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PROBLEMS OF POTABLE WATER.

Modern Methods of Water Purification. By J. Don and J. Chisholm. Pp. xvi+368. (London: Edward Arnold, 1911.) Price 15*s.* net.

WHEN Mr. Don read his paper on "The Filtration and Purification of Water for Public Supply" before the Institute of Mechanical Engineers in January, 1909, it was generally thought that a very useful addition had been made to the literature on this subject, and in following this up with the volume under review, which is in effect an amplification of the former publication, the authors have done a great service to those whose duty it is to provide a pure and efficient supply of water for domestic purposes.

Following a general introduction, the first chapter deals with the sources of supply. The possible pollutions that may be expected are fully discussed, and some most useful information is given of the best means of detecting, and, as far as may be, preventing them.

Obviously, all water destined for domestic purposes cannot be taken from sources unimpeachable, both as to purity and constancy of supply, and the next two chapters in the book deal with the first steps towards remedying these evils under the general heading of "Storage."

The main inference that is to be drawn from this section is that, in addition to ensuring constant and adequate supply from sources which depend largely on the rainfall over a limited catchment area, storage undoubtedly has a very marked effect in purifying and rendering harmless an otherwise polluted and dangerous water. The work of numerous investigators is quoted in support of this contention, particularly the valuable researches of Dr. Houston on the storage of water from the rivers Thames and Lea, published in his reports as Director of Water Examination to the Metropolitan Water Board.

The result of these researches are very lucidly summed up by the authors in the following sentences:—

"1. The microbes of disease, and those which are indicative of sewage (*B. coli*) perish rapidly in stored water. In about three weeks, generally speaking, the safety change is complete, and the dangers imminent from sewage pollution minimised.

"2. After being impounded for two or three weeks the water is in a better state from a chemical point of view, seeing that there is a well marked decrease of ordinary ammonia, oxygen consumed, oxidised nitrogen, lime salts, and occasionally of albuminoid nitrogen.

"3. Storage deprives the raw water of nearly all its sediment, and therefore serves to prolong the life of the filter beds."

There is one danger, however, occurring sometimes after prolonged storage, which should not be lost sight of; that is the abnormal development in the reservoir of algæ and other minute vegetable growths at certain seasons of the year. These growths not only cause great inconvenience by rapidly choking the filter beds, but certain species give rise to exceedingly unpleasant odours and tastes in the water, which cannot usually be got rid of by filtration. A remedy for these evils, however, is suggested in the book, namely, the addition of exceedingly small doses of copper sulphate, which, it is stated, not only will cause the death of myriads of these organisms, but if added in anticipation of a rapid development will prevent the growth taking place. The use of hypochlorites is also recommended.

Following on this exhaustive and extremely valuable discussion of *storage*, the authors devote a large section to the question of *filtration*. There are three chapters devoted to this subject, entitled respectively, "Sand Filtration," "The Management of Sand Filters," and "Mechanical Filters."

Under the first heading elaborate and exceedingly interesting and instructive explanations are given of the theory of sand filtration, which bring out very conclusively the precautions which are necessary to ensure efficient purification. The action of a sand filter appears to be threefold; first, the mechanical straining of the grosser suspended matter, this causes a film or skin composed of silt, algæ, and bacteria to form on the surface of the sand; secondly, the living algæ in this skin seem to have a power of consuming the bacteria which come within their orbit, thus retaining many of the minute organisms which would otherwise pass through the interstices between the sand grains. The third action is brought about by the slimy or gelatinous film which forms round the grains of sand in the lower layers of the bed; this has the power not only of retaining most of those microbes and minute particles of matter which escape the filmy skin, but also by a process of adsorption, of acting on the organic matter *dissolved* in the water, "mineralising" it, and converting it into innocuous nitrates, sulphates, and carbonic acid.

It is pointed out that to ensure all these actions taking place properly it is necessary that the rate of filtration should be slow (about 4 inches per hour) and uniform, as an irregular flow causes disturbance to the microbes adhering to the slimy coating of the sand grains.

All the operations in connection with the management of filters are dealt with under this heading, and details are given of their construction. Descriptions are given of many of the elaborate processes employed in different parts of the world, and the chapter concludes with a discussion on the use of coagulants for the rapid sedimentation of matter in suspension, and also for the formation of an artificial filtering skin. This leads up to an important chapter on mechanical filters, which are rapidly gaining favour in various parts of the world. Numerous appliances are described, differing chiefly in matters of detail. The general features are the use of a much greater head of water or of artificial pressure, and the use of an artificial skin produced by the addition of alum, and, if necessary, lime or some other alkali, if the water has not sufficient natural alkalinity to precipitate the alumina. The filtering medium employed

consists of sand or crushed quartz, and in some cases layers of some such oxidising material as polarite or oxidium are used, in addition to sand, as in the Candy filter.

The advantages of this method of filtration seem to be the much more rapid rate at which the water can be passed through the filters, and consequently the much smaller area which they occupy, and the ease and rapidity with which they can be cleaned by mechanical means. This effects a great saving of labour, and also does away with the workmen coming in contact with the filtering medium. As regards efficiency, it would appear that these filters are at least as efficient as ordinary sand filters.

After two very useful chapters on "The Purification of Water by Ozone" and "Water Softening and Household Appliances," two chapters follow on the testing of water. They consist of a discussion of the bacteriological, chemical, and microscopic examination of the raw and filtered waters and the inferences to be drawn from them.

The bacteriological tests suggested, and the methods of applying them are, however, somewhat open to criticism, and need revision in subsequent editions, and the suggestion that these tests should be undertaken by the water managers themselves (unless specially qualified) is also perhaps not of the happiest. To anyone acquainted with the bacteriological and chemical analysis of water, it will be apparent that unless these tests are carried out by skilled operators errors of execution and judgment are likely to crop up. The growing necessity of dealing with impure and polluted sources of supply renders frequent and careful analysis imperative, and the example of the Metropolitan Water Board and some of the Continental and American water undertakers in appointing a staff of qualified analysts might well be followed by other bodies.

As the authors point out, the interpretation of the results of analysis depend largely on local conditions, yet they give a table of the standards of purity required in Britain and America, which, by the way, are not applicable to a very large number of water supplies, and they do not state from what source these standards, in so far as they apply to British supplies, are obtained.

In the remaining chapters, the book deals with problems of distribution, and, in addition to engineering problems, several pages are devoted to the development of such growths as crenothrix in the mains and the action of peaty waters on lead. This latter subject was exhaustively investigated by Dr. Houston about fifteen years ago, on behalf of the Local Government Board, and the authors quote extensively from his work; the two kinds of action, plumbosolvency and erosion, although attributed to different causes, are frequently caused by the same water.

The authors have surely misunderstood Dr. Houston's work when they state (on p. 324) that erosion, which results in the formation of the hydroxide of lead, has probably no consequences obnoxious to the consumer, for they go on to say that the hydroxide scales away and mixes with the current. The section concludes with a general discussion on public health in relation to water supply, and an account is given of several outbreaks of cholera and typhoid fever, which have been attributed to that cause. It should have been pointed out, however, that in the case of the epidemics at Belfast, mentioned on p. 348, the water supply was completely exonerated by the Health Commission appointed to inquire into the matter.

The arrangement of the book is exceedingly good, the type clear, and the numerous diagrams and photographs make the descriptions of the various appliances very easy to understand. As appendices there are some useful tables of filtration constants and other engineering data, and a concise and well-arranged bibliography of works on water purification.

DENISON B. BYLES.

GERMAN AND FRENCH BOOKS ON CRYSTALLOGRAPHY.

(1) *Lehrbuch der Kristallphysik (mit Ausschluss der Kristalloptik).* By Prof. W. Voigt. Pp. xxiv+964. (Leipzig and Berlin: B. G. Teubner, 1910.) Price 30 marks.

(2) *Leçons de Cristallographie.* By G. Friedel. Pp. v+310. (Paris: A. Hermann et Fils, 1911.) Price 10 francs.

(3) *Die Kristallgruppen nebst ihren Beziehungen zu den Raumgittern.* By Prof. E. Sommerfeldt. Pp. vii+79 (Dresden: T. Steinkopff, 1911.) Price 3 marks.

(1) THIS treatise is based upon the lectures delivered for some years past by Prof. Voigt at the University of Göttingen, and it concentrates also into a single volume of 964 pages the original work in physical crystallography other than optical contributed in numerous memoirs during the course of a long and active career. Prof. Voigt's name is, perhaps, most familiar from his work on the elasticity of crystals and their piezo- and pyro-electrical properties. These branches of physical crystallography are well represented in the book before us, and the only criticisms that suggest themselves are that Prof. Voigt has not given us more experimental details and illustrations of the interesting forms of apparatus employed in the researches, and that British work in this branch of science, especially the thermal expansion and elasticity of crystals, is not referred to. The result of these omissions is that in the first place the book presents a somewhat forbiddingly mathematical aspect, the theoretical and mathematical side vastly predominating and entirely overshadowing the practical experimental side of the subject, and that in the second place a certain narrowness of outlook is inevitable.

Having said so much, however, and remembering that Prof. Voigt's chair is that of theoretical physics, the thorough manner in which the subject is dealt with inside these somewhat narrow lines cannot fail to impress the reader. The most valuable consideration is, moreover, that we have here brought together for us the facts and theories for which hitherto investigators and students have had to search through the numerous original papers of Prof. Voigt. The

specialised portion of the book is preceded by an admirable review of the morphology of crystals and the structure theories of Bravais, Wiener, Sohncke, von Fedorow, and Schönflies (again we notice the omission of a British name, that of Barlow). Such a review is of special value, as it gives us the considered opinion of one who regards crystals essentially from the physical and mechanical point of view, and whose original investigations have brought him more than usually in touch with the phenomena dependent on the internal molecular and atomic arrangement of crystals. The influence of such an experience and of the character of this field of research is evident in a most interesting manner throughout. As Prof. Voigt so truly says:—

"Die besonderer Bedeutung welche die Krystallform für den Aufbau der Krystallphysik besitzt, liegt darin, dass dieselbe eine einfachste und anschaulichste physikalische Wirkung der Konstitution der Substanz darstellt."

The specialised portion of the book deals with pyro-electricity, pyro-magnetism, thermal dilatation, electrical and thermal conduction, thermo-electricity, dielectric influence, ferromagnetism, elasticity and internal friction, piezo-electricity and piezo-magnetism, and the effect upon them of change of temperature, all being considered specially with reference to crystals, as organised and perfect solids. The ground covered is thus very wide, and the practical investigator is most grateful to Prof. Voigt for placing within easy reach the theory and mathematics of all these branches of the subject. If only a few more practical hints as to the mode of carrying out the experiments, and more and better illustrations of the apparatus could have been given, the work would have been well-nigh perfect.

(2) This book does not profess to be a complete treatise on crystallography, but embodies the earlier lectures of the course in mineralogy given for some years by the author at the Ecole Nationale des Mines at Saint-Etienne, of which he is the director. Crystallography is considered first of all as the necessary introduction to the study of mineralogy by students training for mining engineers, and is therefore limited to those properties of crystals which are useful for the identification of mineral species. Hence, many of the less apparent physical properties of crystals are passed over, and those which are considered are dealt with from this limited point of view rather than for their own intrinsic interest. Indeed the author almost apologises for the necessity of treating even cursorily the fundamentally important optical properties of crystals.

The above will have sufficiently indicated the severe limitations of the book, and the narrow aspect from which it is presented. Crystallography has suffered, perhaps more than any other science, in the past from such limitations, imposed by being relegated to a corner in a course of mineralogy, which is itself frequently merely taken as a subsidiary part of a course in geology. There are strong indications that the time has now arrived, however, when these limitations should be swept away, and the fact boldly recognised that the child has outgrown the parent, and that crystallography has become a wide and important subject on its own account, embracing (1) crystal morphology; (2) the optics and other physical properties of organised solids; (3) mineralogy; and (4) the crystallography of metals. Recent progress in the subject has been so rapid, its importance has become so palpably enhanced, that partial presentments of the character of the book before us are entirely behind the times, and no longer called for, except for the convenience of a particular set of students who may desire to have their professor's lectures before them in print.

While from the latter point of view it is possible to say much that is good about the book, there are some defects that cannot be ignored. The illustrations of crystals, for instance, are obviously in many cases inaccurately drawn, that is, not in clinographic or any other projection correctly to their proper elements, but are merely approximations of the nature of ruled rough sketches; hence, lines which should be parallel are often conspicuously not so. Also while one is glad to see a greater tendency than in other French books on this subject to employ the simple and scientific symbols of Miller for the crystal faces and forms, the advantages of which are fully admitted by the author, the notation of Levy is still given as well in conformity with French usage, although the probable confusion to the mind of the student would appear to dictate its abandonment as an unnecessary complication, especially considering the limited time available for the crystallographic part of the curriculum of these students.

A further limitation is the marked tendency to base the whole crystal morphology exclusively on the laws of Haüy as expanded by Mallard, and on the space-lattices of Bravais. Now it will be clear from the following review of Prof. Sommerfeldt's book how great is the importance of the space-lattice; but this book goes to the other extreme in stopping short at this work of the French savants. The only work on homogeneous structures referred to beyond it is that of Schönflies, and this, moreover, is only dealt with briefly as an afterthought in an appendix, and apparently largely as a development of the mathematical work of Jordan. No mention could be found of the work of Sohncke, von Fedorow, or Barlow, in developing the 230 types of homogeneous structures possible to crystals.

Curiously enough, the part of the book most diffidently presented, the optical, is the most readable and interesting, and is marked with originality of distinct value. Indeed, this section leaves the reader with the wish that it had been extended, as the author appears to be on specially familiar and congenial ground.

(3) This is a suggestive little book, the main object of which appears to be to present a simplification of the mode of regarding the homogeneous structure of crystals as a complicated point-system of the character indicated by Sohncke. Its essence is that the space-lattice (Raumgitter) is considered as the basis of the structure. The method is to drop the idea of essen-

tial parallelism, same-ways orientation, of the structural units, and to develop systematically in stages, starting from parallelism in the holohedral class of a crystal system, the possibilities of alternation and other forms of partial parallelism. The idea is justified from two points of view, first, that of the simplification for the student, who can readily construct the fourteen models of the Bravais space-lattices, by means of knitting needles and spherical balls impaled on them, and indicate on them if he chooses the stages of parallelism, corresponding to the various classes, by means of little inclined rods or other devices for indicating differences in the nature of the nodes of the space-lattice; and secondly, from the point of view of the undoubted importance of the space-lattice as regards crystal structure, and the fact that the space-lattice represents the arrangement of the molecules, while the Sohnckian points clustered around its nodes represent the arrangement of the atoms, and that models of such Sohnckian systems of points are very difficult to construct.

An excellent series of stereoscopic photographs of the fourteen space-lattices are given, forming quite a feature of the book, the photographs not merely representing the spherical balls on the steel rods but the shape in stereographic projection of the solid formed by the elementary cell or unit "brick" of the crystal edifice. The photographs were taken from models in the laboratory of Prof. von Groth at Munich. It is interesting to note also that the system of closest packing, as used by Pope and Barlow, is adopted in the book.

After a few pages of instruction in the elementary facts and nomenclature of crystallography, the author passes on to compare holohedral and partial symmetry, and shows how by placing a short inclined stroke, rod, or bar at each point of intersection or node of a space-lattice, and doing so either parallelwise or in an alternately arranged manner, the idea of parallelism or otherwise, and even of a screw arrangement, may be indicated directly on the space-lattice itself, the disposition of the cluster of Sohnckian points about each node of the space-lattice being thus indicated by the mode of arranging the little stroke or rod. It is shown that such an arrangement fulfils Wiener's principle, that homogeneity consists in the continual repetition throughout space of the same relation between an elementary atom and the entire structure. The diagrams in the second part of the book indicate how this idea of constructing all the variations of class symmetry of a crystal-system on separate models of the same space-lattice can be carried out, and the book is well worth attention on account of the simplification which it thus presents of the admittedly most difficult part of crystallography. The difference between right- and left-handed mirror-image forms is also very clearly brought out.

While the particular mode of applying these ideas of Prof. Sommerfeldt is new, it can scarcely be said that the principle is. For Mr. Barlow long ago employed models of the human hand at the nodes of the space-lattice, or about them, to indicate orientational differences of the atomic cluster which each such node represents. But the present mode of differentiation employed by the professor of mineralogy of Tübingen has the especial merit of emphasising in an unmistakable manner the importance of the space-lattice as the fundamental basis of crystal structure. A. E. H. T.

MODERN EXPLOSIVES.

Les Explosifs modernes. By Paul F. Chalon. Troisième édition. Pp. 787. (Paris: Librairie Ch. Béranger, 1911.) Price 25 francs.

THIS volume is really an encyclopædia on the subject of explosives, although many of the materials described, however interesting, are scarcely to be regarded as explosives, for it is only in very exceptional circumstances that they can behave as such or enter into the composition of explosive mixtures.

The book is divided into five parts, dealing respectively with (i.) explosive substances and the primary materials employed in the industry; (ii.) the manufacture of powders and explosives; (iii.) pyrotechny; (iv.) the methods of employing powders and explosives; (v.) employment of explosives for mining and various other applications; (vi.) legislation.

