum is to do its work properly and keep abreast of the times. Such expansion, it is added, will by no means be confined to galleries and rooms for the exhibition and storage of specimens, but must embrace rooms and buildings in which scientific work in connection with the collections is carried on. Indeed, this latter item will probably be found to be the more urgent of the two. "Nowadays, any museum worthy of the name requires libraries, laboratories, workshops, studios, and so forth, and these often occupy a larger area than the exhibited collections of the museum. The ground that lies between the Natural History Museum and the Science Museum might very well prove none too large for either of these museums alone."

APROPOS of the article on "Standard Bread" which appeared in the last issue of NATURE, Dr. Leonard Hill, F.R.S., publishes a note in *The British Medical Journal* of May 6 on the nutritive value of white and of standard bread. Young tame rats were fed for three weeks some on white and some on standard bread, and for a second three weeks some on white and some on standard flour. Two lots of twenty-five rats each were used and kept in identical conditions; at the start the total weight of each lot was approximately the same. The results were astonishing; ten of the white flour and bread lot died against five of the standard. Taking fifteen survivors of each lot, the standard has a percentage gain in weight of 27½, against twelve for the white in the last three weeks, and at the end nearly all the latter are losing weight, and are less lively and less sleek than the standard. Another lot fed on white flour *plus* an addition of the germ equivalent to that in standard flour, have done as well as on standard flour and bread, suggesting that the germ contains bodies essential for growth or activating enzymes engaged in the digestion of wheat proteins.

IN the House of Commons on May 3, Mr. E. Edwards asked the Secretary of State for the Home Department whether any arrangements were being made to continue the experiments with coal dust which had been carried on during the last three years by representatives of the coal owners and others at Altofts Colliery and elsewhere; and whether the Government were prepared to undertake the control and responsibility of the experiments, in view of their great importance to the mining population in the direction of the prevention of coal-dust explosions. In reply, Mr. Churchill stated that it has been decided to continue the experiments referred to under the supervision of the Home Office, and that the Treasury has sanctioned the considerable expenditure that will be necessary for the purpose. The Mining Association has offered to place at the disposal of the Government for the purposes of the experiments the plant and instrument now in use at Altofts, an offer which has been accepted, and arrangements are being made for starting work as soon as possible on a new site. Mr. Churchill has appointed an expert committee to be directly in charge of the experiments, the members being Sir Henry Cunynghame, K.C.B., Mr. R. A. S. Redmayne, Captain Desborough, Prof. H. B. Dixon, F.R.S., and Mr. W. Cuthbert Blackett. He has also requested the members of the Royal Commission on Mines and of the Coal Dust Committee of the Mining Association, under whose supervision the previous series of experiments was conducted, to act as a consultative committee in connection with the experiments.

MR. J. A. J. DE VILLIERS described the foundation and development of British Guiana before the Royal Geographical Society on May 8. Starting with the first settlement in the early part of the seventeenth century, he traced the gradual growth and development of the colony in the hands of the Dutch for some two hundred years. From 1803 the country became British property, and in 1834 Robert Schomburgk, who had been sent out by the Royal Geographical Society, commenced his travels and explorations which enabled him to lay down boundaries provisional at that time, but which were substantially followed and accepted by the arbitration tribunal in Paris in 1899. The whole subject is an interesting and instructive contribution to colonial history.

Miss Olive MacLeod, who, with Mr. and Mrs. P. A. Talbot, has been exploring the country round Lake Chad for several months, returned to England on Tuesday. The expedition passed up the Niger and Benue Rivers by steamer and canoes through Southern and Northern Nigeria, and then traversed the North Kamerun. French Ubangi was reached in October last. A splendid reception was accorded to the party by the Lamido at Lere. The mysterious falls on the Mao Kahi were located, and have been named Les Chutes MacLeod. After mapping this

part of the river, the party went through the Tuburi Lakes and down the Logone to Fort Lamy. The expedition then proceeded down the Shari to Lake Chad, which was crossed, in Kotoko canoes, from the Shari to Saiyorum. Close studies were made of the various peoples visited, especially of the little-known tribes of French Central Africa and the Baduma of Lake Chad. A large collection of objects of ethnological interest was made, especially of musical instruments, while typical examples of music were taken down. A botanical collection of several thousand specimens has been sent to the British Museum, as also a number of birds, beasts, and reptiles. A route-sketch was made across Lake Chad, and a survey by plane-table and theodolite from Maifoni to Kano.

IN a curious paper contributed to the Journal of the Royal Society of Arts for April 21, Prof. H. Chatley discusses Chinese natural philosophy and magic. He endeavours to trace a close analogy between the system advocated by the sage Ch'u Hsi, who lived in the twelfth century of our era, and the discoveries of Sir W. Crookes and Sir J. J. Thomson. Discussing the part played by gambling in magic, he remarks:—"The use of cards is said to be derived from the Turot cards, which were originally employed for occult purposes. The legend which ascribes the invention of cards to the purpose of amusing a mad king does not seem at all a sufficient explanation, and there is, in addition, the fact that cards of a kind existed before the said king. In further support of this idea, the well-known practice of telling fortunes by cards may probably be regarded as a survival of a regular form of divination by such means. It seems, in fact, that card-playing for stakes is a mere development of a ceremony in which individuals consulting the oracle decided to abide by its pronouncements as to the holding of disputed property."

MR. DEAN C. WORCESTER, Secretary of the Interior under the Government of the Philippine Islands, in an interesting and well-illustrated article contributed to the March issue of *The National Geographic Magazine*, describes the methods by which the American authorities have succeeded in gaining control over, and to some extent civilising, the pagan tribes of northern Luzon. During his tour the officer in charge of the district collects representatives of tribes which are normally in a state of war, and secures peace and the cessation of head-hunting by promoting athletic contests, which are most popular among these savages. They are encouraged to compete in their tribal dances, and the games most popular are running, wrestling, the tug-of-war, and climbing the greased pole. He thus sums up the results of this policy:—"We have been able to get results in dealing with wild men by following the simple policy of always giving them a square deal; by not punishing them for a given course of action unless they had had ample warning that such action would be followed by punishment; by never failing to punish them when, *after due warning*, they have misbehaved; by making friends with them again whenever they were ready to be friendly; and by finding an outlet for their superabundant animal spirits in rough but innocent field sports."

THE second number of the Annals of the Cyprus Natural History Society, for 1910, contains a short summary of the more interesting animals observed in the island during the year. A list of Cyprus birds (290 spp.) was published in the first number, and it is proposed to issue shortly lists of the mammals and Lepidoptera.

ACCORDING to the Indian *Pioneer Mail*, the Bombay Natural History Society is appealing for a sum of 2000*l.* with the object of starting a zoological survey of British India. At present about 8000 rupees have been subscribed, and with this in hand the society has started one collector; but as the services of Mr. Shortridge, who was recently invalided home from New Guinea, are available, it is desired that these should be secured, although this cannot be done without a large increase in the subscription list. It is pointed out that a brief glance at Blanford's "Mammals of India" will show how much remains to be done even in that section of the zoology of the country. Later information states that the sum promised has reached about 10,000 rupees.

IN vol. vi., part i., of the Records of the British Museum, Dr. Annandale describes a cirriped of the parasitic group Rhizocephala taken on a crab, *Sesarma thelxinoe*, from a stream 700 feet above sea-level in the Andamans, near Port Blair. The specimen, which is believed to be the only example of the group hitherto obtained from fresh water, is made the type of a new genus and species, under the name of *Sesarmaxenos monticola*. It is pointed out that the crab on which the parasite was found belongs to a group the members of which usually breed in brackish water, if not in the sea, and it is therefore possible that the Andamanese species may periodically visit the ocean to spawn, and that the parasite may have become attached to the type specimen during such a sojourn. "Nevertheless, the fact that the latter contains larvæ in the brood-pouch while living at an altitude of 700 feet entitles it to be included in the fauna of the Indian Empire, and suggests that it is able to flourish in jungle-streams, even if it also occurs in the sea."

IN an article contributed to the May number of *Cassell's Magazine*, entitled "The Vandalism of Collectors," Mr. S. L. Bensusan directs attention to the evil effects on the British fauna produced by the recent expansion of nature-study. For it is pointed out that a considerable proportion of those who cultivate this pursuit are not content with acting the part of observers, but join the ranks of regular collectors. This entails a large destruction of birds and their eggs (probably to a great extent illegal), as well as a prodigious slaughter of butterflies and moths, to say nothing of the reckless uprooting of wild flowers. Game-preservers and game-keepers also receive a share of blame, although it is admitted that the latter are worse than the former. In conclusion, the author observes that it would have been better for the wild life of the country if the cult of nature-study had developed side by side with a fuller recognition of the claim of the wild fauna and flora to protection, or with definite legal restrictions on the taking of specimens for private purposes.

AT the conclusion of his presidential address to the Quekett Microscopical Club, on some problems of evolution in the simplest forms of life, as reported in the Journal of that body for April, Prof. E. A. Minchin expressed the opinion that in the case of the Protista syngamy is the factor which checks variation among individuals exposed to slightly different external conditions. With such restraining influence a species would tend to break up into different races and strains, either as the result of varying environment or from an innate tendency to divergence. Syngamy, on the other hand, tends to reduce individual differences to a common level. If this be correct, and if it be also true that there is no syngamy among them, it follows that real species do not exist among bacteria, the

members of which must be regarded as strains, without the stability of a species, and liable to modification in any direction by environmental influence. Hence he thinks it "evident that the passage from the bacterial to the cellular grade was perhaps the most important advance in the evolution of living beings. The acquisition of the cellular type of structure was the starting-point for the evolution, not only of the higher groups of the Protista, such as the Protozoa and unicellar plants, but through them of the whole visible everyday world of animals and plants, in all of which the cell is the unit of structure, and which consist primarily of aggregates of cells."

MR. A. R. NICHOLS records (Fisheries Ireland Sci. Invest., 1910, i.) 101 species of Polyzoa from the coast of Ireland, twenty-three of which have not been recorded previously from that coast, and six are apparently new to the British list. Mr. W. M. Tattersall (ii.) describes and figures, from the north-east Atlantic slope, six species of Mysidæ, of which a preliminary diagnosis only had been published, and also defines two new species and two new genera. Four bottom-living species are added to the British and Irish list, two of which were known previously only from the west coast of Greenland. Mr. R. Southern (iii.) contributes observations on certain pelagic Polychæta of the coasts of Ireland, and records *Vanadis formosa*, *Greefia celox*, Callizona (three species), Tomopteris (four species), Travisiopsis (two species), and Sagitella (two species), all of which, except two of the species of Tomopteris, do not appear to have been previously recorded from the British marine area. All these pelagic species live in warm and comparatively highly saline waters of the European branch of the Gulf Stream drift, and are carried therein towards the west coast of Ireland, but only rarely do they cross the 200-fathom line.

THE *procès-verbaux* of the council and sections of the International Marine Investigations, the meetings of which were held in Copenhagen at the end of September last, contain interesting references to observations completed and in progress. Prof. D'Arcy Thompson criticised the investigations on the age and growth of herring as determined from the scales, holding that the number of rings exhibited was subject to individual variation, and did not necessarily give a correct determination of the age of the fish. Prof. Heincke maintained that the method of age-determination by the scale-rings was scientifically sound, and Dr. Hjort stated the reasons for his belief in the trustworthiness of this method, remarking that herring examined in all months of the year showed rings which varied exactly according to the time of the year. Dr. Heincke contributed a summary of the present condition of certain aspects of the investigations on plaice. The spawning conditions of plaice are now well known, various more or less separated spawning places having been found in the southern and northern North Sea, the Kattegat, the Belt, and the Baltic, closely correlated with which are different local races, of which six or seven are distinguished, namely, those associated with the regions just mentioned and others with Iceland and the Barents Sea. Those of the Baltic and Barents Sea are slow-growing races, while those of the North Sea and Iceland are quick-growing races. The recognition of these differences is of great importance in connection with the questions of over-fishing and the plaice-production of different regions of the sea.

PRESENTING in the *Bulletin du Jardin Imperiale Botanique*, St. Petersburg (vol. xi., part i.), a list of fungi collected within the government of Samara, Mr. N. N. Woronichin comments upon a new species of Physalospora taken on fruits of Caragana and certain allied species that grow parasitically on species of Astragalus.

ON account of the marked sensitivity of the apex of the coleoptile or first green leaf, oat seedlings are frequently employed for heliotropic experiments, and it has been stated that an incision made in the coleoptile, whatever its orientation, does not prevent the transmission of a stimulus. While offering evidence modifying this statement to the extent that an incision on the posterior side may inhibit the transmission, Mr. P. B. Jensen describes experiments in the *Bulletin de l'Académie Royale des Sciences et les Lettres de Danemark* (No. 1) in which he cut right through the coleoptile, replaced it, and then obtained proof of transmission in the case of stimuli induced by light and also by gravity.

FOREST Bulletin No. 1 of 1911, issued by the Government of India, gives an account of tests of the calorific values of fifty-six specimens of Indian woods carried out by Mr. Puran Singh, Forest Chemist to the Government. The Lewis Thomson calorimeter was used, one kilogram of the wood being burnt in oxygen. The results for thoroughly dried woods lie between 4000 and 5000 kilogram calories per kilogram of wood for the whole of the samples tested. For air-dried wood, which contains about 15 per cent. of water, the calorific power lies between 3500 and 4300 kilogram calories per kilogram of wood. Charcoal prepared from the woods has an average power of 7000 kilogram calories per kilogram.

SYSTEMATIC articles in the *Kew Bulletin* (No. 3) consist of a long series of diagnoses of new tropical African species of Loranthus already enumerated in the "Flora of Tropical Africa," a note on Spatholirion by Mr. S. T. Dunn, and a critical opinion by Mr. T. A. Sprague on the exact status of two saxifrages known as *lingulata* and *lantoscana*, according to which the latter should be regarded merely as a variety of the former. A notable instance of invasion of our southern shores by an alien brown alga, *Colpomenia sinuosa*, is described by Mr. A. D. Cotton. The alga thrives best in sheltered situations, and makes its growth principally in the autumn; persisting through the winter, it produces spores in spring and disappears in summer. On the authority of Lieut.-Colonel A. F. Appleton, a discrimination of the ordinary Transvaal grasses is provided; outside the species of Eragrostis, Panicum, and others well known, *Anthistiria imberbis* and *Chloris virgata* are recommended as fodder plants.

A GENERAL index has been issued for the Journal of the Board of Agriculture in two volumes, dealing with the two periods 1894–1904 and 1904–11. Since the Journal started in 1894, it has maintained a high standard, and has published many articles of permanent value. All these are rendered much more available, now that the general index has appeared, than they were before.

WE are in receipt of the Madras Agricultural Calendar, April, 1911, to March, 1912, issued by the Agricultural College and Research Institute, Coimbatore, containing a number of articles intended for the large and the small agriculturist. In the nature of things, the college is able to play a much more paternal part in the life of the community than would be possible elsewhere, and this publication shows clearly how very extensive are the ramifications of an Indian agricultural department.

THE seasonal distribution of egg production has formed the subject of a biometrical study by Drs. Pearl and Surface, the results of which are published in Bulletin 110

of the United States Department of Agriculture Bureau of Animal Industry. Four cycles were found in the year, the winter period, November to March, wherein egg production is essentially a non-natural (*i.e.* a forced or stimulated) process, the spring period, March to June, this being the natural laying period of the fowl, and two later periods, June to September and September to October. The third period represents in part a natural continuance of the normal breeding period, and in part a stimulated process; it is terminated by the moult, the characteristic feature of the fourth period.

THE Harper Adams Agricultural College has recently issued two reports, one dealing with the experiments carried out in the counties of Staffordshire and Shropshire. Numerous field trials are reported in various centres, dealing with the effects of the various artificial manures alone and in various admixtures on the common crops. Some of the proportions are a little difficult to understand; one of the mixtures, for instance, being composed of $1\frac{1}{2}$ cwt. of one constituent, $3\frac{1}{8}$ cwt. of another, and $1\frac{1}{4}$ cwt. of a third. Unfortunately no soil analyses are given, nor are there any meteorological data for the various centres, so that discussion of the results is not possible. At the college itself, work has been continued on the "wart" disease of potatoes caused by the fungus *Synchitrium endobioticum*, Percival, not the least interesting feature of which is that certain varieties of potato are immune, whilst others, in the same conditions, are attacked.

IN *La Géographie* (No. 3, 1911), M. N. Villate gives an account of his recent journeys from Tidikelt to the Niger by the Ahaggar, and adds to our accurate knowledge of the French Sahara. His object was to extend the network of astronomically determined positions, and he succeeded in obtaining the latitude and longitude of forty-nine points. Equal altitudes of stars were observed for latitude and chronometer correction; longitudes were obtained when practicable by occultation of stars, and chronometer watches furnished a means of determining the difference of longitude between neighbouring points on the route. Observations were also made of the magnetic declination, inclination, and horizontal force at some thirty-five to forty points from Biskra in the north to Gao on the Niger in the south. In consequence of changes which were found to have taken place in the magnetic moment of the magnets during the journey, values of the horizontal force can only be given to three places of decimals of C.G.S. units.

MISS GEORGINA KING has reprinted several newspaper articles in a pamphlet entitled "The Mineral Wealth of New South Wales and other Lands and Countries" (Sydney: Brooks and Co.), with some additional matter and a personal introduction. Her main contention is that the ore-deposits were connected with volcanic activity, which was especially prevalent in Tertiary times. Man, however, is said to have existed in Australia in "the early Tertiary period," and to have acquired a wandering propensity from the mental shocks then received. Glossopteris is said to be in Europe exclusively a Mesozoic plant. Waterspouts over oceans are attributed to "upheavals of subsided metamorphic matter." We can understand the writer's assertion that geologists in Australia have objected to the publication of such papers in scientific journals; but we can scarcely believe, as is alleged, that their motive was a fervent desire to issue the results under their own names.

THE Italian Seismological Society has issued a volume of notices of the earthquakes observed in Italy during the year 1907. The volume is compiled by Dr. G. Martinelli, assistant in the R. Ufficio Centrale di Meteorologia e Geodinamico at Rome, and forms the appendix to the fourteenth volume (for 1910) of the *Bollettino* of the Seismological Society. Twenty years ago, such notices were contained in a few sheets of the *Bollettino Meteorico* of the central office. When the Seismological Society was founded in 1895, they were issued in detachments with each part of the *Bollettino*. Published, as they now are for the first time, in a separate volume of nearly six hundred pages, we can form some idea of the magnitude and value of the work, for the editing of which Dr. Martinelli is responsible. Among the most interesting of the notices are those on the Calabrian earthquake of October 23, 1907. These form the foundation of the report that will shortly be issued by the Government Commission on this violent, if somewhat restricted, shock.

THE monthly meteorological chart of the North Atlantic, published by the Meteorological Committee for May (first issue), includes useful synoptic weather charts of that ocean for April 6–12 (commencing with the day following the blizzard experienced in this country). They show that during nearly the whole of the period in question there was an area of high barometric pressure outside our north and north-west coasts, and that it extended at times to the mid-Atlantic. This distribution of pressure explains the severe weather over England and France, which was accompanied by frequent showers of snow and sleet. As the central part of the anticyclone extended southward the weather became finer. The chart of the Indian Ocean for the same month contains an interesting communication on phosphorescent seas from Admiral Tydeman, of the R. Netherlands Navy (see NATURE, March 16). We note that the chart has been further improved, and extended to the eastward.

A NEW method of producing the line spectra of a metal, which promises to facilitate greatly the study of the subject, is described by Dr. G. Gehlhoff in the *Verhandlungen* of the German Physical Society for March 30. It makes use of the fact that the inactive gases, helium, argon, &c., are spectroscopically extremely sensitive to impurities, their lines disappearing from the positive glow of the vacuum tube if small quantities of air or water vapour are present. A small quantity of the purified metal to be investigated is introduced into one of the ordinary spectral tubes, and the tube washed out with, and finally filled with, helium. On passing the discharge the tube may or may not give the lines of the metal in the positive glow, but on heating it, a temperature can always be found at which the lines appear, and a higher temperature at which the helium lines disappear completely. These temperatures are respectively, for cæsium, 50° and 70° C.; for sodium and potassium, 80° and 140° C.; while for mercury the temperature of the room is sufficient to produce the lines of the metal.

THE March number of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* contains the first instalment of a lecture on the electrification of railways, delivered before the society in November last by M. de Valbreuze. After giving a short history of the slow progress of electrification previous to 1905, and its rapid extension since that date, the author describes the principal features of the systems at present in use under the heads:—Direct current 500–700 volt systems, triphase systems, monophase systems, and direct current high-pressure

systems. As the article is well illustrated and deals to a large extent with installations less well known in this country, it will prove of great value to those who wish to get a bird's-eye view of the present state of the problem of electrification of railways. Subsequent articles will deal more in detail with the conditions under which electric traction is advantageous, and the relative merits of the various systems.

We learn from an illustrated article in *The Engineer* for April 28 that the 9,000,000-gallon water tank, constructed by Messrs. Clayton, Son and Co., of Leeds, for the water supply of Calcutta, is now finished. This tank is 321 feet square and is 16 feet in depth. The height from the top of the tank to ground level is 110 feet; the tank is supported by a large number of braced steel columns. The tank is divided into four compartments by cross frames, each of which can be used independently, so that one or more compartments can be put out of service for cleaning or repairs without interrupting the service from the others. The tank is constructed of steel plates $\frac{3}{8}$ inch in thickness and is thoroughly stiffened. The tank is roofed in, the roof overhanging the tank by 12 inches. Plates and brass wire gauze are fitted in order to prevent birds, &c., from gaining access to the tank. The tank had to be made absolutely watertight by the terms of the contract, and this has been carried out successfully.

The Cambridge University Press has published separately, price 3*s*., the exercises from Dr. C. Davison's "Algebra for Secondary Schools," which was reviewed in NATURE on November 19, 1908 (vol. lxxix., p. 65).

Messrs. Witherby and Co. have in the press and will shortly publish an illustrated travel book, entitled "Through South Westland," by Miss A. M. Moreland, being a chronicle of a ride through a district in New Zealand which is little known to the outside world.

The latest ornithological catalogue of Messrs. John Wheldon and Co., 38 Great Queen Street, London, W.C., which has been received, is conveniently arranged under countries. It includes particulars of the books from the library of an eminent ornithologist lately deceased, and selections from several other important libraries. The catalogue gives details of 1450 books and papers.

The Royal Insurance Company, Ltd., of Liverpool, has issued the eighth edition of "Records of Sports." Among its new features may be mentioned the section dealing with aviation, which provides full information, up to the end of 1910, of notable performances and other events in connection with aviation. The details provided in connection with many sports have been greatly amplified. Copies of this interesting book of reference may be obtained, so long as the supply lasts, by applying to the manager of the company at 1 North John Street, Liverpool.

Erratum.—In the abstract of a paper read before the Royal Society of Edinburgh, printed in NATURE of April 6, p. 200, second column, line 8 from bottom, the " in the formula $y''(x+a)$ was omitted. The formula was printed exactly as it was in the type-written copy supplied by the reporter, and the error was unfortunately not noticed by him in proof.

OUR ASTRONOMICAL COLUMN.

Meteoric Fireballs and Meteors.—On April 30, at 11.58 p.m., the Rev. T. E. R. Phillips, of Ashtead, Surrey, saw a fine meteor about three times as brilliant as Jupiter. It was directed from Virgo, and disappeared in 206°+14°, only the end course of about 3 degrees being observed.

On May 2, at 10.53, Mr. J. H. Elgie, of Leeds, saw a fine meteor equal to Venus descending from 2° above β Serpentis to 4° above β Libræ.

On May 4, at 8.52 p.m., Mr. S. A. Wilson, of Reigate, Surrey, witnessed the flight of a magnificent meteor from the Polar star to a few degrees below Capella. Its light was estimated as three times the apparent lustre of Venus. It left a long train in its wake, and moved with fairly slow speed. The radiant point was probably in the eastern sky at about 247°+2°, as there is a very active shower of bright meteors from this point in May, and the direction of the fireball of May 4 is nearly conformable with this stream.

Mr. F. T. Naish, of Bristol, watched the eastern sky on May 4, 14h. to 15h., and saw eight fairly bright meteors. Three of these were conspicuous from their streaky trains and very long flights, and they were directed from the radiant point of Halley's comet. The paths intersected at 338°−2°. The shower of Aquarids supposed to be associated with the famous comet referred to has certainly returned this year, though not in special abundance according to the reports already received.

The Total Eclipse of the Sun.—Major Hills, secretary of the Joint Permanent Eclipse Committee, has, according to *The Times* of May 5, received a telegram from Father Cortie stating that thick cirrus clouds persisted at totality, but photographs of the corona and spectrum were obtained; the corona was characteristic of the minimum sun-spot period.

A telegram received by the Astronomer Royal from Mr. Worthington, who was also stationed at Vavau, reads:—"Splendid photos. inner and outer corona, one and a half degrees."

A later communication states that Mr. C. L. Wragge, formerly meteorologist to the Queensland Government, saw the eclipse under excellent conditions at Lifuka, Friendly Islands. Hydrogen prominences were wonderfully distinct, and, apparently, a four-vaned corona was seen extending some distance from the moon's disc.

Spark Spectra of Calcium and Hydrogen in a Magnetic Field.—Some results possibly of great importance in the study of solar physics are published by M. Hemsalech in the *Comptes rendus* for April 24 (vol. clii., No. 17, p. 1086).

M. Hemsalech finds that when a spark is passed perpendicularly to the lines of force in a strong magnetic field, the enhanced lines in the spectrum of the spark behave differently from the arc lines. When the spark passes between calcium poles, in a field of from 4000 to 6000 C.G.S., it is violently projected in a sheaf at right angles to the lines of force, and a spectroscopic examination of this sheaf shows that the line at λ 4227 is as long as H and K; the spectroscope is pointed parallel to the lines of force. When the spark is passed in a strong transverse current of air, without a magnetic field, the 4227 line is much longer than H and K.

But when the spark is passed, in the magnetic field, in an atmosphere of hydrogen, a remarkable change takes place, for whereas the respective heights of the H and K lines were 22·6 and 23·7 cm., the 4227 line was only 16·3 cm.; the heights of the hydrogen lines were Hα 21·4, Hβ 20·0, Hγ 18·8, and Hδ 16·3 cm. The spark lines at λ 3706 and λ 3737, in the vicinity of the poles, are also higher than the arc lines λ 4283 and λ 4455. In an atmosphere of oxygen, however, the 4227 line is as long as H and K, and if a weaker current, 800 C.G.S., is employed, it becomes longer and stronger than they.

M. Hemsalech tentatively suggests an analogy with the solar conditions. A mass of hydrogen atoms carrying electric charges, and travelling parallel to the solar surface, might, in the magnetic field around a spot, become violently projected, as in the laboratory, and carry with it to as great or a greater height the calcium vapour so abundant in the solar atmosphere; this could not happen immediately over a spot nucleus, for there the lines of force are perpendicular to the solar surface.

The Solar Constant.—Messrs. Abbot and F. E. Fowle, jun., discuss the value, during recent years, of the solar constant of radiation in No. 3, vol. xxxiii., of *The Astro-*

physical Journal. Two outstanding questions regarding the work are now settled. The first was the true pyrheliometric scale, which, as pointed out in these columns on April 20, they have now decided upon. The second was that of carrying the energy-spectrum observations further into the ultra-violet, with the prospect of increasing the values of the constant previously given, and this has now been done. During this work it was discovered that a region containing considerable energy in the ultra-violet was neglected in the 1905–6 observations, but a special investigation shows that there is no need to raise the value of the solar constant obtained for that period; the published coefficients of atmospheric transmission for 1905–6 are, however, all about 1·4 per cent. too low.