It would indeed be difficult to turn to the book for information on any substance which has either been employed or suggested for use as an explosive for any purpose, and the author has certainly carried out the descriptive part of the work in a thorough manner, the recent improvements in manufacture, for example, with guncotton and nitroglycerine at Waltham Abbey, being satisfactorily dealt with.

No doubt the author as a mining engineer feels the necessity of including much matter which is familiar to the chemist or manufacturer, such, for example, as the percentage composition of common salts, the different series of hydrocarbons, alcohols, &c., but it is to be regretted that chemical formulæ are so frequently incorrectly given that a lengthy errata, mainly to correct these chemical faults, is required, but even this fails to cover all the sins of commission.

Many interesting substances, unfamiliar even to those engaged in the industry, are briefly described, such as the remarkable crystalline explosive salts resulting from the electrolysis of solutions of antimony with an antimony anode, the sulphides and selenides of nitrogen, the sulphide of carbon C_8S_5, which compares with iodide of nitrogen in sensitiveness. In dealing with the explosive nature of compressed acetylene, the author states that its use has had to be abandoned in view of its explosive character, yet by the simple compression into steel cylinders containing porous blocks saturated with acetone, acetylene is now a valuable commercial product, and is largely employed in conjunction with oxygen for cutting steel plates, welding, and other purposes where a high temperature is demanded.

The author's connection with mining ensures that the application of various explosives for blasting purposes, submarine blasting for the removal of obstructions to navigation, including sunken vessels, is

fully treated, and many of the testing galleries employed for investigating the safety of explosives in coal mines are described. Many suggestions for the substitution of perfectly safe bodies in lieu of true explosives for this purpose are referred to. Among these may be noted the use of quicklime and its expansion on slaking; cartridges charged with liquid carbon dioxide or oxygen; but one of the most interesting methods was that introduced by M. Linde for the use of liquid air, in some cases a paper cartridge filled with kieselguhr and saturated with petroleum was then dipped in liquid air, the firing being carried out by a Bickford fuse or fulminate detonator. When the Simplon Tunnel was commenced in 1899 several attempts were made to utilise the explosive force of liquid air mixed with flour for blasting the rocks, but with unfavourable results. Liquid air alone, in metal cartridges, has also been tried for bringing down coal, but the author concludes that it does not seem an economic success.

Of more general interest is the important question of modern smokeless powders as propellants for military purposes. The Powers are fairly evenly divided in the choice between a gelatinised nitrocellulose powder or a nitrocellulose-nitroglycerine colloid. At one time the majority favoured the simple nitrocellulose powder, which is still retained by France and Russia, whilst Great Britain remains faithful to cordite, and Italy to ballistite. Germany may be said to be in a transition stage, for whilst employing a nitrocellulose for field guns, for the larger naval weapons a powder very similar to our modified cordite is employed.

All have had troubles to face with premature decomposition in magazines, and especially France. At Saigon in 1897 a quantity of poudre B ignited without setting fire to some black powder stored near by. 19,500 kilogrammes of this same powder had burnt with little damage in the previous year at the Saint-Médard factory, but the *Jena* disaster will ever be most prominently associated with this particular explosive, to which, in the author's opinion, it was wrongly attributed, whereas the special Commission appointed to inquire into the cause of this disaster believed it to be due to spontaneous decomposition of poudre B.

The instability of smokeless powders has led to the introduction of "stabilisers," the action of which is to absorb the oxides of nitrogen resulting from decomposition, which oxides, if present uncombined, greatly accelerate further decomposition. The author mentions a number of these, which include urea (American powder), diphenylamine (ballistite and the French powder BBo, first introduced after the *Jena* disaster), amyl alcohol (in the most recent French powders, AM_2 and AM_8), which appears to give excellent results. In cordite the vaseline acts as the stabiliser, although originally introduced for quite other purposes. It does not follow that for powders containing both nitroglycerine and nitrocellulose two stabilisers, one for each constituent, should be provided, as the author appears to think necessary.

Summarising the question of relative stability of the two classes of propellants the statement is made that gelatinised nitrated cottons possess more stability than the nitroglycerine-nitrocellulose powders, and although the velocity of the projectile is lower for the same charge they have marked advantages in lower temperatures on detonation, less erosive action on the rifling of the guns, and give less smoke. In view of the troubles experienced with simple nitrocellulose powders, the claim of their superior stability, *per se*, to cordite is open to question.

On the whole the volume will be found a useful work of reference on the composition, manufacture, and application of explosives for practically all purposes. It is more essentially a book suited to the requirements of the engineer or mining expert, and would not afford much information to the chemist or those engaged in the manufacture of explosives.

J. S. S. B.

A STATE MEDICAL SERVICE.

The Dawn of the Health Age. By Dr. B. Moore. Pp. ix+204. (London: J. and A. Churchill; Liverpool: The Liverpool Booksellers' Co., Ltd., 1911.) Price 3*s.* 6*d.* net.

THIS is a remarkable and noteworthy book, powerfully written, and very convincing on most of the points raised. Its aim is to demonstrate the necessity for entirely remodelling the present system of medical service, in the interests of the whole community. It goes far to show that hundreds of thousands of lives and millions of money could be saved annually if diseases were attacked on more scientific principles; and the main theme is that we allow diseases to invade and enfeeble us, and then make an attempt (often a poor one) at cure, instead of concentrating our efforts on prevention.

The first chapter is headed, "How we tinker with disease instead of stopping it." Therein it is pointed out that concerted, statesman-like action is demanded. The present undisciplined mob must be converted into a disciplined army; and there are signs foreshadowed by legislation dealing with some of the great problems of social reform, commencing with invalidity insurance and reform of the Poor Law, that we are turning in this direction. The organised army of doctors would cost the nation from eight to ten millions a year—an amount which is at present exceeded, but in a nationalised medical service the money would be paid through different channels. Under the new *régime*, medical treatment would be as free to everyone as is the education of to-day, and everyone would be bound to accept medical treatment in his own interests, just as to-day he accepts the education of his child. The author estimates that tuberculosis costs the country 16,000,000*l.* a year, and that it can be eradicated for an expenditure of less than 10,000,000*l.* a year for ten years, further expenditure almost stopping at the end of that period. He further maintains that tuberculosis and preventable infantile mortality together cost us more than double the price of an effectual national service for their prevention.

The main object of the national medical service would be twofold:—

(1) To give instruction in the laws of hygiene and healthy living, sowing this knowledge broadcast in both school and workshop.

(2) To take effective steps to stamp out infectious disease, assuming compulsory powers for this purpose.

We require a new system, including in organic coordination the private practitioners, the hospitals (voluntary and Poor Law), and their staffs, the infectious diseases and municipal hospitals and their staffs, the dispensaries, public and provident, the district medical officers and relieving officers, and the present so-called public health service.

"Let us wake up and be truly ashamed of ourselves," and having taught the school teachers the principles of hygiene, provide that this subject is taught in our schools as a compulsory and important one. Under our present medical service neither the medical practitioner nor the public health officer has any ambition to go forth and find the disease, not even if an epidemic is on; the disease must come to the doctor. The service is the more defective and incomplete in that many infectious diseases, and these often the most dangerous, are not even compulsorily notified.

It is maintained that a national medical service must arise in the end out of the general sickness and invalidity scheme now being contemplated by the Government. It is obvious that both the more economical and scientific way of dealing with disease is to catch it early and to stop it at its source.

"So much of medical practice is becoming inefficient under the action of some of the local co-operative systems, clubs, societies, and tontines, that it is making the name of medical science a disgrace. It is turning doctors' private practices into fraudulently conducted business concerns, in which the doctor loses all dignity and self-respect, and the patient is cheated of that advice and treatment which he imagines is being given to him, and upon which his very life depends."

The last thing in this world to have cheap is medical advice. State insurance with a nationalised medical service is the only way out from this chaos. The medical officers should be transferable from one local centre to another, and open to promotion from one place to another. It is a liberal estimate to take the average income of the profession at 250*l*. per annum. The average annual pay for the doctor, under the State national medical service, would be somewhat more than 300*l*. a year, and taking it that a junior commenced at about 150*l*. a year, this would mean a system rising on ordinary promotions and good service to a maximum of 1000*l*., and a small number of administrative officers at higher salaries. Probably about one-third of the profession would elect to remain on in private practice. The whole scheme would not be nearly so costly as the provision required under the Old Age Pensions Act, and it would prove quite as popular and as beneficial. The gain in disease stopped at incipient stages, and in increased health and corresponding power of his workpeople, together with regularity of work, less interrupted by illness, would more than repay the employer for his part of the contribution.

"At least one adult in every seven of us is going to die of consumption, all because of this nefarious 'Wait till your ill system,' which no one has the courage to attack, and because we will not send doctors out on the highways and byways to find disease and haul it apart, so that they may stand between the healthy and infected, and the plague be stayed. As it is with consumption so it is with a hundred and one other disease conditions."

The author deals with our hospital system, its evils and abuses. It is argued that these provisions are only capable of doing about 15 per cent. of the work which they are intended to do; but they are a hopeless failure and a positive drawback, because they stand in the way of the introduction of a properly organised scientific effort. An organised system of State-controlled hospitals, in true coordination instead of chaos, would bring about a reduction of at least 50 per cent. of both disease and expense. The present hospitals are hopelessly out of touch with the present medical practitioners throughout the country, and this is highly detrimental to the public service, the hospitals themselves, and to the medical profession.

"Under a State medical service and State hospitals for all members of the wage-earning classes, hospital abuse is done away with, because it simply cannot exist. The out-patient departments of our hospitals, like the 6*d*. dispensary practice of our slums, are two disgraces on the fair name and reputation of medical science. In both cases the times given are wholly inadequate for observation, care, and attention to the cases."

The writer demonstrates that the race is not relieved from suffering and death by the existence of a cure for the individual.

"There is only one way given under heaven by which disease can be abolished and a finer and fitter race evolved, and that is by stopping the cause of disease, and throwing all our energies into the resistance of its spread."

Without a fairly complete separation of infective consumptives, no progress of any kind is possible. Therein lies the solution of that problem.

"If we could only see the patients hit by the infection of phthisis as we do in smallpox the present order of things would not long be tolerated. As we are free from hydrophobia, so can we be free from tuberculosis when we find a statesman of the courage and fortitude of Mr. Walter Long to lead us to victory."

It is pointed out that in the evolution of the national medical service the friendly societies will be absorbed, the service will be thrown open to the whole of the medical profession, retiring allowances will be provided, and a State medical examination would become the single portal of entry to the medical profession which is so desirable. The voluntary hospitals would soon step into line with the rest of the service, and accept State support and control. The district assigned to each doctor would contain some four or five hundred families or houses. He would have a surgery; he would have no rivals worrying him, no bills to bother about, no suspense lest his patient

thought he was after fees, and it would be to his interest to reduce work by keeping in touch at all times with the people for whose health he is responsible. He would at the same time act as an educating influence, and the absence of the dread of a fee to pay would further promote early treatment.

GEOLOGY FOR STUDENTS.

A Text-Book of Geology. By P. Lake and R. H. Rastall. Pp. xvi+494. (London: E. Arnold, 1910.) Price 16*s.* net.

THIS text-book will fill the gap between several excellent books of a more primary character and the great English work of reference which we owe to Sir Archibald Geikie. Mr. Rastall is responsible for the physical portion, and Mr. Lake for that dealing with stratigraphy.

Dr. J. E. Marr, as editor of "Arnold's Geological Series," to which the work belongs, states in his preface that

"the stratigraphical portion of the book is occupied almost entirely with the study of the stratigraphy of the British Isles, which is sufficient for the purposes of elementary teaching."

This, however, is just the point on which there may be most difference of opinion. It may seem to some of us that in elementary teaching a view of the earth's history should be imparted on the broadest scale. The gaps in our insular stratified series should be filled in unhesitatingly from other lands. The progress of living things from Palæozoic to Quaternary types can be followed with interest even by a beginner in geology; but few people can take delight in British genera and species unless they can picture them in a setting of the successive faunas of the globe. The early editions of Lyell's "Principles of Geology" are appealed to by Dr. Marr as an example, yet nothing is more prominent in Lyell's work than his desire to establish a stratified sequence by observations made in many lands. Consider his table of "Recent and Tertiary Formations," on p. 61 of his third volume, published in 1833, and compare it with Mr. Lake's treatment of the same formations on pp. 439 and 453 of this modern text-book. Lyell, with a fascinating sweep, reminds us in his table of the delta of the Ganges, of Uddevalla, of Asti, and Perpignan, of the Superga, and of the volcanoes of the Velay. On p. 46 he regrets his ignorance of "many deposits known to exist in Spain and Portugal."

Many of us still share Lyell's regret, not because we want to carry in our heads the list of fossil species found on particular horizons, but because we want to fit the beds into the general scheme of stratified deposits. Lyell took his marine fossils as "medals which nature has chiefly selected to record the history of the former changes of the globe." Our universities, since his time, have established the cult of zones and horizons within the British Isles. The British Isles, moreover, have been accepted as consisting of England and Wales, and attention has become more and more concentrated on a limited area of the European outpost. Mr. Lake has worked well under these conditions, and no one will accuse him of ignorance of the wider aspects of the earth. We expect, however, a "text-book of geology" to convey to us some picture of the progress of life upon the globe. Of this we find only scanty traces in the 200 pages devoted to stratigraphical geology. The word "stratigraphical" has been allowed to dominate this section rigidly. In this respect numerous smaller text-books come nearer to the Lyellian conception of geology.

Mr. Lake's treatise, however, is indispensable for those who wish to bring their knowledge of British strata up to date. He has included, for instance, Mr. J. F. N. Green's revision of the St. David's area (p. 298); the probability of an unconformity in the Bala series, emphasising its division into Caradocian and Ashgillian (pp. 318 and 320); and Mr. Clement Reid's assignment of an Upper Oligocene age to the plant-beds of Bovey Tracey (p. 452).

A Scottish geologist may be provoked to find that the rocks which form the main mass of his highlands are described in six lines (p. 297). An Irish geologist will regret that the Dingle problem is dismissed in twenty-six words (p. 352), while the Lower London Tertiaries occupy two noble pages. But this lack of proportion is written large in the programmes of our public examinations.

Mr. Rastall's chapters on physical geology naturally make a wider appeal. Even the Dwyka conglomerate of South Africa is shown in one of the photographic plates, though no explanation appears to be given of its remarkably interesting characters. Spitsbergen and Alaska are well referred to, and the Tonga Islands, the great cone of Misti, and the wind-scored Sphinx, are used as illustrations of features that have a broad significance. The plates are chosen with much care, and the diagrams are as lucid as the accompanying text. Good examples of the author's treatment are to be found in the passages on desert-erosion (p. 69), and on river-capture (p. 45). Where so many physical matters have to be dealt with, few authors will agree as to the degree of prominence to be given to each. We should have liked to hear more of the many varieties of gneisses, and we note that the author regards thermal metamorphism as "usually of comparatively limited extent," a statement that is true enough of the rocks exposed in England. In the Transvaal, Rhodesia, Fennoscandia, and Canada, examples of a very different order may be found. Rock-cleavage is clearly described, and is illustrated by plates iv. and v., which might well be transferred, with their text, to the chapter on metamorphism two hundred and forty pages further on.

Mr. Rastall shows as much caution (pp. 100, 101, &c.) in dealing with the work of ice as his colleague does (p. 464) in dealing with the glacial epoch; but the main results of observation are very fairly stated, and the lessons of Arctic lands are applied to the British Isles. Is Spitsbergen, however, to be described (p. 99) as "a region of heavy precipitation"? Where the actual amount of melting is slight, glaciers, fed by broad snow expanses, can be maintained in an almost arid climate.

In this excellently produced book we have come across no misprints. "Porphyry," in the table on

p. 238 seems a slip for the "syenite-porphyry" of p. 243. On p. 147, for "Skeat" read "Skeats." One or two prominent terms, like *roches moutonnées* and strain-slip cleavage, remain unnoticed in the truly admirable index. GRENVILLE A. J. COLE.

BIOLOGICAL CHEMISTRY.

An Introduction to Bacteriological and Enzyme Chemistry. By Dr. G. J. Fowler. Pp. viii+328. (London: Edward Arnold, n.d.) Price 7*s.* 6*d.* net.

IN this work we welcome a valuable contribution to the scanty English literature of a subject of vast and constantly growing importance. A great increase of interest in biological chemistry and a consequent rapid development of the subject along almost innumerable lines have been among the most noticeable features in the history of chemistry during the last ten or fifteen years. Stimulated by the brilliant successes of Fischer and the important researches of Buchner, many workers have devoted themselves to the study of biochemical problems, and especially to the investigation of enzyme action. Accompanying this scientific movement, and no doubt in part responsible for it, there has been a widespread introduction of biological methods into the routine experience alike of the industrial and analytical chemist. The subjects of agricultural and dairy chemistry, water analysis and sewage disposal, to say nothing of the advance in the old-established fermentation industries, at once suggest themselves as instances of this tendency, and an audience has thus been created anxious for authoritative information on the principles underlying the application of biology to all these questions.

It is to this audience that Dr. Fowler has addressed the main portion of his book. Anxious to meet the needs not only of the chemist, but of the engineer and medical officer of health, and even of the general reader, he has, however, included a chapter on general organic chemistry which it is to be feared will be found superfluous by the chemist, and will be "caviare to the general." Apart from this the plan of the book is excellent. The chief types of enzyme action and of the chemical action of bacteria are first discussed, along with the chemistry of the sugars and proteins, substances which play so important a part in all biochemical changes, and the book culminates in three chapters describing the relation of all these matters to agriculture, sewage disposal, and various industries. The treatment throughout is clear and practical, the excellent method being adopted of quoting as far as possible actual experimental results and methods from the original sources, and thus enabling the reader to appreciate the lines on which successful investigation of such problems must be shaped.

As might be expected in a book ranging somewhat lightly over a large field of detailed information, occasional inaccuracies are to be found. Thus the lactic and acetic fermentations (p. 13) have both been obtained by Buchner with cells killed by acetone; the discussion of the mutarotation of glucose might easily be understood to mean that the change is due to equilibrium occurring between the aldehyde and one of the oxide forms of glucose (p. 98). More serious fault is to be found with the description of the well-known guaiacum test for peroxidases, along with the typical albumin reactions, as characteristic properties of enzymes in general (p. 104). Peroxidases are now recognised as a distinct and individual class of enzymes and it is at least highly probable that many enzymes are not proteins, and among them diastase itself, in connection with which these tests are quoted. Something, moreover, has gone seriously wrong both with the formulæ and argument on p. 173.

Some of the subjects touched upon are of fascinating interest, a notable example being found in the chapter on the "Cycle of Nitrogen." This is, of course, a matter of the most fundamental economic importance, and one with which the author is specially qualified to deal.

For all who feel any curiosity about biological chemistry this book should serve as an excellent introduction, and it should be difficult for anyone to read it without realising some of that glamour which has attracted so many workers to the investigation of the chemistry of living beings. A. HARDEN.

WEST GREENLAND ESKIMO.

Bei den Eskimos in Westgrönland. Ergebnisse einer Sommerreise im Jahre, 1906. By Dr. R. Trebitsch. Nebst einem ethnologischen Anhang, von Dr. M. Haberlandt. Pp. xxiii+162+map. (Berlin: Dietrich Reimer (Ernst Vohsen), 1910.) Price 8 marks.

DR. TREBITSCH gives a very readable and capitally illustrated account of his twelve weeks' journey in western Greenland. Considering how large was the distance covered in this short time, it is creditable to him how much information was collected. West Greenland, between 73° N. lat., and Cape Farewell, is in the possession of Denmark. The entire trade is in the hands of the Kgl. grönländischen Handel, a Government concern, somewhat similar to our old East India Company, and there are stringent regulations to prevent intrusion by other Powers. Travellers must have a valid pretext for going, must undergo medical inspection, and are not allowed to take intoxicants into the country.

It was only as a collector of phonographic records for the K. Akademie d. Wissenschaften of Vienna that Dr. Trebitsch could get leave at Copenhagen to visit West Greenland. The country is divided into districts, the chief town of each is a "colony," where lives a Government official, who is at the same time the sole trader; other officials, mainly natives, are scattered about at trading centres. The Danish *régime* is apparently beneficial; for the West Greenlanders have increased from 6,286 in 1820 to 11,790 in 1904, a striking contrast to the state of affairs among the Eskimo of Alaska. The writings of Dr. Boas and others have taught us to expect some degree of uniformity of culture among the Eskimo, despite their vast extension over some 5000 miles of coast line, but the similarity between the seal-hunting appliances of the Alaskan Eskimo and West Greenlanders is none the less striking; the same talent for drawing and the custom of vying with each other in composing songs are met with among both groups.

The author collected masks, though Andree and others have denied this occurrence in Greenland, which are probably used for magico-religious purposes, as in Alaska. He unduly emphasises the similarity of type occasionally found between Eskimo and American Indians, which he attributes to kinship of race. The low stature of the Eskimo he regards as an adaptation to the climate of the far north, as the strong storms do not permit tall plants to grow, and suggests that the lack of hair on the face of the pure Eskimo is consequent on the inconvenience caused by the formation of icicles! West Greenlanders are for the most part of mixed Eskimo and Danish origin; in fact, the largest "colony" boasts of only one pure-bred Eskimo.

The seal plays a very large part in the life of the Eskimo, and Dr. Trebitsch gives some interesting details of the methods employed in capturing it. The kayak is provided with a square white sail, almost concealing the hunter, which the seal is supposed to mistake for an iceberg. The seal is first shot with a rifle, and then harpooned, so that the harpoon float may prevent it from sinking. In winter two men use a harpoon with a composite shaft some 6 metres long. A very large and a small hole are bored in the ice; one hunter lies down peering into the former, and when he catches sight of a seal he moves the harpoon point to and fro in the small hole, which attracts the seal. At the right moment both men thrust the harpoon with all their might. This mode of hunting is called "he looks through a hole." In East Greenland bait is employed. The mainland Eskimo, however, always wait for a seal to come up to a breathing hole.

Native social customs are considerably in abeyance among the Christianised Eskimo, but the author was sometimes able to secure traces of the past; for instance, one missionary allowed the performance of one of the old native dances. The songs and stories, of which a large collection of phonographic records was taken, are in many cases modern, but some are manifestly old, and refer to cannibalism, exchange of wives, and the mating of girls with animals. Many of the songs have a homely vein. In some cases the distribution of the folk-tales is discussed. There is an ethnological appendix by Dr. M. Haberlandt, who describes the objects collected by Dr. Trebitsch for the Vienna Museum. A. C. HADDON.

A VETERAN ANTHROPOLOGIST.

Memories of Eighty Years. By Dr. John Beddoe, F.R.S. Pp. xi+322. (Bristol: J. W. Arrowsmith; London: Simpkin, Marshall and Co., Ltd., 1910.) Price 7*s.* 6*d.* net.

DR. BEDDOE has followed the example of another distinguished anthropologist, the late Sir Francis Galton, in writing the memories of his life. This practice is to be commended, as it furnishes not only pleasant reading with a great deal of human interest, but also valuable material for the future historian of anthropology.

Dr. Beddoe, who may well be regarded as the founder of field anthropology, since he began making observations on hair and eye colours seventy years ago, records in this book the leading events of a long and active career. Born in 1826, on the English side of the Welsh border, he started life as a student of law, but soon abandoned that for the more congenial study of medicine. He acquired his medical knowledge at University College, London, and the University of Edinburgh.

In 1854 he went out to the Crimea as a member of a civil medical staff, where, though he had very little medical service to perform, he had the opportunity of making observations on many Oriental races. After his return from the Crimea, he decided to complete his medical studies at Vienna, and he gives an interesting account of his journey through Holland, Germany, and Bohemia, with many valuable and original observations on the ethnological features of the races he encountered on the way. He met van der Hoeven in Holland, and Virchow at Berlin. In Vienna he found the upper classes were of the Germanic type, and the lower orders very mixed, with a large Slavic element.

On leaving Vienna he returned to England through Italy and France, adding much to his knowledge of the races of those countries, which at that date were unexplored fields for the anthropologist. He finally settled down as a medical practitioner in Bristol.

The long list of anthropological papers published by Dr. Beddoe shows how persistently the rest of his life has been devoted to his favourite science.

In 1867 he was awarded a prize of 100 guineas by the Welsh National Eisteddfod for the best essay on the origin of the English nation, which was afterwards embodied in his classical book on the "Races of Britain."

He was the proposer of the first anthropometric committee of the British Association, and also the initiator of a separate section for anthropology at the B.A. In 1889 he was president of the Anthropological Institute, and he gives many interesting details about the amalgamation of the two older anthropological societies to form the institution which at present represents anthropology in this country.

Even now, in his eighty-fifth year, Dr. Beddoe's mental keenness and activity would put to shame that of most younger men.

PHYSICAL CHEMISTRY.

Introduction to Physical Chemistry. By Prof. J. Walker, F.R.S. Sixth edition. Pp. xii+417. (London: Macmillan and Co., Ltd., 1910.) Price 10*s.* net.

AFTER a useful life of eleven years, this well-known text-book appears in a thoroughly revised edition, in which, no doubt, it will continue to be a standard work. At first sight it appears as if the size of the work had remained sensibly constant—to use a favourite term of physical chemistry—actually there has been an increase of 27 per cent., and the additional chapters on alloys, hydrates, colloidal solutions, dimensions of atoms and molecules, neutrality and salt hydrolysis, electromotive force, polarisation and electrolysis, and radio-active transformations have

added much to its value. Of these the chapter on alloys may be mentioned as a particularly successful piece of exposition.

The book reflects as much as ever the spirit of a very true believer in the ionic dissociation hypothesis, and little emphasis is given to the difficulties and objections or to the criticism by which it has been assailed. Although in an elementary work an author can scarcely be expected to go into great detail, it must be remembered that the English student still finds himself in an atmosphere where there is a good deal of objurgation about the ionic theory, and if Prof. Walker had dealt with the difficulties collectively it would probably have been a convenience to students.

The following points have been noted for remark in the course of reading. On p. 83 the wording may readily give the impression that the vapour rising from a boiling salt solution has a temperature of 100° C., a matter on which there is a widely prevalent misconception among students. On p. 227 it would have been well to explain why the Brownian movement is compatible with the conventional assumption that a body suspended in a liquid is subject to equal pressure in every direction. The explanation of "salting out," on p. 347, as a process depending *solely* on ionic concentration is scarcely justifiable. Lastly, Prof. Walker has used throughout the book his system of chloridion, sulphation sodion, &c., nomenclature. The present writer took exception privately to this nomenclature when it was first proposed, but was assured that with experience he would learn its value to students. This prediction has not been fulfilled, and whatever philosophical defence may be made of the system, he remains of the opinion that it is not helpful. A. S.

BRITAIN'S BIRDS.

Britain's Birds and their Nests. Described by A. Landsborough Thomson, with introduction by Prof. J. A. Thomson. 132 drawings in colour by G. Rankin. Pp. xxviii+340. (London: W. and R. Chambers, Ltd., 1910.)

ANOTHER gorgeous volume on Britain's birds and their nests! Truly of the making of books on this subject there seems no end. Happy the publishers, and authors we presume, supported by a public with so insatiable an appetite for British ornithology. We could exhaust the space at our disposal with a mere list of the books and serials on this subject which are issuing or have issued from the press within the past two years and have come under notice in these pages. The name on the title-page of a gifted professor in a great northern university, as introducer of his son as author has given special zest to the perusal of this particular volume.

Prof. Arthur Thomson writes an introduction to "Mr. Rankin's beautiful pictures and my son's text." We must, much to our regret, however, confess to considerable disappointment in the volume before us. The text is excellent. Indeed, the various biographies are pleasantly written, and very accurate as a whole, but little really appears to have been left for Mr. Landsborough Thomson to say that has not already been often told.

But it is with the plates that fault is chiefly to be found. They are all "very pretty," but we have more of art than of nature in them. We suspect that they are mostly studio pictures rather than out-of-door studies. Without exception the species Mr. Rankin has depicted are the most "proper" series of British birds we have ever made the acquaintance of. They never foul the ground, when 'tis their nature to; they never disturb a blade of grass or a single petal of the beautiful flowers that emborder their nests in nearly every case. They are indeed the most æsthetic company we have yet met with, in the choice of nesting sites.

We miss, too, in many of the plates, the characteristic attitude of the bird represented. There is something lacking in the pose of the herring gull to those familiar with it "in the open." In the thick-knee the beak is too thin and its eye too small; in the corncrake the true ralline attitude has not been caught. We failed to recognise the nidifugous nestling figured on plate 88, Fig. 3, as a young partridge until we had consulted the reference.

As to the eggs figured, it would be quite impossible for even one well acquainted with them in many cases to determine their parentage from the plates. Their size—no dimensions being given in the text—is also quite undeterminable, and their colour often far from true to nature. There is no doubt that as regards tint the three-colour process is very often to blame; but where it fails some indication should be given in the text.

The author, yet a very young man, shows by this ambitious venture into the world of books that he is possessed of "the passion of the ornithologist," and by it gives promise that we may expect from him an ornithological work "going far beyond the recording of occurrences," to quote his father's words, "and the observations of movements important and indispensable as these and similar inquiries are."

OUR BOOK SHELF.

An Introduction to Experimental Psychology. By Dr. C. S. Myers. (The Cambridge Manuals of Science and Literature.) Pp. vii+156. (Cambridge: University Press, 1911.) Price 1s. net.

IN this little book Dr. Myers gives a very interesting account of modern views in certain parts of the science of experimental psychology. The topics selected for discussion, and forming the headlines of successive chapters, are:—"Touch, Temperature, and Pain," "Colour Vision," "The Müller-Lyer Illusion," "Experimental Æsthetics," "Memory," and "Mental Tests and their Uses" (two chapters). On each of these subjects much important work has been done within quite recent years, and the exceptionally clear way in which the author sums up the latest results and brings out their theoretical importance will make the book of great value to physicians, educationists, and others who are finding a knowledge of the general methods and results of the science an indispensable supplement to their ordinarily-recognised intellectual equipment.

The first chapter contains a full account of the recent researches of Drs. Rivers and Head on human nerve division, which have modified so extensively our views on tactile sensibility. The chapter on the Müller-

Lyer illusion describes an extremely interesting example of the success with which careful psychological experimentation, supplemented by exact measurement, can analyse out the various hidden factors involved in the production of an optical illusion. Colour vision and experimental æsthetics are treated in a way which cannot fail to interest the ordinary educated reader. But the parts of the book which deserve to be singled out as of particular interest for applied science, educational or medical, and as a really masterly description, in a small compass, of work perhaps most characteristic of modern psychological advance, are the chapters on memory and on mental tests and their uses. Readers of the author's larger text-book of "Experimental Psychology," will recognise in the former a condensation of the excellent account of the subject in that book. The discussion of mental tests includes clear instructions as to the method to be employed in applying certain of the more important of them, and gives a summary of many of the results, which will be found exceedingly useful to readers who have not the time or the facilities for referring to the original publications. Such questions as the effect of alcohol and other drugs upon muscular work and fatigue, the standardisation of intelligence, and the correlation of mental abilities one with another, will all be found adequately treated.

The book contains a bibliography and index, and is artistically bound and very clearly printed.

W. B.

Grundzüge der Mathematisch-Physikalischen Akustik. by Prof. A. Kalähne. Teil i., pp. vii+130. (Leipzig and Berlin: B. G. Teubner, 1910.) Price 3.20 marks.

THIS little work forms an excellent introduction to the mathematical basis of acoustics. Though using the calculus freely wherever needed, including differential equations, the treatment is simple and full, the analysis being illustrated by numerical examples and corresponding diagrams drawn to scale. The present part (being the first of two) is divided into seven chapters. Of these the first is devoted to vibrations and waves in general, the second to Fourier's series and harmonic analysis, while the third deals with the musical intervals of the scale, and kindred topics. Then, the subject being introduced, its formal development follows. The fourth and fifth chapters treat the vibrations of a particle, undamped and damped respectively. The sixth chapter deals with resonance and forced vibrations, the concluding chapter extending the treatment to systems of more degrees of freedom and their coupled vibrations. Perhaps to the English reader the most valuable features of the work are the tables and the curves giving concrete expression to the numerical illustrations. The growth of forced vibrations and the sharpness of resonance are very well shown, and may serve as a reminder of the electrical work of V. Bjerknes, Zenneck, and others in Hertzian waves and wireless telegraphy.

E. H. B.

Physical Measurements. By Prof. A. W. Duff and Prof. A. W. Ewell. Second edition, revised and enlarged. Pp. x+258. (London: J. and A. Churchill, 1911.) Price 7*s.* 6*d.* net.

THIS book is intended by the authors for students who have already completed an elementary course of practical physics. It is not, however, a treatise on methods of physical measurement, but the authors have described upwards of seventy typical experiments of an advanced and modern character. While the descriptions of these experiments are usually applicable to apparatus in general, they are in many cases somewhat sparse in detail. Thus, for example, in Expt. lxiii., "Strength of a Magnetic Field by Bismuth Spiral," no remarks are made on the necessity of maintaining the temperature of the spiral constant, which is of primary importance if trustworthy results are to be obtained by this method. These defects are, however, partially remedied by the references given by the authors at the commencement of each experiment to more advanced treatises and sources where the subject under investigation is dealt with more exhaustively. Such well-known text-books as Kohlrausch, Watson, and Stewart and Gee figure conspicuously in this respect. The authors consider that the books and papers referred to in this way should be consulted by the student before commencing the experiment. A few questions are usually appended to each experiment bearing upon its subject-matter, At the end of the book are tables of logarithms and physical constants.

In the diagram on p. 70 (hypsometer) surely it is better to connect the pressure gauge directly with the inner cylinder of the hypsometer. The following experiment, No. xiv., p. 71, would have been better described as "Linear Coefficient of Expansion" and not "Temperature Coefficient of Expansion."