The values of the constant derived from the 1905–9 Mount Wilson results indicate a range of solar variability within a range of 8 per cent., which does not appear to be accidental, and the agreement of the results obtained at different altitudes discounts the probability of this variation having an atmospheric origin. The mean value of the solar constant obtained for the period 1905–9 was 1·922 calories (15° C.) per square centimetre per minute, and this is probably correct within 1 per cent. The most likely explanation of the 8 per cent. variation is that there are really variations of 0·03 stellar magnitude in the solar radiation outside our atmosphere.

PHOTOGRAPHIC OBSERVATIONS OF SOLAR PROMINENCES.—Valuable additions to our knowledge concerning the sun's atmospheric disturbances are likely to accrue from the systematic study of the spectroheliograms showing solar prominences. The results of such a study are published in No. 2, vol. xxxiii., of *The Astrophysical Journal* by Mr. G. Abetti and Miss R. E. Smith, who have reduced a large number of spectroheliograms taken at the Mount Wilson Observatory, and compared the prominences with those shown on photographs taken at the Yerkes Observatory and with those observed visually at Catania. The comparison of the Hα and the calcium-light photographs *inter se* and with the Catania hydrogen observations reveals several points of interest. Among these it would appear that the calcium vapours rise to greater heights than those of hydrogen, a feature shown both in the measures of heights and of areas. The mean height (56″) of the Mount Wilson calcium prominences is about 7″ greater than the mean height of the hydrogen prominences observed there and at Catania. It would also appear that the calcium prominences have a slightly different distribution from those of hydrogen. Results for the period 1906–8 are tabulated and plotted, and one or two special cases of interrelation with disturbed areas are discussed.

THE MOVEMENT OF STARS OF THE ORION TYPE.—In a paper published in the *Bulletin de l'Acad. roy. de Belgique* in 1910, Dr. Stroobaut directed attention to the different values obtained for the sun's velocity through space when it was derived from the radial velocities of Orion stars from when it was derived from the velocities of other stars; since then Profs. Frost and Kapteyn, using different coordinates for the apex, have disclosed a similar difference. Dr. Stroobaut has recalculated his values with their value for the apex, and finds that his new results show practically the same difference as theirs. He obtains for the solar velocity 19·25 km. when using all stars, and 21·8 km. for the Orion-type stars; the latter is divided into 16·0 km. in the region of the apex and 26·2 km. near the antapex (*Bull. de l'Acad. roy. de Belgique*, No. 1, p. 30).

EPHEMERIS FOR ENCKE'S COMET NEAR PERIHELION, 1911.—In No. 39 of the *Mitteilungen der Nikolai-Hauptsternwarte zu Pulkowo* Dr. Backlund discusses the orbit of Encke's comet during recent years, and tabulates the several perturbations it has suffered since its apparition in 1898; these are very small. He also gives a revised set of elements, from which he has prepared an ephemeris covering the period of perihelion passage and extending from July 1 to September 21; the return is not a favourable one for observations.

THE CATANIA OBSERVATIONS OF SUN-SPOTS AND FACULÆ, 1910.—Prof. Ricco's annual tabulated summary (1910) of the spots and faculæ observed at the Catania Observatory appears in No. 3, vol. xl., of the *Memorie di Astrofisica ed Astronomia.* The values for the year show that the solar activity is still declining. The mean daily frequency of spots was 1·7, and on 104 days (35 per cent.) no spots were recorded.

THE ROYAL PHOTOGRAPHIC SOCIETY'S EXHIBITION.

THE Royal Photographic Society is holding its annual exhibition in the spring instead of the autumn this year, and in the hall of the Prince's Skating Club, Knightsbridge. The exhibition is open now and closes on the last day of this month. Queen Alexandra has graciously contributed sixteen of her own photographs, and surrounding these there is a very large collection of portraits of King Edward VII. As these date from about 1853, they may be studied both as a pictorial history of our late King, and also as representative of the development of photographic portraiture from the early days of the collodion plate. Entomologists and microscopists will be pleased to see a fine portrait of Mr. Fred. Enock, by Furley Louis, in the same gallery.

There is a large collection of autochromes, with here and there among them colour transparencies by other analogous processes. By daylight they are excellently shown, and indicate that the number of those who employ these processes for the photography of colour is rapidly increasing, and that the general results are far more successful than they were a year or two ago. Sir W. J. Herschel and Mr. J. H. Gear both show photographs of rainbows, which are very different from the poor representations that the best of monochrome photography can render of them. There is some notable photomicrographic work in colour, especially various minerals and crystals shown between crossed Nicols, and among Prof. Waymouth Reid's collection there are a few examples of high-power pathological work.

The general natural history section is not very extensive, but includes several "life-histories" of moths, butterflies, tadpoles, and, by Mr. William Farren, a series of twelve prints illustrating the nesting period of the nightjar. The "Great American Egret," by Mr. Hugh C. Knowles, and "Gannet going down wind," by Mr. Oliver G. Pike, are of special interest at the present time.

The scientific section is larger than it has been lately. This branch of the subject can never be adequately represented, because only a small proportion of the scientific work done is suitable for an exhibition, but this year the society has been successful in getting together an excellent collection. High-power photomicrography is well represented. Dr. T. W. Butcher's *Navicula Smithii* and *Coscinodiscus asteromphalus*, and Dr. Duncan J. Reid's Trypanosomes are specially noteworthy. Mr. Charles R. Darling shows a series of photographs of drop formation taken comparatively slowly, with exposures of one-tenth of a second instead of, as heretofore, in a few millionths of a second. The drops are of aniline oil in water. Among the radiographs, the series by Dr. Thurston Holland represents probably the finest work at present possible in this direction. Ten lantern slides of a normal stomach, taken by Dr. F. Haenisch with a Rœntgen-cinematographic apparatus, show the peristaltic wave moving down the great curvature. Prof. Zeeman contributes an illustration of his recent work on the effects of a magnetic field on the absorption sodium spectrum lines, and Prof. R. W. Wood sends some of his photographs of landscapes taken with the infra-red radiations. Dr. George H. Rodman shows photomicrographs of the pollen cells of fifty different flowers, and also a series of stereo-photomicrographs of natural history and botanical subjects, which represent some small objects, such as diatoms, in a realistic way that is very rarely seen.

Among the astronomical exhibits that will be studied with interest are fifty transparencies by Dr. Max Wolf, of Heidelberg, of various comets and nebulæ with their spectra, photographed under different optical conditions, and an extensive series of photographs of planets and comets and their spectra, lent by the Lowell Observatory. Of the many other noteworthy subjects we can only refer to illustrations of rotary photogravure in its applications to newspaper illustration and three-colour printing, shown by Mr. A. J. Newton, the principal of the London County Council School of Photo-engraving.

GEOLOGICAL WORK IN BRITISH LANDS.[1]

III.—IN CANADA.

THE Geological Survey Branch of the Canadian Department of Mines has a large amount of pioneer work before it. In a publication numbered 1097, issued in 1910, Mr. J. Keele describes his reconnaissance across the Mackenzie Mountains in Yukon and North-West Territories, involving much personal risk and often dependence on hunting for a supply of food. The country that he explored along its rivers lies between the Mackenzie Mountains, a part of the Rocky Mountain axis, and the St. Elias Range. The valley bottoms are practically free from frost during June, July, and August; but the temperature varies from well below zero in January to 90° F. during the almost continuous daylight of June. Cambrian, Silurian, Devonian, Triassic, and Cretaceous strata have been recognised, and Mr. R. G. McConnell has described a basin of Cainozoic rocks, including basalt. Granite, intruded in local "stocks or pillars" (p. 41) into old sediments, is responsible for Mount Sheldon and other upstanding peaks of the Mackenzie Mountains (Fig. 1). The map accompanying the memoir, like the illustrations, is a fresh contribution to geography.

FIG. 1.—Mount Sheldon, Mackenzie Mts., a granite mass intruded into Palæozoic sediments.

Mr. W. McInnes reports (No. 1008) on a part of the North-West Territories drained by the Winisk and Attawapiskat Rivers, with a large map on the scale of one inch to eight miles, geologically coloured along the rivers traversed. Topographical surveys were made during journeys by canoe. This region, lying north of the Ontario border, has no great relief; the Archæan plateau has been smoothed by glaciation, and much of the lowland is covered with boulder-clay, in which the streams now cut characteristic vertical cliffs. Post-glacial marine clays, with *Pecten islandicus*, *Mya truncata*, and *Mytilus edulis*, those widely spread molluscs of the north, occur in the valley of the Winisk, presumably representing an inflow from Hudson Bay. Lists of living land and fresh-water shells are given on pp. 52 and 53, and will be sought for here only by those zoologists who know the observant outlook of the Canadian Department of Mines. Its Memoir 14-N, by the by, is devoted to new species of marine shells dredged off Vancouver Island. In a report bound up with that on the Winisk area, Mr. A. Wilson describes a traverse from Lac Seul to Cat Lake, across an unexplored area of 15,000 square miles in extent, to the west of that examined by Mr. McInnes. The rocks consist of amphibolites and mica-schists, penetrated by granitoid gneisses on the south, the latter containing inclusions of amphibolites. Here, as so often happens, the schistose rocks, with their metamorphosed basic associates of igneous origin, are the oldest recognised in the district.

Mr. W. H. Collins's account (No. 1059) of the geology between Lake Nipigon and Clay Lake, Ontario, is remarkable for its clear acceptance (p. 52, &c.) of the intrusive relation, over wide areas, of the Laurentian to the Keewatin and Huronian series. Inclusions of the latter in the gneisses, far away from any junction of the two types of material, are used as an argument for the former extension of a schistose mantle over the whole area. It may be confidently stated that in our islands such inclusions would be often treated under the mysterious title of "basic segregations."

The Survey now (1910) issues a definite series of publications styled Memoirs, No. 1 being by Mr. A. Wilson on the geology of the Nipigon Basin. In Lake Nipigon we are glad to note the occurrence of Murchiston, Geikie, and Kelvin Islands, all constructed of firm crystalline rock. These are parts of the great and almost horizontal sheets of diabase which cover a wide area, and which remind one of similar occurrences in the Karroo systems of South Africa. After a full discussion, the author concludes that the capping diabase in his area represents a lava that flowed over a land-surface of great extent, to which it is unconformable, and from which, at certain points, it has gathered boulders (p. 94). The sedimentary series of shales, sandstones, and dolomites, in which the igneous sheets are intercalated, are at present classed as Keeweenawan, but Mr. Wilson thinks (p. 71) that they may be younger than even the Potsdam series farther east. The gneisses that occur below the Huronian series include basic types that "probably represent highly metamorphosed portions of the cover, or rather are new rocks whose constituents in part were derived from the cover, and in part from the granite magma" (p. 57). Many features of the surface that might have been attributed to glacial erosion are found to pass under the diabase sheets, and the author regards the ice in this area as comparatively unimportant from a moulding point of view.

FIG. 2.—Gneiss formed from red granite and amphibolite, with contortion due to flow, and a tendency to produce a second direction of banding. Near More Falls, Ontario.

Mr. D. Cairnes, in Memoir 5, writes on the coal district of the Lewes and Nordenskiöld Rivers, the latter

[1] The second article appeared in NATURE of April 27 (p. 292).

being a tributary of the former, and both draining ultimately into the Yukon. The coals are of Jurasso-Cretaceous age. The physiography and natural history of the district are described, and the summer months are said to be delightful. The drift-filled valley floors, set with little lakes, are likely to attract stock-raisers and even cultivators.

Messrs. F. D. Adams and A. E. Barlow furnish an important memoir of some 400 pages (No. 6, price 30 cents) on the Haliburton and Bancroft areas of Ontario. This region is part of a great elevated plain, dissected into moderate and rolling hills, and formed of Laurentian granite-gneisses, with inclusions of amphibolite. The authors give conclusive reasons for regarding the latter masses as derived from the roof or walls of the granite batholith; the blocks fell into the magma, and partook of its subsequent movements (p. 121). Frequently they become streaked out, until strongly banded and even contorted gneisses are produced (Fig. 2); but the authors hesitate (p. 123) to urge that all the grey gneiss of the district has originated in this composite way. The amphibolites, even on a large scale, are traced to the contact-alteration of limestones by the granite, with perhaps some intermingling from the igneous magma. This is, of course, what has been urged in many other areas; but the broad exposures in these undulating Canadian lands offer unusual opportunities for demonstration. Many other types of crystalline rock are described, including syenites with corundum, and the whole memoir is one of immense interest to the petrographer. The corundum is worked commercially (p. 371).

Mr. J. Dresser describes St. Bruno Mountain, in Quebec, in Memoir 7, a mass of ultrabasic igneous rock intruded into Ordovician rocks, probably in Devonian times. Mr. D. Dowling deals, in Memoir 8-E, with the promising field of Cretaceous and Cainozoic coals at Edmonton, on the Saskatchewan, in the north-west.

Memoir 3 is a quarto by Mr. L. M. Lambe on Palæoniscid fishes from the Albert Shales of New Brunswick. The author correlates these beds (p. 14) with the Scotch Calciferous Sandstone. He figures, among other specimens, the types that were described by C. T. Jackson, without illustrations, in 1851.

Mr. C. D. Walcott (Smithsonian Miscell. Collections, vol. liii., No. 7, 1910) has carried his studies of Cambrian stratigraphy into the Bow River Valley, Alberta, Canada, a highly picturesque and mountainous region, where he finds that the basal Cambrian beds rest unconformably on unaltered pre-Cambrian shales and sandstones.

Perhaps we may mention here, in conclusion, a paper by Mr. R. Guppy, published in Canada (Trans. Canadian Institute, vol. viii., p. 373), on "The Geological Connections of the Caribean Region." Mr. Guppy, writing from Trinidad, discusses deep-water Cainozoic beds in Jamaica and other islands, and argues for a former "land connection between the Caribean and North Africa and a sea connection between the Caribean Sea and the Pacific." Both these probably passed away at the close of Miocene times. Mr. Guppy has a way of abolishing double letters in generic names, which may be American, but is hardly fair to their originators.

G. A. J. C.

PRESSURE IN STELLAR ATMOSPHERES

WITHIN the last fifteen years the spectroscopic equipment applied to the study of both laboratory and celestial investigation has been very materially modified both in dispersive power and design. In the early 'nineties there were very few of the 21·5-feet Rowland concave grating spectrographs in regular commission for terrestrial research, and it is probably safe to say that no stellar spectrographs were in use giving direct spectra comparable in dispersion with Rowland's solar spectrum.

The transference of Dr. G. E. Hale's sphere of labours from the Yerkes Observatory to the new solar observatory on the summit of Mount Wilson, Pasadena, California, in 1905, however, marks an important epoch in the progress of spectroscopy, as from that time may be dated the successful application of high dispersive spectrography to the problems of celestial and terrestrial identification, both chemical and physical. Many of the beautiful discoveries have already been noted as they were announced: the photography of sun-spot spectra on a sufficiently large scale to serve as a standard map for future reference, the magnetic field accompanying the sun-spot vortices, the detailed laws of solar rotation, all giving an enormous mass of detailed evidence from which fruitful discussions may be profitably initiated. In the examination of certain of the solar photographs numerous peculiarities were noticed in the relative wave-lengths of the lines, indicating the operation of a definite law. Some time previously Halm had announced (*Astronomische Nachrichten*, Bd. 173, p. 273, 1907) that certain iron lines were relatively displaced to the *red* at the sun's limb compared with their position at the sun's centre. In 1910 Hale and Adams described the results of a long series of determinations of these minute displacements made with the spectrograph attached to the tower telescope of the solar observatory (*Astrophys. Journ.*, vol. xxxi., p. 30, 1910). After eliminating all the known differences owing to rotation and orbital motion, they found from an examination of 470 lines between λ 3741 and λ 6573 that the residual displacements could be classified to a certain extent. Thus the hydrogen lines, calcium (H, K, 4227), sodium D, and magnesium *b* lines showed no appreciable displacements, and this was also the case with the lines the intensities of which were greatly strengthened at the limb of the sun. The lines of titanium, vanadium, and scandium show considerably smaller displacements than the lines of iron and nickel.

The elements of high atomic weight, such as lanthanum, cerium, in general exhibited very small displacements.

The *enhanced* lines, as a class, showed decidedly *larger* shifts than the corresponding *arc* lines.

All these facts point to the suggestion that they are caused by the varying pressure in different parts of the sun's atmosphere, and it will thus be readily seen how, by a careful study of these interrelations and the laboratory variations known to exist under different modes of treatment, we may find it possible to arrive at a satisfactory explanation of the mechanism of the solar atmosphere.

Now to the astrophysicist the sun is simply our nearest star, presenting to us special facilities for local selective examination by reason of the fact of its having a disc of appreciable diameter, and furnishing abundance of light. When the problem is extended to the case of stellar atmospheres the difficulties are at once greatly increased.

It was to afford the means of attacking this question in an efficient manner that Dr. Hale planned the installation of a very high dispersion spectrograph to be used with the new reflecting telescope of 60 inches aperture which has been so perfectly designed, constructed, and adjusted into working trim by Prof. G. W. Ritchey. With the new spectrograph, the spectra of several of the brighter stars have been successfully photographed, and from a preliminary study of those of α Canis Majoris (Sirius), α Canis Minoris (Procyon), and α Böotis (Arcturus), Mr. W. S. Adams has been enabled to come to some interesting conclusions respecting the conditions existing in the atmospheres of these stars (*Astrophys. Journ.*, vol. xxxiii., p. 64, 1911; Contributions from the Mount Wilson Solar Observatory No. 50).

By means of subsidiary mirrors, the equatorial reflector is employed in the *coudé* form, the light being reflected down and through the hollow polar axis to the slit of the spectrograph. The equivalent focal length of the combination of mirrors is 150 feet (45·7 metres), giving an aperture ratio of 1 : 30.

For convenience of manipulation and constancy of temperature, the spectrograph was arranged vertically downwards in an underground pit. The spectrograph is of the Littrow or auto-collimation type, consisting of a lens of 15·2 cm. aperture and 5·5 metres focal length, used in conjunction with a dense flint-glass prism of 63° angle, and a plane mirror to send the light back through the prism, thus giving the equivalent dispersion of two prisms. The large scale of the dispersion thus provided will be evident from the approximate linear equivalents, given as follows:

At λ 4300, 1 mm. on photographic plate = 1·4 Å.
,, 5000, ,, ,, ,, ,, = 2·4 Å.
,, 6500, ,, ,, ,, ,, = 6·2 Å.

Satisfactory definition is obtained throughout the whole length (43 cm.) of the plate used in the spectrograph camera. In the more refrangible portions of the spectrum Lumière "Sigma" plates were employed, while from λ 4900 to the red end Seed "Gilt Edge 27" plates sensitised by Wallace's formula were used. For comparison the spectrum of the iron arc was photographed alongside the star spectrum.

Six plates of the spectrum of Sirius (λ 4200 to λ 6600), four of the spectrum of Procyon (λ 4200 to λ 4900), and nine plates of the spectrum of Arcturus (λ 4300 to λ 6600) were available for measurement, and the chief object in the study of these spectra has been to test the possibility of detecting any differences of displacement for the different lines, and thereby obtain some idea of the effective pressure in the atmospheres of the stars. In Sirius the number of lines available for measurement was comparatively small; in the case of Procyon and Arcturus the selection of lines was similar to those used in the investigation of similar displacements of the lines in the spectrum of the sun's limb.

The enhanced metallic lines, it will be remembered, show as a class most definitely larger shifts at the sun's limb than the ordinary arc lines. Now in the spectrum of Sirius the enhanced lines form a prominent feature, while the arc lines are few. In Procyon the enhanced lines are less prominent, while the arc lines have become more pronounced. In Arcturus the enhanced lines are almost evanescent, while the arc lines, which are associated with the spectrum of sun-spots, are very strongly developed. Mr. Adams gives a table showing in summary form the main results of the inquiry, from which it is seen that in all cases the enhanced lines show a decided displacement to the red relative to the arc lines. Giving the displacements as radial velocities in kilometres, we may summarise the results as:—

Sirius: Enhanced—Arc Lines = +0·90 km. = +0·014 Å
Procyon: ,, ,, ,, = +0·58 ,, = +0·009
Arcturus: ,, ,, ,, = +0·08 ,, = +0·001

The behaviour of the prominent lines in Arcturus is so definite that a special discussion is given of them. A large proportion of the lines of titanium, vanadium, and calcium are greatly strengthened, the enhanced lines decidedly weakened, and those of iron and chromium either strengthened or weakened according to their temperature gradation. The lines of nickel appear to be more prominent in the star spectrum than in sun-spots. The following table summarises this discussion:—

Element	Displacement Å	Equivalent Velocity km.
H	−0·020	−1·2
Ca	−0·017	−0·70
Mg	−0·011	−0·68
V	−0·006	−0·24
Ti	−0·006	−0·23
Ni	−0·006	−0·22
Fe	+0·006	+0·25

The shifts evidently suggest definite grouping of similar elements. The iron lines show a shift towards the red compared with all the other elements examined.

Such is the material Mr. Adams provides for his investigations. In the absence of any other known probable cause, he considers pressure as the principal agent causing these systematic displacements in stellar spectra. The laboratory experimental results of Humphreys and others gave as an average shift for the arc lines of iron 0·0025 Å per atmosphere of pressure. At the sun's limb the enhanced lines in the more refrangible portion of the spectrum were found to be shifted approximately 50 per cent. more than the arc lines, and recent work by Mr. Gale on the spectrum of titanium indicates that the enhanced lines of this substance are also shifted more than the arc lines at the same pressure. Assuming, then, that a similar relationship exists between the enhanced and arc lines of other elements, this affords a means of estimating the gravitational pressures in the atmospheres of stars the spectra of which show these displacements. Thus, as seen in the table quoted above, the enhanced lines in the spectrum of Sirius are shifted towards the red relative to the arc lines by 0·014 Å. This would correspond to a pressure of 12 atmospheres in excess of that existing in the sun's reversing layer. Similar reasoning in the case of Procyon indicates a pressure of 7 atmospheres over that of the sun's reversing layer. These results appear to be in accord with the modern view of regarding stars of the Sirian type as possessing no true photosphere, being simply a mass of gas increasing in density towards the centre without any surface of discontinuity or condensation. In such a star the light coming from great depths would most probably be visible from outside, and indications of great pressure would then be expected. In Procyon the spectrum indicates a transition stage between Sirius and the sun, and the pressure is shown intermediate also. It should be noted here, however, that one of the most important cases investigated by Humphreys in his work on pressure effects is directly opposed to the above conclusions. He found that in the case of calcium the blue *g* line was shifted by pressure about *twice* as much as the H and K violet lines. Now the behaviour of these lines in the laboratory, and also in the spectrum of the solar chromosphere, indicates that H and K are typical *enhanced* lines, while 4226 (*g*) is a very typical *arc* line. The differential pressure effect on the enhanced and arc lines of strontium was exactly similar to that of calcium, viz. the enhanced lines were shifted *less* than the arc lines. Unfortunately for this discussion, Humphreys only employed the arc spectrum in his pressure investigation, so that the general behaviour of the enhanced lines of other substances than calcium and strontium cannot be inferred from his results.

Passing on to the conditions of pressure in Arcturus, it is pointed out that the facts indicate the existence of a well-formed photosphere, the light from which proceeds from relatively low-pressure areas at moderate depths. The results for the lines of different elements indicated in the table are similar to those found for the solar lines. Thus in the sun hydrogen rises to very great heights, calcium and magnesium also being high-level substances Titanium is also relatively high-level, but iron is distinctly a low-level element. In Arcturus the displacements indicate exactly such an arrangement, and it is thus concluded that the lines of H, Ca, Mg, Ti, &c., are subject to less pressure than those of iron, and therefore that the gases producing them lie at a higher average level.

CHARLES P. BUTLER.

RECENT INVESTIGATIONS ON SOIL FERTILITY.

FOR some years past the United States Department of Agriculture Bureau of Soils has maintained that infertility might, and not unfrequently does, arise from the presence in the soil of toxic organic substances that have been excreted from the roots of plants. This view has been opposed on two grounds: it is not evident that plants do normally excrete poisonous substances; and if such substances are present there is no proof that they would act as poisons in the soil, which possesses a remarkable power of withdrawing dissolved substances from solution. Not long ago Scheiner isolated dihydroxystearic acid from a considerable number of unproductive soils, and now, in conjunction with J. J. Skinner,[1] he has examined its behaviour to plants in water cultures. In all cases its effect was toxic, but the toxicity was much reduced when fertilisers were added to the solution, and was at a minimum when the fertilising constituents were present in the ratio most favourable to plant growth. Several incidental questions were also cleared up dealing with water cultures—perhaps the most difficult of all experiments to interpret—and the paper contains a great number of data bearing on the subject. The behaviour of this acid in the soil is not touched upon, and very wisely no attempt is made to argue from a water culture to a soil. It is, however, a distinct step in advance that an acid has been isolated from certain soils and identified, and shown to be poisonous in water culture. The results may well be connected with the known fact that, in absence of lime, soil becomes acid and loses fertility, which can only be restored by addition of lime or chalk.

[1] Bulletin 70, Bureau of Soils, U.S. Department of Agriculture.

So great is the part played by bacteria in determining fertility, that a great amount of attention is being paid in most soil laboratories to their various actions. The fixation of nitrogen is of perennial fascination, and is still far from being solved. Certain bacteria, notably azotobacter, can take up gaseous nitrogen and synthesise protein, nuclein, &c., without any materials save only sugar and various mineral salts. The organisms occur in most soils, and it is only necessary to inoculate small quantities of soil into a solution containing the sugar, phosphates, potassium and other salts, but no nitrogen compounds, for development to take place and nitrogen fixation to occur. The chemistry of the process is unknown; investigation, so far, has been confined almost entirely to morphological work and to the effect of various conditions on the process. Messrs. C. Hoffmann and B. W. Hammer, of the University of Wisconsin Agricultural Experiment Station, have recently (Research Bulletin 12) repeated and extended some of these observations. They find the best sugars are mannite and lactose, but it is not desirable to have too much. Similarly, there is no advantage in having too much calcium carbonate, although some is needed. In one respect these authors differ from previous investigators; on analysing the dry azotobacter cells they obtained a protein content of 17·75 per cent. only, against 80 per cent. found by Gerlach and Vogel and 70·6 per cent. by Stoklasa. The cause of the difference is not clear, but may perhaps be ascribed to the slime that invariably surrounds the organism without being an integral part of it, and that is only removed with great difficulty.

How far azotobacter is active in the soil is difficult to determine, because there is an opposite process, the liberation of gaseous nitrogen from protein, and also, under anærobic conditions, from nitrates, also brought about by bacteria. But it has been shown by Koch that the addition of sugar to soil some months before the seed was sown led to an increase in crop by increasing nitrogen fixation, although if applied direct to the crop it produced harmful results. These facts are attracting much attention in sugar-producing countries, and it has been shown that waste molasses, which cannot profitably be sold, gives useful increases in crop when applied as manure some weeks before planting, especially on light soils. S. S. Peck, of the Hawaiian Sugar Planters' Experiment Station (Bulletin 34), has studied the two changes, nitrogen fixation and denitrification, and confirms the general results already obtained; molasses applied before planting stimulates nitrogen fixation, but applied to the growing plant it does harm by causing loss of nitrate or diminished nitrification.

He also confirms some recent work of Russell and Hutchinson, and finds that numbers of protozoa harmful to bacteria occur in soil—he found amœbæ, paramecium, and others—all of which can be destroyed by moderate heat or antiseptics like carbon disulphide. Partial sterilisation of the soil is being studied in several directions. *The Journal of Agriculture of South Australia* states that farmers there have long recognised the advantage of burning the stubbles, and thus heating the soil; investigations are in hand at the Roseworthy Agricultural College to study the problem from this new point of view. An apparatus for soil sterilisation suitable for gardeners is described in *The Journal of the Department of Agriculture of Victoria*, which is similar in principle to some that are working in England. *The Scientific American* recently gave an account of methods proposed in the United States.