If the book is used in conjunction with the references it will prove of value to the student of physics.

Unsterblichkeit: Eine Kritik der Beziehungen zwischen Naturgeschenen und menschlicher Vorstellungswelt. By Hermann Graf Keyserling. Zweite Auflage. Pp. iv+285. (Munich: J. F. Lehmann, 1911.) Price 5 marks.

IN the review of the first edition of this work (NATURE, vol. lxxxii., p. 5, November 4, 1909) it was pointed out that the fundamental idea was that of faith as a permanent and essential constituent of human movement along the lines both of thought and of action. In the present edition, this is the single point of view, and the concluding chapters of the original work, amounting to about sixty pages, are now included in the author's "Prolegomena zur Naturphilosophie." The work is rich in thought and represents a noteworthy contribution of a naturalist to the human concept of immortality.

Elementary Regional Geography. Europe and the Mediterranean Region. By J. B. Reynolds. Pp. viii+184. (London: A. and C. Black, 1911.) Price 1*s.* 4*d.*

Cambridge County Geographies. Berkshire. By H. W. Monckton. (Cambridge: University Press, 1911.) Price 1*s.* 6*d.*

MAPS and other illustrations take the most prominent place in Miss Reynolds's little book on Europe. The volume should form a useful introduction to the subject for young people, but it would have been more suitable for this purpose if the children had been provided with more work to do for themselves.

Mr. Monckton's book on "Berkshire" is a worthy addition to an interesting series; it has all the good qualities noticed in connection with its companion volumes.

Space and Spirit. A Commentary upon the Work of Sir Oliver Lodge, entitled "Life and Matter." By R. A. Kennedy. Second edition. Pp. 64. (London: Charles Knight and Co., Ltd., 1911.) Price 1*s.* 6*d.* net.

THE first edition of this booklet was reviewed at some length in our issue of February 24, 1910 (vol. lxxxii., p. 486). The new edition contains some further contributions by way of appendix, and a new list of definitions.

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 Solar Eclipse of April 28.

THE failure of the observers at Vavau to obtain a satisfactory view of the eclipse is very unfortunate, and the whole astronomical world will share their disappointment. It is welcome news to hear that perfect conditions prevailed at islands situated some distance from Vavau, and equally well placed as regards the line of totality.

I have received a letter from Mr. C. L. Wragge, who observed the eclipse under ideal conditions from the island of Moungaone in the Tongan group. He writes to me from Lifuka as follows :—

"It was entirely successful, with a clear sky, and magnificent beyond words. A lovely sketch to scale was also secured by another member of my special party at Lifuka—duration of totality, about two minutes. Four great streamers were seen.

"The shadow-bands rippling over the cocoanuts, and the dark purplish-black of the ocean, obliterating the lovely tinges of blue and green water around the coral reefs, were superb.

"The natives rushed into their houses, and came out and cheered when, with a blaze of glory, the sun reappeared."

The photographs secured have been taken back to New Zealand for development, but a sketch enclosed with the letter shows the corona with four magnificent streamers of the type characteristic of the solar sunspot minimum, and also a very large prominence. The streamers and inner corona are described as "silver-white," and the following *approximate* measurements are given :—

Highest streamer of corona, about 649,000 miles.

Large red flame, about 217,000 miles.

The streamers were in pairs, two extending north-east and two south-west, while silver-white ridges of the inner corona extended round the north-west quadrant.

CHARLES W. RAFFETY.

2 Park Hill Road, East Croydon, Surrey, June 18.

Dinoflagellates and Diatoms on the Beach.

IN walking across the beach between tide-marks at Port Erin on April 7, I noticed a greenish-brown discoloration of the sand in places—especially along the edges of the ripple-marks and other depressions—which I supposed to be caused by a deposit of diatoms. The examination of a sample in the laboratory soon showed, however, that although a few diatoms (*Navicula amphisbaena*, or some closely allied form) are present, by far the greater part of the deposit is formed of the active little peridinian or dinoflagellate *Amphidinium operculatum*, Clap. and Lachm., which has not, so far as I can ascertain, been previously recorded on the British coast.

The innumerable specimens of Amphidinium were all alive, reproducing by longitudinal fission, and very active in their movements. They would leave the sand-grains to which they were adhering, swim round rapidly in the water, and then settle down again upon a sand-grain. These dinoflagellates remained abundant on the beach at Port Erin until the end of April, when the observers had to return to Liverpool. During these weeks the patches of discoloured sand changed a little with each tide, increasing, diminishing, shifting, or even disappearing for a day, and then reappearing. Samples placed in dishes of sand and sea-water in the Biological Station flourished, and the organisms increased so as to form a dark-coloured layer over the sand, eventually rendering the water impure and causing the death of the dinoflagellates.

At the meeting of the Linnean Society on June 1 I directed attention to this unusual occurrence of this small Amphidinium in vast quantities, and exhibited specimens. Two days later I was again on the beach at Port Erin, and found what were apparently the same patches of discoloured sand, but on examining scrapings with the microscope saw that the deposit was now wholly composed of a golden-yellow diatom, one of the "*amphisbaena* group" of Navicula. I searched the beach carefully between tide-marks, and examined samples from every suspected patch of sand, but could find no trace of the Amphidinium so abundant a few weeks before. The Navicula, which was present in April in very small quantities, seems completely to have replaced the dinoflagellate. We have probably much to learn in regard to the comings and goings of such microscopic forms and their physiological inter-relations in connection with what may be called "the metabolism of the beach."

W. A. HERDMAN.

Liverpool, June 12.

A New Method of Chemical Analysis.

WILL you permit me to step outside usual practice in this instance and to direct wider attention to the exceptionally brilliant and momentous work described to the Royal Institution on Friday evening, April 7, by its present professor of natural philosophy, as reported in NATURE of June 1, p. 466?

OLIVER LODGE.

THE author of the present note is probably one of the few chemists living who was originally brought up in the Berzelian electrochemical theory (for which idea Berzelius was indebted to Davy), and, as shown in an article published in 1877 (see also Arrhenius-Jubelband), he made a sharp distinction between elements playing the "electropositive" and "electronegative" *rôle*. So, *e.g.*, the connection between the position of elements in Mendeléeff's periodic system and their valency was expressed thus: The *positive* valency of the elements (towards the negative oxygen) may change between 1 and 8; the *negative* valency (towards the positive hydrogen) may change between 1 and 4 only.

But such ideas, for which I was formerly reproached of being "unmodern," are very modern indeed to-day.

This is seen from the highly interesting lecture, published in NATURE of June 1, by Sir J. J. Thomson, "A New Method of Chemical Analysis" (p. 466 *et seq.*).

Without referring to the results communicated in this lecture with anything but high admiration, I beg to point out that Sir J. J. Thomson finds that, when the elements hydrogen and carbon had passed—originally positively charged—through the kathodes of his tubes, they appear also *negatively* charged. This he calls "remarkable, for *hydrogen* is generally considered to be a strongly *electro-positive* element," and "the atom of *carbon*, also regarded as an *electro-positive* element, is also conspicuous on the *negative* side."

I desire to remark that there is an analogy, but also a certain difference, between the notion "positive" and "negative" as used by the chemist or by the physicist. Physically, and also chemically, a positive atom carries positive charges, and the negative atom *vice versa*. This holds good of Sir J. J. Thomson's atoms (see the article) and of the atoms in solutions which we chemists call "ions." The difference lies in the point that, as regards the atoms constituting the chemical *compounds*, the terms "*positive*" and "*negative*" have only a *relative* value, as pointed out in the introductory lines. Hydrogen is *positive* towards chlorine in hydrogen chloride, H_+Cl_-, and many other compounds, whereas it forms the *negative* constituent of potassium hydride, K_+H_-, and other similar compounds (CaH_2, LaH_3, CeH_4, &c.).

The physical analogy of this relativity is the zero position of hydrogen in the electrical tension series. It is *positive* compared with the "noble" metals and the metalloids; it is *negative* compared with the "ignoble" metals like those of the alkalies, alkaline earths, and the earths.

As regards carbon, it is *positive* in C_+O_{2-}, but it is *negative* in $H_{4+}C_-$ and in the more popular calcium carbide, Ca_+C_{2-}.

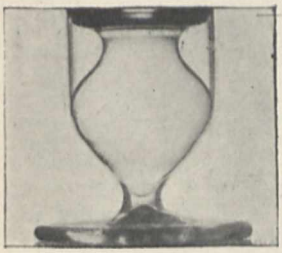
In the compounds KH, CaC_2, and also in $Na_{3+}N_-$ we had already suspected latent negative chemical ions. Chemists will be indebted to Sir J. J. Thomson that he has shown their existence physically. It is interesting, but not surprising, that the said elements take up *negative* charges under the conditions of his experiments.

BOHUSLAV BRAUNER.

Bohemian University, Prague, June 6.

The Formation of Stable Columns of Liquids.

When a liquid of slightly greater density than water is poured into a shallow layer of the latter, it is often possible to produce the formation shown in the accompanying photograph, in which the heavier liquid appears as a column of curved outline, stretched by its own weight, and hanging from the surface of the water. By performing the experiment in the following manner, the production of the column is rendered easy and certain. A test-tube of the dimensions shown in the photograph, preferably furnished with a foot, is filled to about one half the height of the hemispherical end with water, and 5 to 10 c.c. of aceto-acetic ether are then added. Usually, the formation of the column is automatic; if it should fail to form the contents should be shaken up, and the test-tube allowed to stand for a short time, when the liquids will settle as shown. Water globules entangled in the aceto-acetic ether may be removed by drawing to the side with a wire.



If the original layer of water be too deep, the column will break at its narrowest part, and the same occurs if water be poured gradually into the tube after the column has formed. By varying the width of the vessel, a great variety of shapes may be obtained, all of which are perfectly stable. The water is in all cases displaced from the lower part of the vessel, and bounds the sides of the column of heavier liquid. Similar results may be obtained with aniline, orthotoluidine, butyl benzoate, and some other liquids; but in these instances the manipulation is rather more difficult, owing to the tendency to break up into separate globules. By placing the test-tube in a flat-sided vessel and surrounding with water, the column may be projected on a screen, thus furnishing an interesting lecture experiment on the subject of surface tension.

Chas. R. Darling.

THE CORONATION.

From the point of view of social psychology to-day's great ceremony may be said to bind together in a circle of symbolism the past history of the English people and the present interests of the British Empire. From the point of view of individual psychology it may be regarded as a symbolic elevation of human personality to its highest power.

It is an interesting problem for the sociologist how far a given social ceremony succeeds in realising a modern content in an ancient form. The relation of form and content in social ceremonies and institutions alike is analogous to that of structure and function in organisms. But the inertia of social forms is far greater than that of organic structures, for in the case of the latter there is neither sentiment nor tradition to assist survival.

The development of the ceremony of crowning from Greek and Roman times is clear, but the origins of the crown-symbol itself are still obscure. Outside the sphere of classical antiquity its use is rare. But within it, as in mediæval and modern Europe, the crown is, next to the King, the central feature of coronation. Not only in popular language, but in legal phraseology, it is a synonym for the kingly office itself. It has, in fact, long ago superseded unction as the central element of royal investiture, making the recipient a king rather than a priest.

The crown of the kings of Egypt was, like regalia generally, considered divine. Kings of the Yorubas sacrifice sheep to their own crowns. In South Celebes it is the regalia that reign; the king is but their representative. If we attempt to penetrate to the strata of early custom which preceded the Greek and Roman kingly crown, the Athenian crowns which were given, just as ribbons of the Legion of Honour are given, the Roman crowns corresponding to the Victoria Cross and similar honours, the Greek wreaths of sacred leaves won in the games, and even the oak chaplet of the early Roman kings identifying them with the oak-god, we may follow some such line as the following. Like unction, crowning had its origin in personal decoration or accoutrement. Savage chiefs are sometimes invested with a girdle. Just as ankle and wrist straps and the like are frequently worn by rude peoples for the practical purpose of protecting the joints and ligaments, and afterwards attract superstitious ideas, such as the idea that they prevent the soul from escaping, so it may have been with the head-band or head-dress, originally used for protection or for confining the hair. The brain being the crown of the human organism, the head has always received honour. From this point of view the crown is the one royal symbol likely to be retained by enlightened peoples, who for various reasons retain kingship.

Coronations in other latitudes are instructive. Investiture with a special or sacred dress is frequently the main feature. The king-elect of the Aztecs went in procession to the temple. Here, after paying homage to the god, he was anointed over the whole of the body by the high priest, and sprinkled with holy water. The unguent was a black oil of rubber. He was then clothed in ceremonial robes, and about his neck was hung a gourd containing remedies against sorcery, disease, and treason. Hindu coronations took the form of a baptism, or an unction. Eighteen ingredients were required for the holy water, one being the water of the sacred river Sarasvati. After a preliminary sprinkling, the king received a bow and arrows, with which he symbolically conquered the four quarters of heaven and earth. Then, seated on a tiger-skin, facing the east, he received the holy water in a shower from a rose-head of gold. Four officiators poured it. Many prayers were recited meanwhile, some "to enable him to discharge his duties," others to the "divine quickeners"; others stated that he was being consecrated by the gods, and being filled with divine force. Vigour and vitality, royal and priestly dignity, were contained in the ingredients of the holy water. His head was then adorned with stalks of holy grass and ears of corn. At the end he quaffed a draught of the sacred soma. His hair was not to be cut for a year after the ceremony. In modern times a Rajput raja is anointed with sandal-paste and rose-water, and the priest marks his forehead with the sacred Tika symbol. When the raja of the Bhuiyas is consecrated, a chief winds a flexible creeper round his head-dress to signify that he is "Lord of the forest."

Ellis describes the installation of Tahitian kings. The king bathed, and was then ceremonially struck by the priest with a sacred branch. He was then girded with a sacred girdle of red feathers, which rendered him divine. In old Siam the king was placed under the seven-tiered umbrella, the great symbol of royalty. A crown and a collar of diamonds were placed upon him, and he received a golden tube containing his name. In old China the king (like Plato's philosopher-kings) deprecated his elevation, declaring himself to be unworthy. No crown was used; the king was seated upon the throne of the Nine Heavens. In Abyssinia, that most curious pioneer of Christian kingdoms, there

was a pretty piece of symbolism. The king rode on horseback, to find his way barred by a company of girls holding a barrier consisting of a cord of crimson silk. They plied him with the question: Who are you? Then, after an exhibition of horsemanship, the king severed the barrier with his sword. The priests then intervened, anointed, crowned, and incensed him. It was, no doubt, at the same period that Ptolemy Philadelphus of Egypt reduced crowning to an absurdity. At his coronation, Athenæus tells us, three thousand two hundred crowns of gold were carried in procession, and one of these was a hundred and twenty feet in circumference.

Our own ceremony is a wonderful mosaic of survivals. Its main features are the recognition of the king by the people; the oath of good government; the anointing; the delivery of the regalia; the imposition of the crown; the delivery of "the most valuable thing that this world affords," the Bible; the enthroning; the reception of homage. Among the regalia the antiquary may miss "the hand of justice" of the emperors of the Holy Roman Empire. The most ancient feature, the unction, of course, derives from Hebrew ritual, as the crowning from Roman. The combination of the two marks the combination of spiritual and temporal power, and is a curious echo of "primitive" kingship, when the monarch possessed both material authority and supernatural *mana*, and was both president and priest. Unction in its evolution always shows a connection with spiritual ideas; the vehicle is itself a source of life, and, when consecrated, inspires the recipient. But its ultimate origin is the use of oil as part of the festal garb. At one end of the scale we have the Australian medicine-man "singing" a charm of power into a magic ointment; at the other Plato conceives the fancy that the Soul of the Universe was impressed upon material nature by the Creator as an unction in the form of a cross.

To the student of man it is interesting to observe that all these elements of the ceremony except the "recognition," have only lost their original magical import, and become symbolic, within the last eight or nine hundred years. He may ask himself whether the imagination of the people really accepts unction as expressive of modern thought and modern life; whether there is not too much "survival" in the whole ceremony to enable it to retain any living meaning. Dead forms, he may note, are always dangerous. If we still possessed the art and craft of ceremony, new forms might be evolved. It is remarkable that the whole essence of the ancient ritual not only does not contain any recognition of the one great motive force of modern civilisation, science, on which all progress, all wealth, and even all existence increasingly depend, but is actually a negation of it.

A really living symbolism is to be found in the "recognition" of the King by the people. This might form the nucleus of a representative ceremonial adequate to our times. Those present to "recognise" would be representative of every factor that helps to make the Empire, and in proportional numbers and prominence. Other countries have realised this opportunity. At every great State function in Germany a prominent place is assigned to the representatives of pure and applied science; the German mind realises that the wealth and well-being of the empire ultimately depend on science, and science alone. It is a pity that those responsible for the organisation of our ceremony sympathise so strongly with its archaic elements that they have not secured an adequate representation of the depositaries of modern knowledge, the true palladium of people and of empire.