Although nitrates are invaluable in the soil, an excess is injurious, because it causes plasmolysis. Dr. Headden, of the Colorado Agricultural College Experiment Station (Bulletins 155 and 160), reports analyses of soils in Colorado containing such excessive amounts of nitrates that they were sterile. He thinks their formation can be explained only as due to bacteria; he supposed that nitrogen fixation has gone on to an excessive degree, and has thus led to disastrous consequences. Further work on these soils will be awaited with interest.

The factors determining soil fertility are slowly being disentangled, but they are far from being fully known, and therefore investigations of cases of infertility are of considerable scientific interest, besides being of technical importance. Such a case is afforded by the scouring pastures of Somerset, now being studied by C. T. Gimingham, of the University of Bristol. Pastures in certain districts of the Lower Lias formation cause diarrhœa or "scouring" in cattle fed on them. No obvious explanation is forthcoming, no poisonous weeds are found, nor does the provision of a pure water supply obviate the trouble. Mr. Gimingham has, in *The Journal of the Board of Agriculture* (No. 7), collected the main facts, and adduces strong evidence to show that the physical condition of the soil is the determining factor, the peculiar conditions obtaining on the Lower Lias, but not on the adjacent alluvium and Inferior Oolite, being favourable to the factor actually causing the disease. Experimental work on this subject is necessarily slow and tedious, but, in view of its importance, it is much to be hoped that Mr. Gimingham will be able to continue the work on the sound lines on which he has begun.

The phenomena of flocculation and deflocculation in soils have been much investigated, but are far from being worked out. E. E. Free has recently summarised (Journal of the Franklin Institute) the present position of our knowledge, and has shown that a marked influence is exercised by impurities present in the water in which the suspensions are made for experimental purposes. He considers it probable that in absolutely pure water only a medium degree of permanence would be attained. In his view, any material can be suspended in water, flocculated, and deflocculated, if it can be got in a sufficiently fine state.

E. J. RUSSELL.

MUSEUM WORK IN INDIA AND AFRICA.

ACCORDING to the report of the Natural History Section, the year 1909–10 was an important one in the development of the Indian Museum, Calcutta, as it witnessed not only a reorganisation of the staff of that section, but likewise the passing of an Act to give greater independence to the constituent sections in the matter of scientific and educational work, and also to permit the respective chiefs of the same to become *ex officio* members of the board of trustees. As a result of the new regulations, it will be possible to separate the archæological from the zoological section, and to place the former under the control of the director of the Archæological Survey. Among the additions during the year, attention is directed to the cast of a susu, or river-dolphin, from the Hughli.

The report on the fishes collected by the *Golden Crown* is continued, by Messrs. Annandale and Jenkins, in No. 1 of the third volume of the Memoirs of the Indian Museum, these contributions including a supplementary note on the rays, together with accounts of the Plectognathi, Pediculati, and flat-fishes. As the collection of sharks made by the *Golden Crown* was relatively small, the consideration of that group is postponed. The teleostean collection, on the other hand, is so extensive that its description in an adequate manner will practically mean a revolution in our ideas of the Indian marine fish-fauna. In the present contribution three small and compact groups, to which the additions are comparatively few, have been selected for treatment.

From among nine papers on various groups of invertebrates in the fourth part of vol. v. of the Records of the Indian Museum it must suffice to refer to some interesting information, by Messrs. Henderson and Mathai, on the occurrence of dimorphism in certain fresh-water prawns of the genus Palæmon. In many, if not all, the species two forms of adult males occur, namely, a normal type of relatively large size, with well-developed nipping-claws, and a generally smaller type, with the same claws no bigger than in females. Among certain other decapods in which a similar dimorphism obtains, the two phases are recurrent, and severally represent the breeding and non-breeding conditions; but, so far as the authors of the paper could ascertain, this does not appear to be the case with the Indian Palæmons.

The classification of the anopheline mosquitoes of India forms the subject of No. 5 (it may be noted that "part" and "No." are respectively used in the two issues) of vol. iv. of the serial last quoted. The changes proposed are of a radical character, the author, Major S. P. James, refusing to admit that any of the species are referable to the typical Anopheles. The Indian members of the group

are divisible into two series, respectively characterised by the presence or absence of scales on the abdomen.

To the Annals—which now bear the alternative title of Mededeelingen—of the Transvaal Museum for November, 1910, Mr. J. Hewitt contributes a key to the South African members of four families of lizards, with notes on their distribution. The issue is also noteworthy on account of the inclusion of eight beautifully coloured plates to illustrate Mr. Meyrick's article on Microlepidoptera published in an earlier part.

REPORT OF THE BOARD OF EDUCATION.

THE report of the Board of Education for the year 1909–10, published a few days ago (Cd. 5616, price 8*d*.), contains an instructive statement of the position of elementary, secondary, and technical education in England. One section of the report, dealing with the teaching of science in secondary schools, was reprinted in NATURE of May 4 (p. 326), and we now give an abstract of other portions. The section of the report devoted to elementary education reviews the history and recent development of the provision made for teaching the pupils in public elementary schools, and touches upon certain aspects of the subject of school staffing which have been especially prominent very recently. With this subject we are not particularly concerned in these columns, but the subjoined extracts, relating chiefly to higher education, will interest readers of NATURE.

Establishment of the Universities Branch of the Board.

The Board has recently organised a special branch of its department to deal with the many matters arising from the connection with the work done by the modern universities. Experience had shown that the technological and professional instruction (including the training of teachers for elementary and for secondary schools) given by the universities and aided by grants from the Board, could not be properly dealt with as part of the ordinary administration of the Board as applied to institutions which have less autonomy, responsibility, and prestige than the universities. The universities need the greatest possible degree of freedom in organising and carrying out their important national and international functions, and the Board has for long been convinced that their relations with the universities should be so adjusted as to further this end. In April, 1910, the President accordingly appointed the Board's director of special inquiries and reports, Mr. H. F. Heath, to the office of principal assistant secretary for the new universities branch of the Board. Mr. Heath had a long connection with, and an intimate knowledge of, the modern universities before his appointment to the Board in 1903, and his work in the Board's staff as an advisory rather than an administrative officer since that date marked him out as specially qualified for the new post. Mr. Heath continues to hold his office as director of special inquiries and reports.

The International Commission on the Teaching of Mathematics.

In view of the fact that a meeting of the International Congress of Mathematicians is to be held at Cambridge in 1912, and that an International Commission on the Teaching of Mathematics has been constituted in connection with the educational section of the congress, the office of special inquiries and reports has made arrangements to publish a series of papers dealing with the teaching of mathematics. It is intended that copies of these papers shall be placed at the disposal of the International Commission, and that they shall ultimately form a volume or volumes in the series of special reports on educational subjects.

An advisory committee has further been appointed by the President of the Board to assist in the collection of papers and to advise as to the suitability of the contributions sent in. This committee will also act as the British Subcommission—one of a number of national subcommissions established to assist the International Commission in its work—and is constituted as follows:—Mr. C. E. Ashford, Sir G. H. Darwin, K.C.B., F.R.S., Prof. G. A. Gibson, Mr. C. Godfrey, Sir George Greenhill, F.R.S., Mr. G. H. Hardy, F.R.S., Prof. E. W. Hobson, F.R.S., Mr. C. S. Jackson, Sir Joseph Larmor, M.P., F.R.S., Prof. A. E. H. Love, F.R.S.

Mr. C. S. Jackson is honorary secretary to the British Subcommission.

The Science Museum.

The needs of the Science Museum have been before the Board for some years, and it has recently become possible to take active steps to provide for them. The matter formed the subject of a memorial of great weight, presented just a year ago by a deputation representing the learned societies, the universities, and the technical colleges of the country; and the evidence then put before the Board amply confirmed the view that the science collections are even now of great value to the nation, but that their usefulness is crippled, and their growth prevented, by the inadequacy of the buildings in which they are housed.

The accommodation for these rich collections, which include many inventions that have proved to be pioneers in industrial arts and afford much effective exposition of modern developments of pure and applied science, ought to be in every way worthy of the interests which they serve. What has now to be done to meet this requirement ought to be done on a scale and in a form that will give the Science Museum an assured place among the permanent national institutions of the country. The Board is anxious that the scheme for the future development of this museum should receive adequate consideration before the work is actually put in hand, and it feels that the requirements of the collections in the Museum of Practical Geology in Jermyn Street should be discussed at the same time. In whatever action it may take in this matter, it wishes to assign to the valuable collections in these two museums definite part in the provision of facilities by national museums. A Departmental Committee was therefore appointed in March, 1910, to consider and report upon various questions in regard to the collections. In particular the committee was asked "to advise (*a*) as to the precise educational and other purposes which the collections can best serve in the national interests; (*b*) as to the lines on which the collections should be arranged and developed, and possibly modified, so as more effectively to fulfil these purposes; and (*c*) as to the special characteristics which should be possessed by the new buildings, which it is hoped will shortly be erected on the South Kensington site to house these collections, so as to enable the latter to be classified and exhibited in the manner most fitted to accomplish the purposes they are intended to fulfil." [See NATURE, May 4.]

The committee informed the Board in a preliminary report in July last as to the general conclusions it had then reached on these questions, and in particular as to the nature and extent of the collections and as to the size of the buildings that would be required for such a development of the collections as they contemplated. The Royal Commission for the Exhibition of 1851 has intimated that it is prepared to make a grant of 100,000*l*. from the funds at its disposal towards the erection of a new building for the museum, the balance of the cost of which would be provided from public funds.

Secondary Schools (England).

The total number of schools regarded as eligible for grant during 1909–10 was 841, as compared with 804 during 1908–9. Of these, 325 were controlled by local authorities, 447 were endowed schools or schools of a similar type, 29 were schools belonging to the Girls' Public Day School Trust, and 40 were controlled by Roman Catholic teaching orders. In these schools there were on January 31, 1910, 76,909 boys and 64,649 girls, as compared with 73,273 boys and 62,401 girls on January 31, 1909.

In addition to the 841 schools on the grant list there were 87 other schools recognised by the Board as efficient during 1909–10, being an increase of 5 on the number recognised as efficient during 1908–9. Of these 67 were endowed schools or schools of a similar type, 3 were controlled by Roman Catholic teaching orders, and 17 were private schools. In these schools there were on January 31, 1910, 8215 boys and 7249 girls, as compared with 7117 boys and 7179 girls on October 1, 1908.

Thus during the year 1909–10 there were in England altogether 928 schools recognised by the Board as efficient, educating 85,124 boys and 71,898 girls, as compared with

886 schools in 1908–9 educating 80,390 boys and 69,580 girls.

Length of School Life.

The length of school life is a matter to which the Board attaches very great importance, for if the bulk of the pupils in fact drop out of a secondary school after passing through only a fraction of the school course, it is clear that the secondary school is not fulfilling its aim and is not entitled to State aid. An article of the regulations expressly provides that a school will not be recognised as a secondary school unless (1) an adequate proportion of the pupils remain at least four years in it, and (2) an adequate proportion of the pupils remain in it up to and beyond the age of sixteen.

The average length of school life in schools on the grant list is not yet nearly so high as it should be. Some improvement is being made, but it continues to be slow.

At the end of 1909 the Board took up the cases of thirty-five schools which appeared to have an exceptionally short average school life, and, after a careful investigation of the circumstances of each case, addressed to twenty-six of these schools a warning that continued failure to comply effectively with the Board's requirements would entail removal from the grant list. In many of these cases the Board suggested that an undertaking should be required from the parents of all pupils, on their admission to the school, that they would not be removed without good reason before completing an adequate period of school life; and directed attention to the fact that such an undertaking with a penalty enacted had already been adopted by several school authorities with marked results. The suggestion has, as a rule, been cordially accepted, and is, it is believed, already having good effect; but these and all other cases where there is a tendency for the school life to be abnormally short are being kept under careful observation, and action is being taken where necessary.

Attendance at Evening and similar Schools.

Statistics for 1909–10 with reference to schools and classes intended for those whose ordinary avocation occupies the greater part of their time will be given in the statistical volume for that year, to be issued later in 1911. Reference, however, to Tables 83 and 99 in the 1908–9 statistical volume reveals an increase in the total number of students enrolled in these schools from 751,600 in 1907–8 to 752,356 in 1908–9. These figures show but little progress in popular appreciation of the facilities offered to those desirous of recovering what they have lost of their previous education, or wishing to obtain a wider and firmer grasp of the principles underlying their several callings, whether these be in industries, in commerce, in professions, or in domestic occupations. It is also matter for regret that nearly 20 per cent. of the students enrolled failed to complete the small minimum of attendances required in order to enable grants to be paid towards their instruction.

The average number of hours of instruction received per student in the county boroughs (including London) as a whole was 55. In seven county boroughs this average was under 40; and in 21 others, while more than 40, it was under 50. In 47 it was above 50; in nearly all of these it was under 80, but in 10 county boroughs, situated in Lancashire and Yorkshire, and in one in Cheshire, the average number of hours received per student during the year 1908–9 exceeded 80, in two cases the average being more than 100 hours. In such cases the high average reflects considerable credit on the organisation of the work of further education, and very satisfactory results may fairly be anticipated from the instruction received by the students.

In the administrative counties (excluding London) each student received on an average 48 hours of instruction. In view of the number of short courses of special instruction recognised as eligible for grants in certain rural areas, as well as for other reasons, it is to be expected that the average should be lower in rural than in urban areas. Only in seven cases, however, was the average below 30 hours; in 17 others, while more than 30, it was under 40; in the remaining 37 this average was above 40, and in three of these cases it exceeded 60, in two of them being more than 80.

From these figures it will be seen, on one hand, how meagre is the amount of instruction received by the students in some areas, and, on the other, that even under existing circumstances some students can be induced to give real and continued attention to their further education.

The number of students more than 21 years of age has fallen from 253,677 in 1907–8 to 247,436 in 1908–9.

Technical Institutions.

The total amount of advanced instruction of the kind provided in technical institutions is still disappointingly small. In some of the more important industries, as, for example, engineering, the instruction is largely utilised by students; but in a great many others the supply of students is very small. It is to be deplored that there are several schools in which the well-qualified staffs and the excellent equipment practically stand idle in the day-time through lack of students.

The students enrolled in the 42 technical institutions which were recognised as eligible for grant in 1908–9 numbered 3400, of whom 3010 qualified for grant. Of these latter 1990 took full courses of instruction; 806 were engaged in the work of the first year, 653 in that of the second, 406 in that of the third, and 125 in still more advanced work. There is still a tendency to admit students to technical institutions before they have had an adequate course of general education; 211 students were under 16 years of age at the opening of the session 1908–9.

For the year 1909–10, 49 technical institutions were recognised as eligible for grant, showing an increase of seven over those recognised in the previous year.

Day Technical Classes.

Grants are payable under Article 42 of the regulations to schools and classes which are, as a rule, for students younger than those in the technical institutions. Under this category there are included, however, some classes of a standard equal to that required in a technical institution, but with courses not of sufficient duration to be eligible for grants as technical institutions. Day technical classes vary in their aims, some being preparatory to trades, such as engineering, others providing instruction of a domestic type, others again being for blind or deaf students.

In 1908–9, in England and Wales, day technical classes were recognised as eligible for grant in 103 institutions; and at the 180 courses for which grants were paid, 10,237 students were enrolled, of whom 9636 qualified for grant. Of these courses, 109 were full-time and 71 part-time; 6137 students attending the former, 3499 the latter. Of the full-time courses, 52 were for junior students, of whom 4039 qualified for grant, and 57 courses were for senior students, of whom there were 2102 who also satisfied the conditions of eligibility for grant.

For the year 1909–10, day technical classes were recognised as eligible for grant in 109 institutions.

THE BRITISH SCIENCE GUILD.

THE report of the British Science Guild, presented at the fifth annual meeting, held on April 7, has just been distributed. A few of the subjects dealt with in the report were mentioned in the account of the annual meeting which appeared in NATURE of April 13; and we now reprint the section referring to Government organisation, a summary of the first report of the Canadian committee, and the conclusions and recommendations of the Technical Education Committee. The report of the Canadian committee shows that valuable work in promoting the aims of the Guild is being carried on in the Dominion. We note with interest that among the subjects receiving consideration are the teaching of science in schools, technical education, the conservation of natural resources, and the location of icebergs by their temperature effects—a very important matter to ships navigating in many waters during foggy weather.

The report of the Technical Education Committee, which runs to forty-eight pages, should be read in connection with Lord Haldane's remarks upon technical education at the annual meeting. In the course of his speech, he said:—"With regard to technical education, there is more going on in this country than people realise, and the mistake that has led to the want of recognition of this is the habit people

have of comparing things that are unlike. It is quite true that in higher education and in the application of science to industry Germany has marked features which we do not possess, but evening schools and evening classes connected with universities or technical colleges are things which are little known in Germany as we know them."

Lord Haldane seems himself to have erred in comparing things which are unlike, and the conclusion derived from the comparison is, therefore, misleading. Our evening-class system is admirable, but as the report of the Guild's Technical Education Committee points out, it is to a large extent of the nature of continuation school work, and has no relation to technical education rightly so-called. About three-quarters of a million students attend evening schools and classes, but the average number of hours of instruction received by each student throughout the session is only about fifty, and 20 per cent. of the students fail to complete the small minimum number of attendances required by the Board of Education as qualification for a grant toward the instruction. Moreover, nearly 150,000 students in evening schools and classes are under fifteen years of age. It is obvious that, however excellent this evening-school work may be considered from the point of view of further education, it can be of little assistance to national industries and manufactures which require highly specialised knowledge and research for their development.

The latest report of the Board of Education provides the best reply to the suggestion that we have reason to be satisfied with what is being done for technical education in England. It appears from this report that in the forty-two technical institutions recognised by the Board (and that number includes practically all the technical schools and colleges in which organised courses of relatively advanced instruction are given in the day-time, as well as applied sciences departments of such Universities as Birmingham, Liverpool, Manchester, and Leeds), about 2000 students took full courses of instruction in 1909–10. Of these students only about 400 were engaged in work of the third year, and 125 in still more advanced work. What it comes to, therefore, is that the total number of day students in English polytechnics, technical schools, and colleges is less than in a single German technical university such as that of Charlottenburg or Munich.

But putting comparisons aside, there is surely nothing to be satisfied with in the fact that only 125 students in the technical institutions connected with the Board of Education are doing work beyond that of the third year, considering that the entrance age is sixteen, and in some cases is reduced to fifteen years. No wonder the Board of Education remarks in its report:—"It is to be deplored that there are several schools in which the well-qualified staffs and the excellent equipment practically stand idle in the day-time through lack of students." Details of our position as regards technical education, and suggestions for its improvement, will be found in the report of the Technical Education Committee, printed as an appendix to the report of the Guild. The subjoined extracts from the general report and this appendix are of particular interest.

Government Organisation.

In the appendix to the fourth report several opinions were quoted touching on the need of a better reorganisation of our executive Government. It was pointed out by our president that at present our "executive government is about as disorganised and chaotic an institution as anybody can conceive." "There was too little science in it at the present time. There was hardly a department which did not require the aid of science if it was to be effective."

"I believe that things will not be right until we have a scientific corps under a permanent committee, just as the Defence Committee is under the Prime Minister to-day. I think you should not have a body which consists of officials of the ordinary kind, but one which should consist of the most scientific men, who would go there because they are honoured and paid, and put on the footing on which they deserve to be placed, and are recognised as a body of men who will be at the elbow of the department, and who can organise the scientific work of the State. If we get that, as I hope we shall, I trust that the example of the Government in adopting science will be followed by the municipalities, as I believe it is going to be followed more and more by our manufacturers."

"The creation of the Committee of Imperial Defence carried scientific principles into the sphere of government, and was the first step towards getting military and naval motions into order. We now have a general staff which is a body, not to exercise command, but to give advice in a thoroughly practical fashion and in a fashion which can be enforced. The speculation may be indulged in whether one of the great reforms of government to which we are coming—because we have been driven to it—will not be the creation in an organised fashion of just such a general staff for departments of government, and not merely for the army."

Apart from the question of advisory committees already referred to, there are other parts of our administrative system, or want of system, which have to be considered.

The oldest Government departments were set going in the pre-scientific age. War, diplomacy, and finance were then the chief things considered. The State did not concern itself with commerce and industry, or the health or education of the people, nor had science or art any place in the administration. It was in connection with the Navy that the first scientific services were established, the Royal Observatory for preparing an ephemeris[1] and a survey of the seas to render the navigation of warships more secure.

In most Continental nations, including our own, the scientific education of army and navy officers was insisted upon long before that of civilians; hence the former were necessarily employed in various departments of the State, when the necessity of facing scientific problems arose. Thus our land survey was carried out by the Board of Ordnance.

It was while this state of things existed that the Board of Trade and the Department of Science and Art were established, as a result of the Prince Consort's warnings and pleadings. It was the Board of Ordnance which supplied its well-instructed officers of engineers to these and other public departments as the need for scientific treatment arose, and because fully educated civilians were not available either in the departments or outside them. It is in consequence of these various additions to the State machinery at different times to meet different needs that the "chaotic" condition to which our president has referred has arisen. The new problem raised by the necessity of scientific inquiries to aid the service of the State has not yet been faced.

To take an instance of our administrative system, or want of system, we may refer to our national surveys. Our four national systems of surveys of the surface of the land, of which that surface consists and of what lies underneath it, of the air and of the seas, are at present controlled by four different departments of the State.

The two land surveys, one using the maps prepared by the other, are controlled, one by the Board of Agriculture, the other by the Board of Education. The Meteorological Office, which deals with the air, is under the Treasury, while the hydrographic survey is controlled by the Admiralty.

There is good reason for the last named being under the Admiralty, because to the Admiralty belong the ships which are necessarily used in the work; but there is no reason why the other three surveys should not be administered by one department.

The question arises whether the surveys dealing with the land surface and what lies beneath it should not be brought together, and under the Board of Education, and whether the air survey (the Meteorological Office) should not be transferred from the Treasury to the same department, which already administers the Solar Physics Observatory, in which allied work is carried on. The recent transfer to South Kensington of the Meteorological Office is another argument in favour of this proposal.

To take another instance. The primary, secondary, and technical education of the country is controlled by the Board of Education, while the Treasury is supreme in matters relating to the universities. The situation is as if

[1] Even then, however, according to Sir George Airy, the latitude of the court had more to do with the foundation of the Observatory than the importance of determining the longitude at sea A Royal mistress had reasons for wishing the new departure.

the Secretary of State for War were only concerned with barrack-yard drill, the higher training at Aldershot and Salisbury Plain being in charge of another Minister.

No other civilised Government attempts to deal with general education in two watertight compartments. The present position suggests inquiry which may show that the Board should really be made responsible for the whole of the educational ladder, and not merely for the lower rungs of it. This would take from the Treasury a matter with which, from its constitution and personnel, it is not so fitted to deal as is the Board of Education.

We have already found in two cases, the Meteorological Office is one and university education another, and to these can be added a third, the administration of scientific grants, in which the Treasury, the function of which is to control the expenditure of spending departments, acts as a spending department itself; an Alice in Wonderland arrangement, in which the Chancellor of the Exchequer acts both as judge and jury; there is no Minister in the Cabinet to advise or defend expenditure thus administered, except the one whose chief function is to veto it, and no consultative committee to refer to; to this may doubtless be attributed the small regard paid to the claims on behalf of science and the higher learning generally.

In the matters under review the practice of foreign Governments varies according as science is regarded from the pure or applied standpoint, but the rule most generally acted on is to place the scientific services under the control of the Minister of Public Instruction, who is thus a Minister for Science.

It would appear from the foregoing references to the distribution of the services among departments, that much of the apparent confusion would disappear if certain of them were transferred to the Board of Education. This would be in harmony with Continental practice, and would have the advantage of utilising to the fullest extent the services of an advisory committee, when, following the precedent recently so fully acted on, one is appointed to deal with the scientific services. Another way out of the present chaos is to appoint a Minister of Science.

Although the words "Science and Art" have disappeared from the title of the Board of Education, it still carries on the work of the Science and Art Department, and the more thoroughly it is carried on and developed the better it will be for the nation. It is unfortunate from this point of view that in the controversies which have been carried on of late years in the name of education, the real functions of the Board have become obscured.

If we pass to the question of museums we find the same chaos; this was reported on by the Duke of Devonshire's Commission in 1874. Of these the oldest, the British Museum, including the Natural History Museum with a Geological Department at South Kensington, is administered by trustees; the youngest, the Victoria and Albert Museum and the Science Museum, also at South Kensington, by the Board of Education.

The Board of Education also controls the Geological Museum at Jermyn Street, the Geological Department of the British Museum being, as stated above, at South Kensington.

The above anomalies lie on the fringe of the subject; they are given as examples of the ground to be covered when an inquiry is made.

Conclusions and Recommendations of the Technical Education Committee.

(1) The work of technical education should be organised as a national system. A system of scholarships or bursaries should enable the most promising students to pass from the technical school to the university, or to highly specialised institutions established to promote the scientific and practical study of particular industries. Technical institutions of sufficient standing should be connected with local universities, and others should be assigned work and place in an organic scheme to prevent waste of effort and undesirable competition.

(2) There should be a national Advisory Board for Technical Education and local Advisory Boards should also be appointed; these should include a certain number of teachers as well as representatives of industry and commerce. Greater appreciation of the value of scientific and technical education to industrial progress may thus be secured. The development of specialised institutions closely connected with local industries is always promoted by the appointment of representatives of the leading manufacturers upon the governing bodies of such institutions.

(3) Courses of study and syllabuses leading to national certificates in technical education should be approved by the National Advisory Board. Such work should be of a more advanced character than that for which local bodies may grant certificates, but a national certificate relating to attainment in the specialised knowledge of the district could be established by the local and national Advisory Boards acting jointly.

(4) Evening classes provide a valuable means of combining theoretical studies with actual practice—concurrent training in factory and school—and have done much to qualify strong and capable men for positions of responsibility in commerce and in certain industries. An extension of the opportunities for part-time study in the day is, however, greatly to be desired, and the increase of such classes should do much to advance technical education.

(5) There should be in each district a sufficient number of (*a*) trade preparatory schools for pupils of about twelve to fifteen years of age, such schools to differ from ordinary secondary schools in the large amount of time given to various forms of manual instruction; (*b*) continuation schools for part-time day pupils and for evening pupils. Both (*a*) and (*b*) would be concerned chiefly with the further education of pupils trained in primary schools.

(6) For the comprehensive training required to produce future captains and leaders of industry, whole-time instruction is essential in institutions of advanced type. It is desirable that each institution of this type should add to its curriculum, as far as possible, specialised instruction in a particular subject, or group of subjects, relating to one or more of the principal industries of the district.

(7) The national and municipal expenditure upon education in England in respect of technical, art, evening, and similar schools and classes is about one and a half million pounds per annum: and the number of students above fifteen years is about half a million; so that, neglecting younger pupils, the annual cost is only about 3*l*. per student. As, however, the chief part of the work of most of the schools, whether day or evening, is elementary or of a continuation-school grade, it cannot be classified as technical education; hence the actual expenditure upon technical education properly so called is only a small amount of the total.

(8) In most parts of the country, bursaries or scholarships are provided, by means of which promising pupils in public elementary schools may pass into secondary schools or technical schools, and thence into a technical college or university for more advanced instruction. For work of what may be called a post-graduate standard, however, little provision has been made, though it is of the highest importance. To secure the highest development of industries, highly technical and specialised work must be carried on in suitable institutions by well-qualified students. Increased facilities should therefore be afforded by liberal scholarships or other assistance, to enable such students to enter institutions of this type and maintain themselves while following approved courses of study or research.

Report of the Canadian Committee.