A. E. CRAWLEY.

AËRIAL NAVIGATION AND MECHANICS.[1]

THE exigencies of modern aëronautics combined with the uncertainties attaching to aëroplane flight are slowly but gradually directing attention to the necessity of researches and original papers of a highly specialised character, dealing with air pressures and the motions of bodies acted on by them. The question thus becomes imminent: Where should such investigations be published?

Until now no attempt has been made to make use of journals and transactions of societies publishing physical papers, and articles full of formulæ, diagrams, and tables have generally found their way into periodicals of a semi-popular or practical character, devoted to general aëronautical or engineering questions. The result has not always been satisfactory, and it has often been a question as to whether the printing of the formulæ or the reproduction of the diagrams has suffered the most. The insufficiency of the existing media for the publication of theoretical articles on aëronautics is, however, more clearly shown by asking the question: What is to be done with a manuscript of 100 foolscap pages filled from beginning to end with long formulæ or diagrams? Further, whatever may be the drawbacks of the system of refereeing papers no doubt can exist as to the advantages of a collection of memoirs, all of which have been subjected to the judgment and criticism of external examiners.

The Government Blue-books contain exactly the kind of investigations to which these remarks apply, and the hope may therefore be expressed that these will in the future become a recognised medium for the publication of lengthy investigations which have been approved by the Government Committee.

The "Report" for 1909–10 consists of (1) records of experiments performed at the National Physical Laboratory; (2) original papers by members of the committee and others; (3) abstracts of papers of a scientific character dealing with aëronautical problems.

Probably the features which possess the greatest interest for the large majority of readers are the abstracts and reports on the state of science with regard to specified subjects. The thirty-five pages of general abstracts do for aëronautical science what is done for physics and electrical engineering by "Science Abstracts." In order to make the collection more complete the compilers have included papers published some time ago; for example, abstract No. 8, deals with Turnbull's experiments, which were published in *The Physical Review* for 1907.

Mr. F. J. Selby's special reports on the present state of knowledge regarding electrification of balloons and on papers by Ferber, Crocco, and Soreau, dealing with equations of motion and stability considerations, form a valuable contribution of a similar character. It is interesting to notice that several stability conditions in the papers referred to are defective, owing to the

[1] Report of the Advisory Committee for Aëronautics for the year 1909–1910. Pp. 191. (London: H.M. Stationery Office; Wyman and Sons, Ltd.; Edinburgh: Oliver Boyd; Dublin: E. Ponsonby, Ltd., 1910.) Cd. 5282. Price 8*s.* 5*d.*

Interim Report on the work for the Year 1910–11. Pp. 30. Cd. 5453. (London: H.M. Stationery Office; Wyman and Sons, Ltd.; Edinburgh: Oliver Boyd; Dublin: E. Ponsonby, Ltd.) Price 1*s.* 2*d.*

Report on the Theory of a Stream Line past a Plane Barrier, and of the Discontinuity arising at the Edge, with the application of the theory to an Aëroplane. By Sir George Greenhill, F.R.S. Pp. 96+106 figs. (Advisory Committee for Aëronautics Reports and Memoranda, No. 19.) (London: H.M. Stationery Office; Wyman and Sons, Ltd.; Edinburgh: Oliver Boyd; Dublin: E. Ponsonby, Ltd., 1910.) Price 5*s.*

"The Aëroplane, an elementary text-book on the principles of dynamic flight." By T. O'B. Hubbard, J. H. Ledeboer, and C. C. Turner. Pp. xi+128. (London: Longmans, Green, and Co., 1911.) Price 2*s.* 6*d.* net.

"The Mechanics of the Earth's Atmosphere, a collection of Translations." By Cleveland Abbe. Third Collection. Pp. iv+617. (Washington, D.C.: Smithsonian Institution, 1910.) (Smithsonian Miscellaneous Collections, Vol. li., No. 4 Hodgkins Fund.)

failure of the writers to take account of sufficient data, and in particular to appreciate the interdependence of the equations of motion, and this is the less easy to understand as this interdependence in the case of lateral stability is clearly pointed out in Lanchester's "Aërodonetics."

The report on electrification of balloons is followed by brief accounts of experiments by Messrs. G. W. Walker and W. Makower. The subject is an important one, the neglect of which may be responsible for at least one serious dirigible fatality in Germany. Rear-Admiral Bacon gives a translation and abstract of the programmes of the German Society for the Study of Airships.

Passing, however, to the articles dealing with "researches," we find voluminous descriptions of apparatus and diagrams of experimental details, none too easy to follow, which may well suggest to the uninitiated reader to ask, "What has all this to do with aëronautics?" A doubt may readily arise as to whether the structural details of a wind tower, experiments on a fish-shaped body moving in water, or a diagram showing the weather conditions prevailing on a certain day at Portsmouth or Berwick will in any way reduce the record of a score of people killed, besides those wounded by accidents during the first four months of the present year. The inclusion of unnecessary *minutiae* will only tend to strengthen the violent attacks which were made recently on the work of the committee by a well-known motorist writing in a popular magazine. The writer in question took up the well-known "practical" attitude, and suggested that if the Government wanted to do any good they should buy a commercial aëroplane; they should keep their committee muzzled (so to speak), and should only consult them when the machine got out of order, in which case they should be expected to rectify the mischief, presumably, at a few hours' notice. This, according to the writer, was the condition under which experts in English commercial firms labour, and he was shocked at the idea of a Government committee having any free will as to what they were to do.

It is hardly necessary to point out in NATURE that no body of scientific men would consent to serve on a committee under conditions so detrimental to efficiency, or to direct attention to the waste of money which occurs when experts are called on to patch up defects which, under more favourable conditions, they could have anticipated previously. But it does appear that the bearing of many of these researches on aërial navigation has been considerably obscured by the inclusion of unnecessary matter which would have been better filed for future reference instead of being published.

At the present time, apart from stability and the construction of light motors, the most important problem of aërial navigation is the behaviour of aëroplanes and dirigibles in gusty winds, the determination of the maximum fluctuations, of the stresses these set up in the various surfaces and frameworks, and of the changes of motion they produce, and whether these involve loss of control. Now Dr. W. N. Shaw, F.R.S., of the Meteorological Office, has drawn up a report of about sixteen pages on "Details of Wind Structure," in which he states at the beginning, "In drawing up this statement, endeavour has been made to summarise briefly. Additional details can be supplied in further illustration if required." After the concise and lucid exposition which the author gives, it is rather a striking contrast to find more than forty sheets of diagrammatic details of records taken at particular places. These greatly increase the bulk of the volume, and in view of the previous work by Langley on "The Internal Work of the Wind," the provisions stated on p. 10 for enabling the records to be consulted might well have been utilised to save the cost of printing all these diagrams. Moreover, the scale of time is too small to show the intervals between the gusts, a detail of some importance.

The sections dealing with the measurement of pressures also contain a profusion of diagrams and mechanical details of a purely subsidiary character, and the general conclusions are not well stated. A good deal of space is taken up with the details of experiments in water, which would find a more natural place in the transactions of the Institution of Naval Architects than in a report on aëronautics.

The splendid equipment of the National Physical Laboratory at Teddington is described in six pages of letterpress by Dr. T. E. Stanton, but here again the diagrams are unnecessarily large and bulky, and a more useful purpose would have been served if these had been reduced, and the space used for a fuller exposition of the bearing of the experiments on aërial locomotion.

We notice that for experiments on the pressure on planes the use of a whirling table is not considered satisfactory, and that a wind tunnel has been preferred for the purpose. The main objection to this plan is that no attempts have been made so far to investigate the pressure distribution on a plate which has a movement of rotation as well as of translation. The results therefore can only apply to an aëroplane driven steadily through calm air, since when either free or forced oscillations take place rotation plays an important part in them. The experimental determination of these rotational effects will necessarily be difficult, and a whirling table suggests a possible method; at the same time results possessing even a very rough degree of accuracy are better than no results at all, and their absence limits the systematic investigation of aëroplane motions to machines the supporting surfaces of which are narrow. No reference to rotating planes is made in the programme of the committee.

If the committee instead of confining its attention to ideal surfaces, had discussed the application of its conclusions to the successful types of aëroplane and dirigible of the present day, the report would have better corresponded with its title.

The interim report on the Motor Prize Competition offered by Mr. P. Y. Alexander in 1909, which took place last July, exhibits the same features as the other reports. It contains details and diagrams of the friction dynamometers used for testing the motors, particulars as to the mode of estimating the weight of the latter, the quality and price of the petrol, the insurance of the maker's servants for employer's liability, the number of representatives allowed to be present at the tests, the temperature of the room, the times of day at which two pints of water were added to the radiators, and other details carried to the same degree of elaborateness; in short, everything except a statement of the general conclusions of a scientific character to be derived from the tests, as apart from mere statistics.

Sir George Greenhill's report is essentially a mathematical treatise on discontinuous motion, covering all the problems which have up to the present been solved. An important improvement has been made on the treatment given in the earlier text-books, by the introduction of constants. Old students of hydrodynamics will remember a difficulty that suggested itself arising from the fact that a solution might apply to a stream flowing past a lamina of breadth π with velocity 1, but it was not obvious what could be done if the breadth of the lamina were a and the velocity v. This treatise will be of great use to workers in our universities who are seeking to extend the applications of pure mathematics to physical

problems, and thus to furnish fresh starting points for experimental research.

The utility of measurements of the tensile strength of fabrics, of diffusion of hydrogen through membranes, and of a search for light alloys, are too obvious to need further comment, and the fourteen pages of the first report dealing with these questions are concise and to the point.

If there is one conclusion to be derived from a study of these reports it is that a serious mistake was made years ago when in America the grant for the late Dr. S. P. Langley's experiments was withdrawn. If the work now being done does not altogether make up the deficiencies caused by neglect in the past, it is gratifying to learn that experiments are progressing in this direction.

In a recent review of a translation by the editors of *The Aëronautical Journal*, the suggestion was made that they might well bring out further books on aviation. "The Aëroplane" provides in a small compass a summary of the general principles involved in aviation, and the hope expressed by the authors "that the book will find a sphere of usefulness as a comprehensive introduction to the latest and the most fascinating of sciences" is well supported by an examination of the contents. The first chapter deals with properties of the air, including meteorological considerations and relations between pressure temperature and density. The next two chapters are devoted to the flow of air round variously shaped bodies, its pressure on plane and curved surfaces, formulæ for the centre of pressure, and lift and drift. Then comes a study of gliders, in which the reader is asked to make a few experiments with a sheet of paper; stability and steering next follow. In the chapter on propulsion the main notions regarding "pitch" and "slip" are clearly defined. If the authors prepare a revised second edition they might, however, point out a little more clearly that a limit to the efficiency of screws is afforded by the fact that to obtain the maximum thrust there must be no forward motion, while if there is no slip there is no thrust. The next chapter deals with the leading present-day monoplanes and biplanes, giving their dimensions and advantages. Under "Navigation" great emphasis is laid on the importance of the parallelogram of velocities, though not called by that name, and stress is laid on the impossibility of finding the way when the earth is invisible, owing to winds. The last chapter, on "Motors," extends from the simple elastic to the gnome, and the bibliography, glossary, and tables will be found useful. But is there any glossary that contains all that is needed? "Angle of attack," "bent-up wings," and "single- and double-lifting aëroplanes" should certainly be recognised, or better terms substituted by the Aëronautical Society's committee. And are Mr. Hubbard and his colleagues correct in defining "angle of incidence" as the angle at which a plane is inclined to the horizontal? Moreover, the entry occurs, "*Pressure.*—See Resistance"; but resistance is not to be found.

In the third collection of papers and translations issued under the title of "The Mechanics of the Earth's Atmosphere," Dr. Cleveland Abbe has continued the task he has for some time been undertaking of introducing English-speaking students to the rapidly increasing literature that has arisen out of the efforts to break down the line of demarcation between meteorology and physics. The earliest application of the notions of mechanics to the earth's atmosphere in the present collection is Hadley's paper of 1735, on the cause of the trade winds. The study of rotational effects is next taken up in the papers of Poisson (1837), Tracy (1843), Braschmann and Erman (1859–62), Sprung (1881), Gorodensky (1904). Kerber's paper (1881) on the limits of the atmosphere is now reprinted in view of the interest attaching to the subject arising out of explorations with sounding balloons. The translation of Guldberg and Mohn's studies (1876–83) is due to Prof. Frank Waldo. We next have a series of papers by Von Bezold, dealing with the thermodynamics of the atmosphere and other considerations, and dating from 1892 to 1906, and, finally, the two memoirs of Margules (1901 and 1904), which, as the editor points out, introduce us to the great problems of the future—that is, the thermal transformations of energy persistently going on in the atmosphere. The collection might with advantage form the subject of courses of lectures in our universities, and the openings which the subject presents for original work are as numerous as they are intricate and complex. The student will be glad to have such a collection of literature rendered so easy of access.

THE SEA DYAKS OF BORNEO.

IT is obvious that this pleasantly written book is not intended for the anthropologist, but is rather meant for that large class of readers who take a general interest in remote countries and strange peoples. Nor is Mr. Gomes in any special sense himself an anthropologist, a matter it is well to mention, since in some reviews considerable stress has been laid on the fact that no mention is made of the so-called *nyarong*, the "spirit helper" of the Dyaks. But even if the *nyarong*, or, as it should be spelt *ngarong*, is not mentioned by name, its existence is not ignored; an undoubted example will be found on p. 188, and it may be assumed that the reference to a Dyak of whom it is recorded on p. 143 that "he treated a snake with the greatest kindness, because it had been revealed to him in a dream that the spirit of his grandfather dwelt in that snake," is another example of the same belief.

With the possible exception of the Kenyahs, the Sea Dyaks are the most companionable and pleasant race in Sarawak, and it is clear that the author has enjoyed so considerable a measure of their friendship and confidence that, had he but possessed the necessary knowledge, he would have been able to write a book of great ethnological value. The work is thus one of the strongest arguments in favour of the preliminary training of missionaries that has fallen into our hands, for it is clear that its weaknesses are due to nothing but the author's lack of knowledge of where and how to look for information, since every page indicates his interest in his people and the trouble he has taken to know them.

The honesty and truthfulness of the Dyaks are described and illustrated by the *tugong bula*, the "liar's mound," which, once started, seems to persist long after the liar it commemorates is himself dead. A pile of branches is heaped up in memory of the man who has uttered a great lie, so that future generations may take warning. The persons deceived start the *tugong bula* by piling up the branches in some conspicuous spot by the side of the path from one village to another. Every passer-by contributes to it, and at the same time curses the man in memory of whom it is raised. "Once started, there seems to be no means of destroying a *tugong bula*. There used to be one by the side of the path between Seratok and Sebetan. As the branches and twigs that composed

1 "Seventeen Years among the Sea Dyaks of Borneo." By E. H. Gomes, and an introduction by the Rev. J. Perham. Pp. 343. (London: Seeley and Co., Ltd., 1911.) Price 16*s.* net.

it often came over the path, on a hot day in dry weather I have more than once applied a match to it and burnt it down. In a very short time a new heap of branches and twigs was piled on the ashes of the old *tugong bula*." The author points out that a man prefers almost any other punishment than that of having a *tugong bula* erected to his memory, for other punishments are soon forgotten, while this remains as mute evidence against him for succeeding generations, and is a disgrace even to his children's children.

Mr. Gomes gives a good account of the Dyak burial rites, though it may be doubted whether the cemetery shown in the plate facing p. 136 is not in fact of Kenyah origin, and some of the accoutrements of the warriors shown in the other plates are not strictly Sea Dyak. The illustrations are perhaps the weak part of the book, for although they are all of excellent quality, there is not that variety in the subjects selected for reproduction which might legitimately be expected from one who has lived so long among the Dyaks. It would, however, be unfair to blame the author's judgment for this, as he was dependent on borrowed photographs, but he may be strongly recommended to learn to use a camera before returning to Sarawak. C. G. S.

Dyak Houses. From "Seventeen Years among the Sea Dyaks of Borneo."

THE BIOLOGICAL STATIONS OF EUROPE.[1]

PROF. KOFOID'S report referred to below admirably fulfils the purposes for which he prepared it, namely, to put in convenient form for reference an account of the history, organisation, equipment, and work of the various biological stations of Europe, and to indicate their relations to research and to education of advanced or popular character. In the introduction he lays down some general guiding principles regarding the situation and functions of stations of different types—for research, teaching, and economic work—and gives some useful hints on fittings. Then follow descriptions of the stations, that of the Naples Station coming first. The inception, organisation, staff, financial arrangements, plans of the building (including floor plans and sections), details regarding aquarium fittings, pumps, pipes, valves, storage and circulation of water, apparatus, boats, and many other matters connected with this famous station are considered in a clear and concise manner, and the account, which extends over twenty-four pages, cannot fail to be of interest and of great use to those who have the management of, or are planning, marine stations.

The descriptions of other stations are not so detailed, but the chief features of each are mentioned, and opportunity is taken to give the details, often with a photograph or a drawing to scale, of any specially ingenious device or effective piece of apparatus, which the author observed during his tour of inspection. Plans are given of all the more important buildings, showing the arrangement of the laboratories, aquaria, workrooms, &c. Prof. Kofoid has earned the thanks of biologists by providing this excellent account of equipments and working arrangements.

The opening paragraph in the introduction to the stations of Great Britain is quoted here, as it so accurately states the conditions and limitations under which they carry on their work. Prof. Kofoid writes:—"The direct support of biological stations by educational funds of local or State origin, often in connection with universities, so generally prevalent in other European countries, is almost wholly lacking

[1] "The Biological Stations of Europe." By Prof. C. A. Kofoid. U.S. Bureau of Education, Bull. 1910, No. 4. Pp. 13, 360. 55 Pls., 48 text figs.

in Great Britain. With the single exception of the Gatty Laboratory at St. Andrews, which is supported by the university, the biological stations of England derive only meagre rentals of a few tables directly from university or educational funds. The stations have been forced, therefore, to turn to memberships of supporting societies composed to a considerable extent of scientific men themselves, to private benefactors, and to the commercial interests of the fisheries for aid. The result has been a relatively meagre and fluctuating financial support, a large, but, fortunately, rarely predominating amateur, as over against strictly scientific control, and a relatively very large absorption of the funds and activities of the British stations in scientific fisheries work. The scientific fisheries work done by the British stations is unsurpassed in its excellence and effectiveness, and the popular features, such as public aquaria, elementary and technical instruction, are generally well developed, but the strictly scientific phases of the station's activities too often suffer for lack of adequate financial support and from consequent loss of scientific interest."

The report describes the marine stations at Plymouth, Lowestoft, Cullercoats, Port Erin, Piel, Millport, and St. Andrews, and the Sutton Broads freshwater laboratory (which owes its origin and support entirely to private benefaction), and points out their special features and the facilities they offer. Appreciative reference is made to the teaching work carried on among the fishermen at Piel, as being mutually beneficial and leading to a better understanding, on the part of the investigators, of fisheries problems, and on the part of fishermen to a more just appreciation of the efforts of those who seek most wisely to preserve the resources of British waters.

The author urges that a well-equipped and scientifically maintained aquarium should form part of every marine station easily accessible to the public, for in no other way can attention be secured and instruction so forcefully conveyed as by the never-failing interest presented by living creatures well displayed.

The bulletin before us affords striking proof of the vitality of the principle carried into practice by the late Prof. Dohrn, for it shows that there are nearly one hundred institutions in Europe which may be classed as biological stations. These and the laboratories of a similar type in other lands, which owe their foundation to the stimulus and example given by Prof. Dohrn, have exerted an inestimable influence on biological science by placing the investigator in positions of greatest advantage with respect to living creatures, and by providing opportunities for long-continued and close observation and experiment upon abundant and varied material. Not the least valuable factor of such laboratories is the stimulus of contact with other investigators engaged in different lines of research.

In addition to the morphological and embryological researches, which, for many years constituted the chief work done in biological stations, these stations have in recent years facilitated the rapid extensions which have taken place in the domain of experimental physiology and in the wide application of experimental methods to the casual analysis of biological phenomena, thus helping materially to place the science on a broader and more comprehensive basis. During the past decade the work of biological stations has been more fully appreciated in regard to economic and industrial affairs, as is witnessed by the foundation of so many new laboratories on the continent of Europe, and by the increasing use of their facilities in medical instruction, in researches in comparative physiology, and especially in connection with the modern development of fisheries research. In this last direction it becomes increasingly evident that scientific investigations are imperative if the harvest of the sea is to be fully reaped and its resources to be maintained unimpaired for the future. But these investigations, while, of course, directed largely to the solution of the problems presented by the fisheries, must of necessity be founded on the broader basis of general biological inquiry. Fresh-water stations are likewise doing a sound work in regard to the problems of pisciculture, restoring and improving the sanitary conditions and food resources of the streams and lakes with which they are associated.

But apart from all economic problems, important though they are, the purely scientific aspect of the work of these stations wholly justifies their existence and the claims they have upon the community, for, to quote again from Prof. Kofoid's report,

> The biological station is a unique agency in biological research, indispensable in the equipment of a nation for the upbuilding of leaders in biological teaching, and in the development and expansion of the spirit of research.

NOTES.

A WARM tribute to the value of the scientific work carried through in the West Indies by the Imperial Department of Agriculture was paid by the Prime Minister, Mr. Asquith, in a speech at a banquet given by the West Indian Club on June 15. In the course of his remarks, Mr. Asquith said:—"I desire to refer for a moment with the warmest appreciation to the work of the Central Department of Agriculture. Established in 1898 at the cost of the Imperial Government, presided over with distinguished ability first by Sir Daniel Morris and now by his successor, Dr. Watts, the work of that department is universally and gratefully acknowledged by the planters to be largely responsible for the improved state of affairs in all branches of agriculture, and I believe—I speak with some experience—it would be difficult to find a case in which any analogous experiment made by the Home Government has attained such speedy and satisfactory results. The outlook is thus full of promise, and not the less so by reason of the fact that the Panama Canal is now approaching completion. The ultimate effects of that great enterprise are, of course, at present incalculable, but it can hardly be doubted that it will in the long run favourably influence the economic progress of the West Indies." It is seldom that such warm commendation is given by a Minister, but the work that has been done merits it fully. So long ago as 1888, the value of botanical federation in the West Indies was urged in these columns, and several articles appeared relating to it and the starting of experiment stations and other aids to the development of the colonies. It is gratifying to find that after all the years which have elapsed since then the results are regarded with such satisfaction, not only by the persons closely concerned with the West Indies, but also by statesmen in the mother country.

A MEETING was held at the Colonial Office on June 14 to discuss with representatives of the self-governing Dominions and States a scheme for imperial coordination in the prevention of the spread of disease in agriculture and horticulture, which it is proposed to organise in connection with the Colonial Entomological Research Committee. An official report states that Lord Cromer, chairman of the Entomological Research Committee, explained the proposals, the object of which is to establish a central organisation in London for the transmission of

information to the various parts of the Empire, thus enabling them to legislate against the introduction of certain insect pests with a greater knowledge of the facts than would otherwise be possible. After a discussion, in the course of which the representatives expressed their hearty approval of the scheme, the following resolution, proposed by the Premier of New South Wales and seconded by the Premier of Tasmania, was passed unanimously:—"That this meeting is of opinion that the proposal to obtain and disseminate information of a scientific and useful nature, tending to prevent the spread by insects of diseases both in animals and plants to various Dominions and States of the Empire would be highly advantageous, and that steps should be taken to obtain the adhesion of the Dominions and States interested in the matter."

WE notice with deep regret the announcement of the death, on June 16, of Sir Rubert Boyce, F.R.S., Holt professor of pathology in the University of Liverpool, in his forty-ninth year.

THE Duke of Connaught has consented to become honorary president of the Royal Geographical Society.

THE annual conversazione of the Institution of Electrical Engineers will be held at the Natural History Museum, South Kensington, on Thursday, July 6.

THE council of the Royal Society of Arts, with the approval of the president, the Duke of Connaught, has awarded the Albert medal of the society for the current year to the Hon. Charles A. Parsons, C.B., F.R.S., for his experimental researches into the laws governing the efficient action of steam in engines of the turbine type, and for his invention of the reaction type of steam turbine and its practical applications to the generation of electricity, the ventilation of mines and other large spaces, blast-furnace work, ship propulsion, and other important purposes. The beneficial results which have followed upon these inventions include a cheapening of the production of mechanical power, greater economy and speed for steamships, and the first successful solution of the problem of rotary engines, which long had baffled many other inventors.

As already announced, the twenty-second annual conference of the Museums Association will be held in Brighton on July 10–15 next under the presidency of Mr. H. M. Platnauer, who will deliver his address on the morning of July 11. The same evening Dr. F. A. Bather, F.R.S., will deliver a public lecture on "Open-air Folk-Museums." The mornings of July 12 and 13 will be devoted to the reading of papers. Numerous excursions and receptions have been arranged for the visitors. The association was founded in 1889 with the object of improving and extending the work and usefulness of museums, the word being used in its widest sense to include collections illustrating pure and applied art, archæology, technology, and the natural sciences. Originally confined to the institutions of Great Britain and Ireland, the association has been joined by leading museums of all types in every part of the world, and now includes members from most countries of the world.

AN appeal has been made by the British Empire League for funds to secure the establishment of a solar observatory in Australia. The need for such an observatory is strongly felt by solar physicists. A cooperative scheme of research has been initiated between the great solar observatories of Europe, America, and India whereby the sun may be continuously observed throughout the whole of the twenty-four hours, but a gap exists between the two latter stations which would be filled by a solar observatory in Australia. Mr. Geoffrey Duffield, on behalf of men of science, has personally pressed this subject on politicians in the Commonwealth, and Mr. Deakin has promised 1500*l.* a year upkeep if the sum of 10,000*l.* is privately forthcoming. 4000*l.* has already been offered in money and apparatus, so that 6000*l.* is still required. The scientific world will be grateful to the British Empire League for bringing the matter before members of the league and others, thus giving them an opportunity to support a movement which, if successful, will complete the chain of solar observatories which circle the earth, and enable the international scheme to be carried into complete effect. Mr. C. Freeman Murray, secretary of the league, Norfolk House, Laurence Pountney Hill, London, E.C., will be glad to receive and acknowledge any subscriptions which may be sent to him towards this important project.

AN extra meeting of the Chemical Society was held on Wednesday, June 14, when Prof. T. W. Richards, of Harvard University, delivered the Faraday lecture, entitled "The Fundamental Properties of the Elements." The president, Prof. Percy F. Frankland, in introducing the lecturer, stated that the Chemical Society had assembled to celebrate what was one of the most important festivals in the calendar of the society, namely, the delivery of the Faraday lecture and the presentation of the Faraday medal. The significance of the meeting would be most effectively realised by calling to mind the names of the following illustrious men who had acted as Faraday lecturers since the first lecture was delivered by Jean Baptiste André Dumas in 1869:—Stanislao Cannizzaro, 1872; August Wilhelm von Hofmann, 1875; Charles Adolphe Wurtz, 1879; Hermann Ludwig Ferdinand von Helmholtz, 1881; Dmitri Ivanovitsch Mendeléeff, 1889; Lord Rayleigh, 1895; Wilhelm Ostwald, 1904; Emil Fischer, 1907. To these eminent *savants* the society had now added another in the person of Prof. Richards, whose great work and whose great contributions to science, especially his determination of atomic weights and his experiments on the compressibility of the elements, are not only well known in this country, but throughout the whole chemical world. Prof. Richards then delivered the Faraday lecture, of which we hope to print an abridgment in a subsequent issue. At the conclusion of the lecture the president, in presenting the Faraday medal to Prof. Richards, spoke of the sincere appreciation and the deep regard which his colleagues in this country had for his work, and also for the great and enduring importance which was attributed to his scientific discoveries. The vote of thanks to the lecturer, which was proposed by Prof. W. Odling, seconded by Sir William Tilden, and supported by Prof. Harold B. Dixon, concluded the meeting.

MR. W. HOUGH, curator of ethnology in the United States National Museum, has prepared a descriptive catalogue of the valuable ethnographical collections made by Mr. Hoffman Philip, Minister and Consul-General at Addis Abeba, the capital of the Emperor Menelik. Ethnographical material from Abyssinia is notably scanty, and this large collection is interesting on account of the survivals which it exhibits from the ancient culture of northern Africa, the neighbouring Asiatic continent, and eastern Europe.

MR. R. TORII, under the title of "Études anthropologiques, Les Aborigènes de Formose," contributes to the Journal of Science issued by the Imperial University of Tokyo an introductory account of the primitive races of the island. The present portion consists of a list of the tribes with their geographical distribution, and it is accompanied by a large collection of photographs illustrating their physical appearance, environment, and occupations. Anthropologists will await with interest the publication in the journal of further instalments of the results of Mr. Torii's careful survey of these little known races.

MUCH has been written about the North-West Frontier Province, once an integral part of the Punjab, and specially interesting in connection with the restless Pathan tribes and the diversity of its physical characteristics. The problems which face the officers who control the relations of the British Government with the races within and beyond our border are discussed by a distinguished political officer, Mr. W. R. H. Merk, in a paper read before the Royal Society of Arts on May 25, and published in the society's journal. The conclusion of the writer, supported by Lord Minto and generally concurred in by Sir Mortimer Durand, Sir T. Holdich, and other authorities who joined in the discussion, is that, though we may expect occasional trouble from these tribes, our frontier policy is gradually attaining its object, and that it is possible that in the future this belt of rugged mountain territory will be, not a source of anxiety, but a barrier against aggression and a substantial addition to the security of India.

THE report of the Otago University Museum for 1910 records the gift to that institution of the valuable collection of Maori ethnology made by the late Dr. Hocken, who died on May 17, 1910.

IN the May number of *The Ottawa Naturalist* Mr. Lambe describes the skull of a new species of the bear-like genus Arctotherium from the Pleistocene of the Yukon. The genus, which is in some degree intermediate between Ursus and the extinct Old World Hyænarctus, has not hitherto been known north of California, and has accordingly been regarded as a southern type. The discovery of *A. yukonense* is therefore of considerable importance, as indicative of the northern origin of these huge, big-headed bears, and thus of the probable genetic connection with Hyænarctus.

WE have received the first section of a work to be published by Messrs. Friendländer, of Berlin, under the title of "Nomenclator animalium generum et subgenerum," in two volumes, at the price of 5*l*. The section received is devoted to the Primates. The various names are arranged in generic order, without any reference to the species by which they are typified. When names have been misspelt, they are frequently quoted as if they were new terms proposed by those responsible for such errors, without any clue as to their real origin, as, for instance, in the case of Aulaxinus for Aulaxinuus.

THE discovery in the autumn of 1907 of mummified carcases of mammoths and rhinoceroses in the ozokerit deposits of the Starunia district of eastern Galicia gave rise to considerable interest at the time. The specimens were transferred to the museum at Lemberg, where the skin of the rhinoceros has been set up, and an illustrated account of both specimens, by Mr. E. L. Niezabitowski, has been published in the April number of the *Anzeiger d. Akad. d. Wissenschaften in Krakau*. The rhinoceros belongs to the woolly species (*Rhinoceros antiquitatis*), and so well is the head preserved, that the author has been enabled to compare it in detail with that of its nearest relative, the existing white rhinoceros of Africa. The species presenting the next nearest relationship appears to be the European Pleistocene *R. mercki*. The hair of the Starunia rhinoceros had disappeared.

IN *The British Medical Journal* for June 3 (p. 1310) Dr. Leonard Hill and Mr. Martin Flack publish a second note on the comparative nutritive value of white, standard, and whole-meal bread when used as food for rats. The experiments show still more conclusively than in their first note (see NATURE, May 11, p. 355) the deficiency of white bread as a food, and the better nutritive qualities of standard and whole-meal breads. The germ seems to contain adjuvant bodies whereby the tryptophane-containing portions of the proteins are split off in larger amount and more easily when it is present in the flour.

IN his annual report for the year 1910, recently issued, Dr. Herbert Williams, medical officer of health for the Port of London, describes the incidence of plague among the rats and the measures taken for plague destruction in the port. Plague has now appeared among the rats for three years in succession: in 1908 in the West India Dock during five weeks in August and September; in 1909 seven dead rats which were proved to have died of plague were found in the South-West India Dock; and in 1910 three dead plague rats were picked up in the Royal Albert Dock. Of 199 rats captured and examined last year, only three were plague-infected. Dr. Williams remarks that this occurrence of plague among the rats three years in succession indicates the need for special vigilance.

THE rhythmic character of the movement exhibited by the plasmodia of Myxomycetes is discussed by Dr. V. Vouk in the *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften*, Vienna (vol. cxix., part viii.). The progressive and regressive flows together constitute a rhythmic period, which is found to be tolerably constant for the main streams of any given plasmodium. The period increases up to a certain point with the age and size of the plasmodium. Obviously mechanical stimuli upset the rhythmic flow.

THE frequent occurrence of localised hailstorms, generally of very short duration, as a typical phenomenon during late spring and summer in Missouri and Nebraska, prompted an investigation into the injury caused to forest trees, the results of which are communicated by Mr. F. J. Phillips in the Transactions of the Academy of Sciences (vol. xix., No. 3). Catalpa, sycamore, and mulberry suffered most both in the matter of defoliation and bark wounds. The soft nature of the bark on cotton wood and box elder was also apparent in the damage sustained. It is suggested that hail injury increases the development of *Polystictus versicolor* on Catalpa.

A NOTE on fungi collected in clay mines is communicated by Mr. P. Spaulding to the report of the Missouri Botanical Garden (1910). The greater number of the specimens were growing on the oak timbers used as supports. *Polystictus versicolor* and *Merulius lachrymans* were generally common, and *Merulius rubellus* was abundant in one mine. Stalked pendant forms of *Hydnum erinaceus* and *Schizophyllum commune* were also found. Only one fungus, *Fomes annosus*, was observed on the pine timbers, and *Coprinus atramentarius* was growing on the clay.