Since the meeting of the organising committee of the British Science Guild in Canada, held in Winnipeg during the meeting of the British Association, the Canadian committee has been established on a firm basis, and some definite work has been undertaken. It is a source of satisfaction to have the sympathy and advice of Lord Strathcona, who kindly consented to become honorary president of the committee this year, owing to the withdrawal of Earl Grey as Governor-General of Canada.

One of the most important questions now being considered by this committee is the teaching of science in the schools. A special subcommittee has been formed, with Dr. C. J. Lynde, Department of Physics at Macdonald College, as chairman. The object of this committee is to gather information as to the facilities for science teaching offered in the various provinces. The committee has in view the following questions:—

What sciences are taught in the schools, and by whom? What qualifications (academic or professional) has the teacher?

Is the instruction assisted by lecture, experiment, and laboratory work?

How far instruction in physics or chemistry encourages scholars to take up a scientific or technical career?

In what way can assistance be given by the universities to the science teachers in the schools?

Whether the giving of one or two lectures by university professors in the schools from time to time, on modern development in science, would be of assistance to the teachers?

Whether special summer courses in elementary science given in the universities would be of help to the science teachers?

Whether there is a modern scientific publication taken regularly by the school, or by the teacher?

Dr. J. W. Robertson, a vice-president of the committee, has been appointed by the Government chairman of the Commission on Technical Education. This commission is entrusted with the duty of thoroughly investigating the needs for technical training all over Canada. It will, in addition, go to the United States and Europe, where the educational systems will be thoroughly investigated. In Dr. Robertson's own words, we state the work of the commission. He said that "the Government had expressed a recognition in a new form of the heritage of Canadians. This recognition is in the form of the conservation of the resources of the country. These cannot be utilised until the people have been educated in this regard, and in their proper development. The best way is that whereby labour can be applied with the least waste, cost, &c. Industrial efficiency is an all-important item in the successful development of Canada. The commission, by investigation and by personal observation, is to secure all the information possible on the industrial life of Canada."

One of the vice-presidents of this committee, Mr. F. H. Sexton, is director of technical education for Nova Scotia. Prof. Sexton's work is proving of the greatest benefit to the province. It is to be hoped that his efforts may be directed to wider fields. Nova Scotia was the pioneer in establishing technical education in America, being the first province in the Dominion to do so, and being two years ahead of Massachusetts, which was the first State of the Union to take this up. Through Prof. Sexton's efforts, there exists in all the colleges a uniform course of study for the first two years' work. Scholars can then do advanced work in the provincial technical college in any branch of engineering they desire. There are a number of night schools, mostly for miners, which are of great benefit. These schools are supported by the Government, and are entirely free. They are not intended to increase the number of men seeking employment, but to increase the efficiency of those already at work.

A commission has been appointed by the Government to study the natural resources of the country. In this important matter the Guild committee is ably represented by the Hon. Sydney Fisher, Minister of Agriculture, one of our vice-presidents.

The Forestry Association in Canada has been actively engaged in educating the people to a better appreciation of the value of conservation. There exists in Canada at the present time vast areas of forest wealth. Each province has its own forestry regulations, and much valuable material has been collected and distributed by the association. It is safe to predict that the paper-making industry will in the near future be controlled in Canada. The destruction by fire is one of the most serious features of our national loss. Through the efforts of the association, however, greater intelligence is being displayed in fire patrol. The people are beginning to realise the need for stricter regulations in the forest regions.

In the matter of parks and playgrounds in the rapidly increasing City of Montreal, one of the members of the committee, Dr. J. G. Adami, F.R.S., has been among the chief workers in securing a Parks Commission, which is to have power to acquire land for parks in and around the city, as well as to investigate the housing of the poor. Dr. Adami has been active, also, in the work for the prevention of tuberculosis, and much good has already resulted from his labours.

The secretary has been devoting much study to the ice conditions of the St. Lawrence River as it affects navigation. A report now being printed by the Department of Marine and Fisheries sets forth the result of the study last year. The Minister of Marine, the Hon. L. P. Brodeur, one of the vice-presidents of the committee, has shown the greatest interest in this work, and has given the secretary every facility for study. Investigations have been carried to the lower St. Lawrence and Gulf in order to determine a matter of vital importance to the St. Lawrence route to be able to determine the influence of icebergs on the temperature of the water. It is a matter of vital importance to our St. Lawrence route to be able to determine the effect of icebergs, and, if possible, devise some means for ships to locate them when navigating in foggy weather. Already an instrument has been devised which is capable of detecting the temperature effect of an iceberg for distances varying from two to seven miles. This year the Minister has so far recognised the importance of the work by detailing a special ship for the temperature tests.

It is hoped that the Canadian committee may be of active help to the British Science Guild by advising it on Canadian questions. Already the Canadian committee has received assistance from the secretary in London on the question of the work of the National Standards Laboratories, for which it desires to express its thanks.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. G. E. Moore has been appointed university lecturer in moral science for five years from October 1, 1911, until September 30, 1916.

Mr. Keith Lucas has been approved by the general board of studies for the degree of Doctor in Science.

On Thursday, May 11, the following Grace will be offered to the Senate:—That the bequest to the University by the late William Chawner, Master of Emmanuel College, be gratefully accepted, and that the Vice-Chancellor be requested to communicate this Grace to Mr. Chawner's executors.

OXFORD.—Further instalments of the scheme of university reform are promised for the present term. On May 16 the preamble of a statute exempting honour students in mathematics or natural science from the requirement of Greek in Responsions will be submitted to Congregation, and on May 23 the first stage will be taken of a statute constituting a new board of finance, the main duties of which will be to review annually the published accounts of the University and colleges, to report thereon to the Hebdomadal Council, and to advise the council generally on matters of financial administration. It is not proposed to abolish the existing board of curators of the University chest, but to continue it, with somewhat limited powers, side by side with the new board of finance.

A member of Congregation has circulated a protest against the proposed exemption of science and mathematical students from compulsory Greek. His main points against the measure are that it will tend to diminish the opportunities given in the smaller grammar schools and new "secondary" schools for the teaching of Greek to boys of pronounced literary gifts, and that it will lead to an undue diversion of endowments in the University and colleges from the literary and historical and philosophical humanities, which he thinks are in some danger of being neglected in other universities and in the country at large, whereas science is in no such danger.

Statutes reconstituting the boards of electors to fourteen mathematical and science professorships in the University passed Congregation on May 9 without opposition.

BIRMINGHAM.—The University is the recipient of a munificent bequest under the will of Mr. John Spencer, of Handsworth, chairman of Messrs. John Spencer, Ltd., tube manufacturers, of Wednesbury. The bequest includes "5000*l.* to the University of Birmingham, to be applied in the advancement of science and in promoting the work-

ing out of scientific problems in any department of science in such a way as the principal and vice-principal shall determine as being wisest and best for the end I have in view, which is to promote discovery and knowledge, believing that this conduces to the good of humanity." In addition to this, the University will ultimately, as residuary legatee, receive the benefit of considerably more than the above amount.

DR. A. E. KENNELLY, of Harvard University, has accepted an invitation of the University of London to come to London for the purpose of delivering a course of advanced lectures, and has chosen as his subject "The Application of Hyperbolic Functions to Electrical Engineering Problems." The course will be given at the Institution of Electrical Engineers at 5.30 on five consecutive days, commencing on Monday, May 29, and tickets of admission may be obtained free by application to the academic registrar of the University of London.

THE leading article in *The Builder* for May 5 deals with the amalgamation of the Society of Architects with the Royal Institute of British Architects. It is a matter of congratulation that a mutually satisfactory basis of amalgamation has been arranged. The unity of action which will result in matters connected with registration and with education cannot fail to be of benefit to the profession. There must be many whose chief interest in obtaining a settlement of the question of registration is based on the hope that it will clear the ground for a thorough reorganisation of our educational methods, without which our architecture must drop behind that of other nations. If the new union will secure this advance, it will justify all the sacrifices that have been made to consummate it.

THE Worshipful Company of Drapers has given to the Battersea Polytechnic the sum of 6000*l.* in order to erect a building to house a department which is to include such branches of science as physiology, hygiene, bacteriology, and also that further work which, for want of a better name, may be termed hygiene or town planning. It is hoped also to include the subject of geology, more particularly in its application to the nature of soils, forms of vegetation, &c. It is expected that important results will arise from the establishment of this new work, and that the department is likely to prove, from the sanitary science point of view, of great service, inasmuch as it will give opportunities for the study and advancement of the principles which in the future must control life, and especially that of the towns. A suitable letter of thanks has been sent to the Drapers' Company for their munificence.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society May 4.—Sir Archibald Geikie, K.C.B. president, in the chair.—Dr. F. W. **Mott,** Edgar **Schuster,** and Prof. C. S. **Sherrington**: Motor localisation in the brain of the Gibbon, correlated with a histological examination. A comparative study of the convolutional pattern of the brains of lemurs and apes led to the expectation that the remarkable use the Gibbon makes of its arms and hands would be found by experiment and histological investigation to be correlated with the remarkable expansion of the cortex cerebri in the precentral region as shown by the development of a broad gyrus extending from the middle of the precentral region to form the second frontal convolution. This development, it was inferred, would push downwards and forwards that portion of the cortex which on stimulation gives rise to eye movements in Macacus. Stimulation experiments by unipolar excitation are given in detail showing the correctness of this deduction; moreover, for the first time the excitable motor cortex is precisely mapped out in this animal. The experimental observations have been correlated with a histological survey of the cortex cerebri in front of the central fissure. Figures are given to show the distribution of two quite distinct types of cortex in the lateral surface of the Gibbon's brain in front of the central fissure corresponding to Campbell's precentral and intermediate precentral types, or to Brodmann's types 4 and 6. The great forward extension of the intermediate precentral area (especially that which may be described as the middle frontal convolutions) forms a most characteristic feature of the Gibbon's brain, and distinguishes it in a very striking way from the Orang and Chimpanzee on the one hand, and Cercopithecus and the Baboon on the other.—J. S. **Huxley**: Some phenomena of regeneration in Sycon, with a note on the structure of its collar-cells. *Production of normal individuals from isolated cells* (as in Wilson's experiments on Monaxonida).—Cells were obtained singly by straining sponges through gauze. They first unite into lumps, all the kinds being confusedly mixed (reunion). Next the dermal cells migrated to the surface to form a flat epithelium round a mass of quiescent collar-cells (reorganisation). Then came redevelopment: spicules arise, monaxons before triradiates; gastral cavity and osculum appear. The spicules form later than in the larva (where, however, they are certainly precocious), and the regenerates failed to fix permanently. Otherwise redevelopment resembled normal post-larval development. None became heterocœlous, though one lived and grew as a functioning sponge for several weeks. The fate of the cells here is *not* a function of their position, for they have to migrate into position before development can proceed. *Behaviour of pure collar-cells.*—If large bits of gastral epithelium are taken, they bend back and round up into perfect hollow spheres with collars directed *outwards.* Similar spheres were formed, but in a different way (with preliminary solid stage), if numerous single cells were taken. Though some lived more than a month, no other tissue was regenerated by them. These spheres have no bearing on phylogeny. Their structure is probably due only to oxygen requirements and to surface tension. Their failure to regenerate other tissue proves nothing against choanoflagellate ancestry; the ancestral cells may have given up their regenerative powers to others, more suited, as has happened elsewhere (*e.g.* Ascidians). *Collar-structure.*—Longitudinal rods do exist in the collar, as described by Bidder.—Dr. J. A. **Murray**: Imperial Cancer Research Fund. Cancerous ancestry and the incidence of cancer in mice. The present paper is in continuation of a previous communication (Roy. Soc. Proc., B, vol. lxxxi., 1909, p. 310). The analysis of the ancestry of 1600 mice bred in the laboratory has permitted their classification in two groups differing considerably in the incidence of cancer. Out of a total of 562 female mice which lived for six months or more, cancer had occurred in the mother, one or other grandmother, or all three in 340, and in them 62 developed cancer of the mamma (18·2 per cent.). In the remaining 222 mice in which cancer was absent from the maternal and grandmaternal ancestors, only 19 developed cancer of the mamma (8·6 per cent.). The group with recent cancerous ancestry is found on analysis to be more severely attacked at all age-periods than the non-cancerous group (cancerous ancestors remote). Detailed analysis of the ancestors enhances the importance of the differences. The differences exceed their standard errors sufficiently to render them significant. The predisposition is apparently not constitutional, but local, and is regarded as only one of the factors in the development of cancer.—Dr. R. Tanner **Hewlett**: Immunisation by means of bacterial endotoxins. The action of bacterial endotoxins in immunising against the corresponding living organisms has been investigated. Guinea-pigs were the animals employed. *Typhoid Endotoxin.*—Series of guinea-pigs were given single injections of the endotoxin, ranging from 0·01 mgrm. to 1·0 mgrm. Five to eleven weeks later the animals were injected with living typhoid culture; considerable protection was obtained, particularly with doses of 0·1 and 1·0 mgrm. The protection afforded by the endotoxin was better, and lasted longer than that conferred by a baciliary typhoid vaccine. *Cholera Endotoxin.*—Six guinea-pigs each received 0·25 mgrm. of the endotoxin, and all survived an injection of living cholera culture given eleven weeks later. *Diphtheria* and *Plague Endotoxins* similarly confer some protection against the living organisms. No immunising substance was obtained from the *Trypanosoma brucei.* The results suggest that bacterial endotoxins may be of considerable value as protective vaccines. The endotoxin solutions maintain their

activity for some weeks at least, probably for a much longer period. A few inoculations of typhoid and diphtheria endotoxins have been performed in the human subject. The inoculations cause some local reaction at the site of inoculation, but little general reaction. (The endotoxin solutions were prepared by the method described in Roy. Soc. Proc., B, vol. lxxxi., 1909, p. 325.)—J. E. **Barnard** and Dr. R. T. **Hewlett**: A method of disintegrating bacterial and other organic cells. Bacterial toxins are of two kinds, extra-cellular and intra-cellular. The former are excreted into the medium, *e.g.* beef broth, on which the organism is cultivated, so that by a process of filtration the organisms can be removed, and the toxin is obtained in the filtrate; but the majority of pathogenic micro-organisms do not excrete their toxins, at least to any extent, and the toxins are retained within and form integral parts of the cells of the organisms. One method of obtaining these toxins is mechanically to disintegrate the bacterial cell, so that the cell contents are expressed, and the apparatus here described accomplishes this. It consists essentially of a containing vessel, in which, by a suitable rotation of steel balls, the organisms are crushed. The principal conditions to be fulfilled in such an appliance are:—Approximately every cell should be brought under the grinding action. Little or no rise of temperature should take place. The disintegration must be carried out in a vessel which is sealed, so that, when dealing with pathogenic organisms, none can escape at any stage of the process. These conditions are, in the main, complied with in the apparatus described. Experiments indicate that by this method the cell-juices are obtained unaltered, and suitable for investigations on the chemical composition and properties of the bacterial proteins and other cell constituents. Also that, after the grinding process has been carried on for a sufficient time, practically no cells remain which can be properly stained by any recognised bacteriological method, and which therefore can be regarded as whole cells containing a normal quantity of cell-juice.