AN explanation of the differences observable in specimens of the common garden shrub, *Osmanthus Aquifolium*, is offered by Dr. O. Stapf in *The Kew Bulletin* (No. 4), as he is able to identify two plants, distinct both in foliage and flowers. The type of the original species has a leaf like the holly, and bears both hermaphrodite and staminate flowers. Another type, having leaves with shallower indentations, and for which only staminate flowers are known, fits in with a species segregated long ago as *Osmanthus Fortunei*. It has been suggested that the latter represents a hybrid between *O. Aquifolium* and *O. fragrans*; this opinion is supported by the characters, including the less hardy constitution, of *O. Fortunei*. Another item of horticultural interest is supplied by the note acknowledging the receipt of seeds of trees and shrubs collected in south-west China by Mr. Forrest. They include a number of rhododendrons, in connection with which the question arises whether any of them will supply a yellow-flowered hardy shrub so long desired.

THE systems of training and pruning fruit trees followed by the Japanese, as is the case with so many of their methods, are essentially different from those prevailing in European countries. According to the account by Prof. T. Ikeda, published in the Journal of the Royal Horticultural Society (vol. xxxvi., part iii.), a system—known as "tana"—of training the branches on overhead trellis-work is generally adopted for pears and vines, less often for plum and apple trees. The trellis is made of bamboos or wire fitted on wooden posts at a height of 5½ feet and one to two feet apart; the pruning is very light, and is generally done in winter. Tana-training is said to offer advantages, notably in the matter of early fruit production and of protection from wind and rain storms. A more vigorous system of pruning is adopted in the case of Kaki trees, *Diospyros Kaki*, that appears to have arisen out of the practice of pulling the fruit with a portion of branch suitable for hanging it up to dry. The fruiting shoots are broken at the base, while the sterile shoots are left intact to produce spurs the next year.

WHAT is popularly known as "blackhead" in turkeys covers several different diseases, but one has been studied in some detail by Hadley and Amison, of the Rhode Island Agricultural Experiment Station, and traced to flagellated protozoa occurring in the cœcum. The organisms are identical with some previously described by Smith as *Amoeba meleagridis*; their development was studied, and found to resemble that of other parasitic flagellates which, at certain stages, have the habit of losing their flagella and becoming amœboid. They occur also in the English sparrow and other wild birds, several of which can act as hosts, and further they are found in game birds. So much damage is done that, in some districts, they constitute a severe menace to the poultry-raising industry.

SOME years ago Whitney and Means investigated the connection between the conductivity of a soil and the amount of saline matter present, and as a result of their experiments a method was elaborated whereby the percentage of soluble salts in "alkali" soils could be estimated in the field with sufficient accuracy for ordinary purposes and in a very short space of time. Thus a survey of a whole district could be made, and it was possible to ascertain the effects of irrigation, cultivation, &c., on the soluble salts of the soil. A bulletin has recently been issued by the United States Department of Agriculture giving the results of accumulated experience with the method. The writers, Messrs. R. O. E. Davis and H. Bryan, state that the method works well provided there is not too much organic matter present, and provided also carbonates are practically absent. In the former case it is better to drop the electrical method altogether, in the latter case the method can still be used, but a special set of tables is needed.

THE Canadian Department of Mines has sent us a volume, by Mr. F. Cirkel, entitled "Chrysotile-Asbestos, its Occurrence, Exploitation, Milling and Uses," which gives a very complete account of this extremely important Canadian industry. Asbestos is obtained from a relatively restricted area in the province of Quebec, but it has attained in a short time a most prominent position amongst the mineral products of Canada. The Canadian output at present is about 60,000 tons, forming about 80 per cent. of the total production of the whole world; it has practically doubled since 1904. The account now published, which is essentially a new edition of a previous report on the same subject and by the same author, issued in 1905, is a most exhaustive one, and deals very fully with all aspects of the asbestos industry, with the occurrence and distribution of the mineral, its mining and dressing, and with the subsequent manufacture of the prepared mineral into a large number of articles. Whilst, perhaps, more especially written from the commercial rather than the scientific point of view, it contains a quantity of valuable information not otherwise accessible, and should be of decided assistance to all who have to deal with asbestos either in the crude or in the manufactured state.

ON Monday, June 12, Dr. Arthur Neve, who has spent thirty years in Kashmir, lectured before the Royal Geographical Society on his journeys in the Himalayas and on some factors of Himalayan erosion. In Ladak erosion is at the present time not especially active, and the valleys are of easy gradient, but in Lower Baltistan and Gilgit rivers flow in deep gorges and have cut their way recently through immense accumulations of detritus. The rainfall is slight, and the dry, loose deposits, by their instability, are a source of considerable danger, which is greatly increased in the wet season, when vast landslips are common and rapidly alter the contour of the hillsides. Accounts were given of the damage caused by glaciers blocking up lines of drainage in such a way as occurred some years ago in the Saru valley. The lecturer's travels in the Karakorum range and the Nun Kun group in the Central Himalayas were referred to, and several points of doubtful topography were discussed. The subject of Himalayan erosion and topography were treated descriptively rather than analytically from experience gained in a long acquaintance with the region.

Le Radium for May contains a paper by M. de Broglie and L. Brizard in which their observations on the apparent radio-activity of sulphate of quinine are described. They find that the phenomena show neither of the characteristics of radio-activity—*i.e.* they are not atomic and are not independent of external influences. They have succeeded in tracing them to a thin layer of strongly ionised gas which surrounds the salt during hydration or dehydration, and they find that sulphate of chinchonine, which possesses the same phosphorescent properties as sulphate of quinine, shows the same effects. The search for other salts has not been successful. The mobility of the ions formed is of the order 1 centimetre per second in a field of 1 volt per centimetre, which shows that the ions are small. They may either diffuse slowly outwards from the layer in which they are formed or may be driven out more

quickly by an electric field. In the former case saturation currents can be obtained, in the latter the current increases indefinitely with the voltage applied. In either case the conductivity of the surrounding gas increases rapidly as its pressure is diminished.

UNDER the title of "First Report of the Bird Construction Committee," the Aëronautical Society of Great Britain has issued an attractive pamphlet, in which it is sought to summarise existing knowledge of the mechanical constants associated with the flight of birds. A special feature is the tabulated list of about 460 species of bird with numerical values of their wing dimensions, weights of their muscles, and similar data, compiled from the works of Harting, Marey, Moillard, Mullenhof, Legal and Reichel, and Winter. To the ornithologist, the list of Latin names with their equivalents in English, French, German, Italian, Spanish, and Russian will be exceedingly useful. Another pamphlet dealing with natural flight is Dr. Wolfgang Ritter's study of "The Flying Apparatus of the Blow-fly," published by the Smithsonian Institution (1911). For the first time in this connection, photography was used to delineate the structure of the wings and arrangement of the thoracic muscles, most of the illustrations being stereoscopic. Other figures give kymographic curves showing the movement of the wings, and serial photographs of the insect in the act of flight. Natural flight also figures in a pamphlet by Dr. Otto Wiener entitled "Vogelflug, Luftfahrt und Zukunft" (Leipzig: Johann Ambrosius Barth, 1911, pp. 60), based on the author's contributions to the *Deutsche Revue*. In addition, however, to sailing and other flight, the article deals with the influences of artificial flight in peace and war, its future effects on human progress, and other considerations of an equally general character.

OUR ASTRONOMICAL COLUMN.

THE ECLIPSE OF THE SUN, APRIL 17, 1912.—Next year's eclipse of the sun, although, under the best conditions, of very short duration, is arousing a great deal of interest owing to the proximity of the central line. It was at first suggested that a very brief totality might occur near Paris, but the slight uncertainty as to the moon's semidiameter makes this doubtful; probably it will be a very large annular eclipse there. According to the data of the *Connaissance des Temps* a six seconds' totality should occur in Spain, but according to those of *The Nautical Almanac* the eclipse will not become more than annular anywhere.

In the June number of *L'Astronomie* M. Landerer discusses the conditions for Spain, and, taking the moon's semidiameter as 15′ 31·62″, he finds that at one or two places in the peninsula an evanescent totality should occur. At El Barco (Orense) the eclipse path should have a diameter of 166 metres, and totality should last for 0·2s., so that an intending observer would have to make very sure of his position. Between El Barco and Penafiel (near Oporto) would probably prove a better station, the computed totality at the latter place being 0·4s. For Castandiello, a small village in the province of Oviedo, the computed magnitude is 0·9999, and the eclipse may easily prove total. All the places are shown on a map accompanying the article, and a special article dealing with the conditions for eclipse in France is promised in the next number.

THE CHANGES ON JUPITER, 1881–1909.—An important monograph of 180 pages discussing the features of Jupiter during the period 1881–1909 is contributed by Dr. O. Lohse to vol. xxi. of the *Publikationen des Astrophysikalischen Observatoriums zu Potsdam*, No. 62.

The observations of the various spots, bands, and other surface features of the planet are discussed individually, and the descriptions often illustrated by a sketch of the special feature made at the time of observation. Measures of the equatorial and polar diameters were frequently made with a filar micrometer, and are tabulated and discussed for each opposition. For the mean values Dr. Lohse obtains 38·343″ ± 0·059″ for the equatorial, and 36·031″ ± 0·044″ for the polar, diameter; the ratio expressing the amount of flattening is 1/16·584.

The changes in various features and many other interesting points are discussed, and the monograph concludes with twelve excellent plates, eleven reproducing drawings of the planet and the twelfth showing the normal joviographic longitudes of the Red Spot during the period 1879–1909.

BARNARD'S COMET, 1892 V.—The third return of Barnard's 1892 comet is due this year, and if the period lies between 6·23 and 6·52 years, as given by two of the three sets of elements prepared by M. J. Coniel, there is a chance of its being rediscovered.

To facilitate the search, M. Coniel publishes a comprehensive ephemeris in No. 4504 of the *Astronomische Nachrichten*, which is based on the assumption of a period equal to 6·37 years, and shows the places (for 1911) week by week from July 1 to the commencement of 1912.

THE MOTION OF THE POLE.—The provisional report of the results obtained by the International Latitude Service, for 1910, is published, as usual, by Prof. Th. Albrecht in No. 4504 of the *Astronomische Nachrichten*. The figure accompanying the paper shows that practically since 1906·1 the swing of the momentary, from the true, pole has been increasing; the curve for 1910·0–1911·0 encircles the previous spiral curve described since 1900·0. The x and y values (extrapolated) for 1911·0 are +0·002″ and −0·282″ respectively.

THE PROPER MOTIONS OF THE STARS.—Several interesting conclusions are deduced by Dr. Oppenheim in a paper wherein he subjects to harmonic analysis the proper motions of the stars between declinations +38° and +65° given in the Greenwich new reduction of Groombridge's catalogue of circumpolar stars. He finds that the position of the stars into swarms along definitely directed "highways" is not finally established, and that their motions can be accounted for analytically by assuming a relative motion analogous to the geocentric paths of the minor planets, but he leaves the question of an ideal central body open (*Astronomische Nachrichten*, No. 4497).

STELLAR PARALLAXES.—More stellar parallaxes are given by Dr. Schlesinger in No. 4, vol. xxxiii., of *The Astrophysical Journal*. Seven stars are considered, and of these four have positive parallaxes greater than 0·1″. Among the latter, one of special interest is the well-known star Positiones Mediæ 2164, otherwise designated *Struve* 2398. The distance separating the components is now 17″, having increased nearly 5″ since the double was first measured by Struve in 1832. Recent measures show that the pair has a comparatively rapid orbital motion considering the great separation and the faintness of the components. Dr. Schlesinger finds the parallax to be +0·282″ ± 0·003″, and his results are so concordant, *inter se* and with independent determinations, that he considers that there are few stars the distances of which from us are known with so small a probable error.

POSITIONS OF STARS IN THE HUYGHENIAN REGION OF THE ORION NEBULA.—As a Bulletin of the Philosophical Society (University of Virginia), vol. i., No. 4, Mr. Ralph E. Wilson publishes newly determined positions of a number of stars in the Huyghenian region of the Orion nebula. After reviewing the earlier work on the subject he gives his measures in detail; all the measures were referred finally to Bond's No. 628, but Nos. 558, 669, and 685 were also employed as fundamental stars. Six stars show what appears to be proper motion, which in the case of Bond's 612 and 618 amounts to 4″ or 5″ a century northwards. The motions of 622 and 636 can be explained by the supposition that they are physically connected with the trapezium and share its motion. In the cases of Nos. 686 and 688, the proper motions are affected by large proper motions, or Bond's positions are erroneous; observations in ten years' time would probably settle this point.

THE BRITISH SOLAR ECLIPSE EXPEDITION.[1]

T.S.S. "Marama,"
Pacific Ocean,
May 20, 1911.

MY last letter was very brief, as the ss. *Bouverie*, the steamer which ran on a coral reef and was subsequently got off, arrived unexpectedly at Vavau on her way to San Francisco. This meant that a mail could be sent by her, but only a short letter was written in consequence.

Although this letter is sent by the following mail to England, it happens that I am travelling in that particular mail steamer which is bound for Vancouver. We have therefore had a considerable time now to consider past events, and, incidentally, I have been down with a sharp attack of fever which I managed to pick up at Fiji; we are now three days off Honoluiu, and I am convalescent.

Although during the first ten days of our stay at Vavau the weather conditions were all that could be desired for eclipse work, they gave way slowly to quite a different type; while rain had been the exception, it now became a daily occurrence, and not only did it rain, but it came down in torrents. This change of weather put quite a different complexion on our prospects. Nevertheless we worked and hoped for the best, but still the nearer the eclipse day approached the worse the weather became. On the day before the eclipse my notes regarding the weather are as follows:—"To-day would have been a bad day for the eclipse. There is a great amount of high cirrus which would have prevented good photographs from being secured, and the presence of low drifting cumuli would most probably have totally blotted out the sun for some period during totality. I expect the conditions to-morrow will be somewhat like Palma over again, but I hope the cloudy part will occur at third contact and not at second contact as it did there."

Luck was against us, however. Eclipse morning broke, and this was the cloudiest we have experienced. Cirro cumulus cloud in the form of waves extended over a considerable part of the sky, and low cumuli of various sizes were numerous. There was sufficient sun at intervals for all the instruments to be set and kept running, and I went round all the individual instruments and critically examined the definition of the solar images on the ground-glasses. Everything was most satisfactory.

I had arranged that all the working parties should be ashore at 7 a.m., and that the remainder should arrive half an hour later. The camp assumed a most business-like air, and everyone seemed glad that the day had at last arrived. I had taken the precaution to distribute parties as far apart as possible that could be distributed, and with this object I sent one party off early in the morning to take up their position on Talau Hill, 400 feet high and about three miles distant. This party consisted of observers for stars, shadow phenomena, and drawing the corona, and a small camera party. On another hill, 200 feet high and half a mile away, a second similarly constituted party was dispatched. A special party was also on board, and men placed at the mastheads.

Alas! with all these precautions no party saw the sun free from clouds. There is little doubt that, as the moon gradually covered the sun and a natural reduction of the air temperature took place, the tremendously moist atmosphere gradually condensed in the form of cloud, which became denser the nearer totality approached. Some minutes before second contact a very large black, dense cumulus with billowy tops came sweeping up from the eastward, and this cloud it was that practically sealed our doom. Onward it came, and just before second contact its outliers began to cover the sun and then totally eclipse it. The presence of the clouds made the image of the cusp very difficult to observe, as it was jumping up and down on the card. The cusp observer had eventually to give the signals from the chronometer alone.

Three whistles, two whistles, and one whistle were the signals to precede the order "go," and at "go" the whole camp began their combined effort. I fired off my first four instantaneous exposures, and then one of a few seconds, and then a long one. During this last I went out of my tent with opera-glasses and card and pencil to draw the corona, when, alas! I could not even see where the sun ought to be. The large ominous black cloud had completely blotted out the whole region. I returned to my tent very sad; at a later long exposure I emerged once more, and there was the silvery corona as rigid as an Indian order suspended in the sky. It was shorn of most of its beauty, for the cirrus cloud was very thick, and must have absorbed a great amount of light. There was no doubt about its form, however, for at a glance it represented the minimum type known as the wind vane.

Something extraordinary, however, seems to have happened. While the timekeeper shouted out twenty, *i.e.*

FIG. 1.—Landing the Instruments.

[1] Continued from p. 529.

FIG. 2.—In the early stages of the erection of the Instruments. View taken from a Cocoanut Tree.

FIG. 3.—A General View of the Eclipse Camp. Camera facing nearly West.

there are twenty seconds left, the sun burst through! The eclipse was over!

Being busy with my instrument at the beginning of totality, and not being able to see the sun because of the roof of my tent, I could not observe whether totality began with the word "go." A consultation with my *confrères* afterwards soon gave me the information I was seeking. The eclipse began fully twelve seconds before the word "go" was given, and finished twenty seconds before the word "stop" was shouted. This very considerable difference between calculation and observation seems at present unexplainable, but similar, or nearly similar, times were recorded by the other parties at Neiafu.

In addition to three chronometers, regular transit observations had been daily made with the transit that was set up on a concrete pillar in our camp. The ship's chronometers were also in very close agreement with those we brought out, so there could be no error of any magnitude regarding the time. This important matter will be cleared up when Mr. Brooks, who has the matter in hand, sends in his report on the subject.