Physical Society, April 28.—Prof. H. L. Callendar, F.R.S., president, in the chair.—Prof. E. **Wilson**: High-tension electrostatic wattmeter. When using the electrometer as a wattmeter it is necessary (in order to secure accuracy) that the voltage impressed upon the quadrants shall not be less than a certain minimum depending upon the voltage to be impressed upon the moving system. When the latter voltage is of the order 10,000, the quadrants require a voltage larger than can economically be provided by a shunt. One is led, therefore, to consider intensifying devices. The "series" or "current" transformer, the secondary winding of which is closed on a non-inductive resistance, can be used to give fairly good results, but it is not accurate at all frequencies, and is dependent upon wave form. The author's quadrature transformer is a very simple piece of apparatus which can be relied upon to give for electrostatic wattmeters an electromotive force which is strictly the differential of the current in the primary winding. When so used it is necessary, for accuracy, at all frequencies and on all wave forms, that the integral of the mains voltage shall be impressed upon the moving system, although for sine curves only the differential need be impressed instead of the integral.—Dr. R. S. **Willows** and T. **Picton**: The behaviour of incandescent lime kathodes. Wehnelt has shown that incandescent lime emits a large number of negative ions; if, therefore, hot lime is used as the kathode, a discharge may be obtained in a vacuum tube with P.D.'s so low as 30 volts. The alteration with time of these kathodes, under continued use, has been investigated and the following results obtained:—(1) When lime is heated on platinum foil, so far from showing fatigue, it actually increases in activity. With P.D.'s greater than the saturation voltage this increase may be nine-fold. At lower voltages a slow but steady increase up to 100 per cent. has been found. The steady activity falls when the lime is cold; the initial activity may greatly increase. (2) When the lime is heated on nickel foil, if the tube carries a heavy discharge, the current increases to a maximum and then decreases. A greatly increased activity is frequently shown after the lime has been cold for some hours. At the lower voltages the same general variations are shown as with platinum. (3) Great irregularity is frequently shown when the current is first started; at this stage other causes than temperature, such as mechanical vibrations, greatly influence the emission of ions.—Dr. S. **Marsh** and W. H. **Nottage**: The formation of dust striations by an electric spark. The formation of dust striations by electric spark has been investigated by many observers. The paper attempts to explain their formation as being due to hydrodynamic forces existing between the dust particles while the wave motion is passing over them. The application of this theory to the striations in a Kundt's tube has been made by Kœnig and Robinson. The wave motion is assumed to be of the spherical progressive type, and expressions are obtained from the intervals between consecutive striæ and the distances of the striæ from origin. Measurements were made of striæ formed on a glass plate with vertical central spark. The agreement between theory and experiment is within the experimental error. Experiments with channels of various shapes were made. Illustrations of the various striæ patterns obtained with small obstacles and reflecting surfaces are given, and the use of these as a convenient means of indicating reflecting interference and diffraction of sound waves is pointed out.—Prof. E. **Wilson** and L. C. **Budd**: Previous magnetic history as affected by temperature.

PARIS.

Academy of Sciences, April 24.—M. Armand Gautier in the chair.—M. **de Forcrand**: The hydrates of potassium fluoride. The results of determinations of the solubilities and heats of solution of the fluorides of the alkalies and the alkaline earths are given. In addition to the hydrate $KF.2H_2O$ already known, the properties of a new hydrate, $KF.4H_2O$, are described.—G. **Tzitzéica**: Certain conjugated networks.—Francesco **Severi**: The simple integrals of the first species attached to an algebraic surface.—Henri **Villat**: The determination of certain discontinuous movements in fluids.—L. **Hartmann**: The mechanism of the permanent deformation in metals submitted to extension. The metal bar under tension is polished on one face, and this repolished at intervals during the gradual increase of the load. The method gives valuable information on the changes taking place in the bar above the elastic limit.—G. A. **Hemsalech**: Some spectral phenomena accompanying the displacement of the spark by a magnetic field. A study of the spectrum of the spark between calcium electrodes in a magnetic field, the metal poles being in an atmosphere of hydrogen. The spectrum obtained approaches that observed in the upper layers of the chromosphere of the sun.—M. **Gutton**: Experiments on the velocity of light in refractive media. In a preceding note the author has described a method for the comparison of the velocities of propagation of Hertzian waves and light in air. The same apparatus has now been applied to the measurement of the ratio of the velocities of light in air and liquids. These results are compared with the indices of refraction determined in the ordinary way, and the differences are shown to be in accord with the theory developed by M. Gouy in his memoirs on the propagation of light in media possessing dispersion.—M. **Guilleminot**: The intensity and quality of the X-rays diffused by aluminium plates of varying thickness (secondary rays).—Georges **Baume** and Georges **Pamfil**: The fusibility curves of gaseous mixtures, combinations of hydrochloric acid and sulphur dioxide with methyl alcohol. With the system methyl alcohol, hydrochloric acid, a clear mixture is shown at the composition corresponding to equal molecules. With sulphur dioxide two compounds are defined, CH_3OH,SO_2 and $2CH_3OH,SO_2$.—L. **Franchet**: The preparation of the black enamel of the Greek potteries by means of natural ferroso-ferric oxide. The black enamel of the ancient potteries was obtained with magnetite. The flux for this was probably made from silica and alkali salts.—D. **Gauthier**: Syntheses of the secondary α-ketonic alcohols. The only ketones of this type described up to the present have the composition R.CH(OH).CO.R. In the present paper a general method of preparing ketones of the type $R_1.CH(OH).CO.R_2$ is given. An aldehyde $R_1.CO.H$ is treated with hydrocyanic acid, giving $R_1.CH(OH).CN$. In presence of two molecules of an organo-magnesium compound $R_2.MgX$, the alcohol ketone $R_1.CH(OH).CO.R_2$ is obtained.—Amé **Pictet** and Alphonse **Gams**: The synthesis of oxyberberine.—G. **Darzens** and J. **Sejourné**:

The condensation of ββ-dimethylglycidic ether with bromacetic ether.—A. **de Schulten**: The crystallographic examination of some silicides, borides, and carbides obtained by Henri Moissan and his pupils. Data are given for the silicides of iron, cobalt, manganese and chromium, for aluminium and beryllium carbides and for calcium, barium and strontium borides.—L. **Blaringhem**: The production of a new form of maize by a traumatism.—Léon **Pigeon**: A new form of stereoscope. This instrument has been designed specially for the physiological study of vision, for the study and treatment of astigmatism, and for ophthalmological clinical work.—René **Cruchet** and M. **Moulinier**: Pathological conditions induced by aviation. A description of the changes in the arterial pressure and nervous system caused by aviation. The most serious cause of trouble appears to be due to a too rapid descent from a high altitude.—Henri **Piéron**: The regressive evolution of mnemonic traces.—R. **Robinson**: The relations between the suprarenal glands with the state of gravidity, and on the use of adrenaline in the vomiting of pregnancy. Two cases of vomiting due to pregnancy, resistant to all ordinary methods of treatment, were cured by treatment with adrenaline.—E. **Bataillon**: Experimental parthenogenesis in *Bufo vulgaris*.—Armand **Dehorne**: The number of the chromosomes in the parthogenetic larvæ of the frog.—A. **Railliet**, G. **Moussu**, and A. **Henry**: Researches on the treatment of distomatosis of the sheep. Of all the medical agents tried, the only one which gave clear positive results was the ethereal extract of male fern. Four doses of 5 grams appear to be the minimum for success.—MM. **Bordas** and **Touplain**: The estimation of phosphorus in milk. A reply to some criticisms of MM. Fleurent and L. Levi.—Alexandre **Lebedeff**: The extraction of zymose.—F. L. Pereira **de Sousa**: The tidal wave of the great earthquake of 1755 in Portugal.

DIARY OF SOCIETIES.

THURSDAY, MAY 11.

ROYAL SOCIETY, at 4.30.—On a Method of making Visible the Paths of Ionising Particles through a Gas: C. T. R. Wilson, F.R.S.—The Vertical Temperature Distribution in the Atmosphere over England, and some remarks on the General and Local Circulation: W. H. Dines, F.R.S.—On some Mineral Constituents of a Dusty Atmosphere: Prof. W. N. Hartley, F.R.S.—The Path of an Electron in Combined Radial Magnetic and Electric Fields: Dr. H. S. Allen.—On the Absolute Measurement of Light—a Proposal for an Ultimate Light Standard: Dr. R. A. Houston.—On Harmonic Expansions: Prof. A. C. Dixon, F.R.S.

ROYAL INSTITUTION, at 3.—The Optical Properties of Metallic Vapours: Prof. R. W. Wood.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Driving of Winding Engines by Induction Motors: H. J. S. Heather.

MATHEMATICAL SOCIETY, at 5.30.—Exhibition of a Model of a Deformable Octahedron: G. T. Bennett.—The Scattering of Light by a Large Conducting Sphere (Second Paper): J. W. Nicholson.

FRIDAY, MAY 12.

ROYAL INSTITUTION, at 9.—Biology and the Kinematograph: Prof. W. Stirling.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Rotation of Stars about their Axes: George Forbes.—Parallax of 17 Lyræ C.: F. Slocum.—Positions of Hallev's Comet and of Comet 1910*a*, from Photographs taken at the Khedivial Observatory, Helwân: H. Knox Shaw.—On the Harvard Eclipses of Jupiter's Satellite IV.: W. de Sitter.—Determination of the Moon's Parallax from Meridian Observations of the Crater Mösting A.: Royal Observatories, Greenwich and Cape of Good Hope.—Occultations observed during the Lunar Eclipse, 1898, December 27: Walter Heath.—*Probable Paper*: Discussion of the Greenwich Zenith Tube Observations, 1906-9: A. S. Eddington.

MALACOLOGICAL SOCIETY, at 8.—Some Remarks on the Nomenclature of the Veneridæ: Dr. W. H. Dall.—Description of a New Species of Conus from South Africa: G. B. Sowerby.—A Modification in the Form of a Shell (*Siphonaria Algesiræ*) apparently due to Locality: Rev. A. H. Cooke.

PHYSICAL SOCIETY, at 8.—Stream Lines Past the Elliptic Cylinder and Magnetic Interpretation: Sir George Greenhill and Col. R. E. Hippisley.—The Method of Constant Rate of Change of Flux as a Standard for Determining Magnetisation Curves of Iron: J. T. Morris and T. H. Langford.—Demonstration of an Electric Thermo Regulator: Prof. H. L. Callendar.

INSTITUTE OF METALS, at 8.30.—The Hard and Soft States in Metals: Dr. G. T. Beilby, F.R.S.

MONDAY, MAY 15.

ROYAL SOCIETY OF ARTS, at 8.—Rock Crystal: its Structure and Uses: Dr. A. E. H. Tutton, F.R.S.

TUESDAY, MAY 16.

ROYAL INSTITUTION, at 3.—The Brain and the Hand: Prof. F. W. Mott, F.R.S.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—River Life and People in Upper India: Percy B. Bramley.

ROYAL STATISTICAL SOCIETY, at 5.—On the Use of the "Normal Crop" as a Standard in Crop Reports: H. D. Vigor.—Seasonal Fluctuations in Employment in the Gas Industry: F. Popplewell.

WEDNESDAY, MAY 17.

ROYAL SOCIETY OF ARTS, at 8.—Les Basses Températures: Prof. Raoul Pictet.

ROYAL METEOROLOGICAL SOCIETY, at 4.—On the Frequency and Grouping of Wet Days in London: Dr. H. R. Mill and C. Salter.—Report on the Phenological Observations for 1910: E. Mawley.

ROYAL MICROSCOPICAL SOCIETY, at 8.—A Method of Disintegrating Bacteria and other Organic Cells: J. E. Barnard.—Structural Details of *Coscinodiscus asteromphalus*: T. W. Butcher.

THURSDAY, MAY 18.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Inbreeding in a Simple Mendelian Stable Population with Special Reference to Cousin Marriage: S. M. Jacob.—The Properties of Colloidal Systems. II. On Adsorption as Preliminary to Chemical Reaction: Prof. W. M. Bayliss, F.R.S.—On Distribution and Action of Soluble Substances in Frogs deprived of their Circulatory Apparatus: S. J. Meltzer.—Transmission of Amakebe by means of *Rhipicephalus appendiculatus*, the Brown Tick: Dr. A. Theiler.—The Discrimination of Colour: Dr. F. W. Edridge-Green.—On the Direct Guaiacum Reaction given by Plant Extracts: Miss M. Wheldale.

ROYAL INSTITUTION, at 3.—Air and the Flying Machine. I. The Structure of the Atmosphere and the Texture of Air Currents: Dr. W. N. Shaw, F.R.S.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Research Meeting. Principles of the Construction of Vegetation Maps: Dr. C. E. Moss.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Automatic Telephone Exchange Systems: W. Aitken.

FRIDAY, MAY 19.

ROYAL INSTITUTION, at 9.—Recent Experiments with Invisible Light: Prof. R. W. Wood.

SATURDAY, MAY 20.

ROYAL INSTITUTION, at 3.—Phases of Bird Life. I. Flight: W. P. Pycraft.

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