The eclipse being over, I called my party together, and we gave three cheers for the captain, officers, and men of H.M.S. *Encounter* for the magnificent assistance they had rendered on the occasion of this eclipse. It was most disappointing that the weather had been so unfavourable, for had it been otherwise we should have gathered a wonderful harvest of valuable solar data.

While we were so hard dealt with at our station, the Australians at Neiafu, about a mile from us, suffered nearly the same experience. They watched the approach of the large cloud, and thought that it would affect them and not us—it affected both of us, however, with disastrous results. A hundred yards or so distant from the Australian camp was that of Mr. Worthington and his party. He seems to have been wonderfully lucky, for in spite of all the clouds about, a rift in them enabled him to secure some beautiful photographs of the corona, as good as the best photographs that have ever been taken during an eclipse. I have not seen the negatives myself, but everyone who has is most enthusiastic about them.

On development of the photographs of my party, the useful results are very meagre. No record at all was shown on the large films of the large grating spectrograph worked by Mr. McClean. On the 6-inch prismatic camera plates one plate may be very useful. This plate was closed at twenty seconds according to the eclipse clock, *i.e.* was closed about half a second after third contact. All the chromospheric large arcs are well shown, and a great number of short bright arcs, showing that a record of the chromosphere was secured. There is a certain amount of continuous spectrum shown on the plate, but the spectrum is rich in lines in the violet end. A plate exposed immediately after this gives a dark-line spectrum. Several of the coronographs show images of the corona sufficiently good to enable the general form of the corona to be deduced, but they all show too much cloud. The 4-inch 16-foot coronograph has perhaps the best record of the lower corona, and this is beautifully sharp and gives a very fine photograph of the large prominence, the most conspicuous object just before third contact.

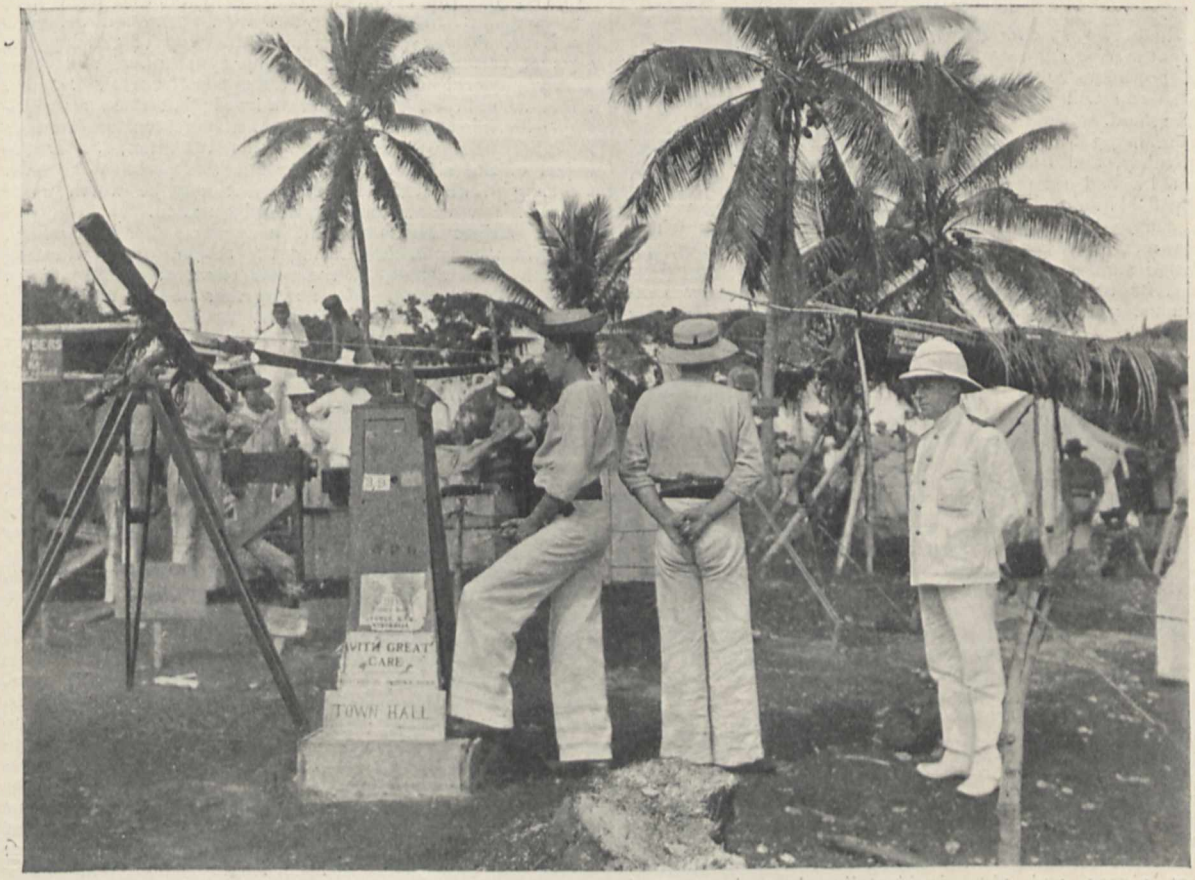


FIG. 4.—The Captain and his two time callers at the Eclipse Clock.

The above practically sums up the results of the expedition from the astronomical side. In other directions we have positive results. Thus a fine series of observations made with the self-recording barograph, thermograph and hydrograph have been secured. A very complete collection of botanical specimens representing the wild flowers, ferns, &c., and numerous seeds, of the island will, I hope, prove useful.

An excellent collection of butterflies and moths representing most of the varieties has been made, and we are bringing home numerous pickled specimens of fish, centi-

pedes, lizards, ants, scorpions, &c. Geological specimens were not numerous, but what there were were secured. A large number of specimens of shells and different varieties of coral were also collected.

The day following eclipse day, a Sunday, it rained steadily from morning until night. The camp became a hopeless morass; every tent was saturated through and through, and most of the contents as well. Fortunately, packing up had been commenced directly totality, of the day before, had finished, and by the evening the greater portion of all the instruments were safely housed away in their packing-cases in the instrument tent. Fortunately, again, I had had the floor of this tent covered with thick rafters to keep the cases off the ground, and if it had not been for this precaution the cases would have been thoroughly soaked. The rain therefore did little damage. We filled as many barrels as we had with the water from the awnings, and this came in extremely useful for the dark-room during the subsequent days spent in developing and making copies.

I had two special boxes made on board the ship to carry the original negatives, and the copies and one box will go home with the rest of the packing-cases, while the second will be dispatched later by a different steamer to England.

On May 3 the ss. *Tofua* arrived at Vavau on her way to Sydney, and I boarded her to inquire from her captain what he had seen of the eclipse. Captain Halford had stopped his ship right on the central line, and they viewed the eclipse in a cloudless sky. Several drawings which were made on board were shown to me, and they all indicate similar appearances, namely, equatorial extensions and rifts at both poles. Shadow bands were very conspicuous, and a great number of stars were logged. The captain kindly had a copy of his observations made for me, as I wished to compare the times of his contacts with those observed by us.

In the evening the *Tofua* left with all the eclipse parties except those going by the *Encounter*.

The next morning the *Encounter* weighed anchor from the spot where she had remained so long. I think we were all very glad to get away. If we had had a successful eclipse we might have severed our connection with a pang of regret. There were no regrets. We had worked hard and been treated very badly, and some of us, myself included, hoped we should never see the spot again. Out of the little harbour we steamed, stealing away before the inhabitants were up. One by one we passed the thickly tree-covered islands, and at last we came to the open sea and the cooler air, leaving the pests of flies and mosquitoes behind us. Oh those flies and mosquitoes; they were the curse of the island!

The *Encounter* being now bound for Suva, Fiji, to coal, and land Mr. McClean and myself, our course was shaped for that island. In order to make all land by daylight, a six hours' stop was indulged in off Late Island. This island is on the western outskirts of the Tonga group, and is nothing but a large volcano. With difficulty a landing was made, and while one party, including myself, started out to climb to the crater, another party went to shoot pigeon and pig. Incidentally, I made a good botanical collection, and gathered numerous specimens of seeds. On our return to the shore the tide had gone down, and the pools in the lava were full of the most beautiful coral fish and snakes, weird in colour and shape, that one could desire. An exciting return to the boats ended quite a successful day's adventure. The next day was spent at sea, and we sighted Suva on Saturday morning (May 6). Being "Accession" Day, the ship was dressed as the anchor was let go.

Mr. McClean, Mr. Anderson and myself took up our quarters at this port to await our ship, the t.s.s. *Marama*, which was to take us to Honolulu. On May 11 H.M.S. *Encounter* steamed gracefully out of the harbour on her way to Sydney, and it was sad to see her go without us, for both officers and men had become quite endeared to us. However, it had to be, and we watched her until nothing more than smoke was visible.

At Suva there was little to be done, as it was very hot, but there were no flies and very few mosquitoes, so we might have been worse off. On May 13 we drove to Rewa, a distance of twelve miles, and then took a motor-boat up the fine river Rewa, the upper reaches of which are very beautiful. To me this trip was disastrous, for next day I was laid up with fever. On May 15 our steamer, the *Marama*, bound for Honolulu and Vancouver, arrived, and we boarded her and sailed the same evening. At the moment of writing (May 21) we are now two days off our destination, and we are indulging in the cool N.E. trades after the stillness of the doldrums.

After Honolulu we are bound for the States, where I hope to see first hand the chief American astronomical observatories. We are due in England about July 11, when we shall have completed a most interesting circuit of the earth. We shall have gained one day!

W. J. S. LOCKYER.

A NEW ROD OF AARON.

THE naturalist and the physiologist have been well acquainted for several years with the results achieved by Loeb, Delage and others, in the way of causing the eggs of various animals to develop by chemical and other purely physical means, apart altogether from the agency, direct or indirect, of the male animal; but these astonishing experiments are still very little known to workers in other sciences. Before directing attention, as is the object of this short note, to the last and perhaps the most startling of all such experiments, it may be worth while to say a few words on the general question.

The subject seems to fall under two heads, namely, artificial means of facilitating the action, or of widening the sphere of action, of the male element, and, secondly, means of dispensing with it altogether and of replacing it by some wholly artificial stimulus.

In Loeb's early experiments he showed that, while under normal conditions the eggs, for instance, of a sea-urchin could not be cross-fertilised by the sperm of a starfish, yet by simply rendering the surrounding sea water faintly alkaline, a new condition was established in which the sea-urchin's eggs were capable of fertilisation by the sperm-cells of any or every species of starfish, and by certain other alien species of echinoderms besides, while, at the same time, in this more alkaline sea water the sperm of the original sea-urchin had actually lost the power of fertilising the eggs of its own species.

More than five-and-twenty years ago it had been shown, by Tichomiroff and others, that the eggs of the silkworm could be caused to develop "parthenogenetically" by simple mechanical stimulation, such as brushing, or by chemical treatment, as with sulphuric acid. But these results attracted less notice than they should have done, partly, perhaps, because in other insects parthenogenesis, or the development of unfertilised eggs, was known to occur under natural conditions, as in the case of green-flies or plant-lice (Aphides), or in the case of the drone-progeny of the queen-bee.

Passing over various intermediate experiments, we come to those which Loeb published in 1904, in which he showed that, if the eggs of a sea-urchin be put into sea water to which has been added a little formic, acetic, butyric, or other fatty acid, and then after a minute or two be put back into ordinary sea water, they begin to show the initial changes characteristic of nuclear division. But if, on the other hand, they be transferred from the acidified sea water to sea water the concentration of which is increased by a suitable addition of common salt, then the whole cycle of development proceeds just as though normal fertilisation had taken place, and the highly complicated free-swimming larvæ are produced in unlimited numbers and in the same manner and at the same rate as in the ordinary course of sexual development; and if the experiment has not been carried further, to the complete post-larval development of the entire sea-urchin, it must be remembered that the artificial feeding and rearing of this and other marine animals beyond a certain stage, even from normal and fertilised eggs, is a matter of the very greatest difficulty. Precisely similar experiments have been successfully performed by various workers on marine worms and molluscs, and a few years ago Bataillon showed that even the eggs of the lamprey could be induced to segment by simply placing them in water of a certain

degree of salinity. It is impossible to discuss here the various theories of fertilisation to which these astonishing experiments have given rise.

But such phenomena appear, perhaps unreasonably, all the more astounding to us, as the animals experimented on are higher in the scale; and so we may look with renewed wonderment at a phenomenon which M. Bataillon has demonstrated in the frog, and M. Henneguy has repeated and confirmed.[1] Eggs were taken from the body of a female frog, under proper antiseptic precautions and with careful simultaneous "control" experiments. The eggs were placed in a little dish, and were then carefully pricked with a tiny needle of platinum or a sharp spicule of glass, after which they were covered with a layer of water sterilised by heat. In the hands of these physiologists, the little needle was as potent (or almost as potent) as Aaron's Rod. In about four hours the eggs began to develop, but while all of them passed through some initial stages, it was about one-fifth only that segmented in the normal way. At every stage the mortality was greater than in the case of ordinary fertilised eggs, but at length, out of a thousand eggs experimented on, one hundred and twenty hatched into tadpoles, and of these three were reared through parts of their metamorphosis. They did not actually turn into frogs, but died accidentally or for want of proper nourishment after the appearance of their legs, and after the oldest (about three months old) had all its four legs well developed and its tail already beginning to disappear; it was, in short, all but a perfect frog. As with St. Denis, when he walked a short distance with his head under his arm, "ce n'est que le premier pas qui coûte"; but these tadpoles, if they did not endure to the end, went a long distance on their way.

It is all but superfluous to add that the authors of these researches are men of high standing and reputation, skilled in all the precautions necessary for the carrying out of their experiments and for safeguarding them from all sources of accidental error. In short, we may have no doubt at all that what they assert they have actually performed—that they have demonstrated the artificial fertilisation of a vertebrate ovum by a simple mechanical stimulus, and that, so to speak, they have raised a hybrid between a needle and a frog! But here we are face to face with the double *rôle* which the male plays in the process of fertilisation, for, on one hand, it is his part to give the initial impulse or stimulus to the act of development, and on the other to convey to the offspring a share of his own hereditary qualities or characteristics. In these artificial experiments of parthenogenesis the two influences are dissociated. The former one is efficiently replaced by chemical or mechanical means, but the other drops out of sight altogether. For, as a French critic has remarked, "il ne peut être question d'hérédité du côté du père, car on ne voit pas très bien les jeunes grenouilles héritant des propriétés de leur épingle paternelle"!

D. W. T.

AGRICULTURAL RESEARCH IN CEYLON.[2]

THE staff of the Royal Botanic Gardens, Ceylon, show commendable activity in investigating the planters' problems that come under their notice. At frequent intervals issues are made of the Circulars and Agricultural Journal containing their papers, which will be found to bear comparison with any publications from other experiment stations. These papers show an obvious mastery of the situation, they are conceived in a scientific spirit, and exhibit none of the looseness characteristic of amateur investigations into agricultural questions. Tea and rubber naturally come in for a good share of attention, but other crops also present their problems, many of them of considerable interest and importance.

As usual in subtropical countries, most of the problems are connected with insect and fungoid pests, and half of the present batch of publications are from the mycologist, Mr. T. Petch. Five root diseases of tea caused by fungi are described. The commonest is caused by *Ustulina zonata*, Lév.; the dead tea roots show no external mycelium, but only a few inconspicuous black spots; if the cortex is removed, however, white fan-shaped patches of mycelium are found overlying the wood. The starting points of the disease are usually the dead stumps of Grevillea, which is grown among tea, and cut down either for firewood or when it has grown too large. Another common disease is caused by *Hymenochaete noxia*, Berk., a fungus that attacks numerous other plants. Here the mycelium is external to the root, and binds up a mass of sand, earth, and small stones, thus forming a crust 3 or 4 mm. thick; in the early stages the mycelium is brown, whence the name brown root disease has been given; later on, however, the whole turns black. It is the commonest root disease of Hevea in Ceylon, but does less damage than *Fomes semitostus*; unlike the latter, it does not spread through the soil, but only along the roots of trees; hence its progress is so slow that, as a rule, the first affected tree is dead before the neighbouring trees are attacked. Another root disease of Hevea, so far uncommon, is also described. It is caused by *Sphaerostilbe repens*, B. and Br., and is characterised by the black or red flattened strands running over the surface of the wood after the cortex is removed, there being no external mycelium. *Acacia decurrens*, which has been extensively planted as a wind-break for tea or for green manuring, and for more than thirty years seemed immune from disease, has now been found to suffer from two root diseases in addition to a "gummosis," the cause of which is not yet ascertained. An agaric, *Armillaria fuscipes*, causes one root disease, and *Fomes australis* the other. Another publication deals with canker in cacao and hevea. The latter plant does not usually suffer from canker when grown alone, but it is badly affected when grown in mixed plantations with cacao, which serves as a permanent source of infection. It is concluded that both canker and pod diseases are caused by *Phytophthora faberi*, Maubl.; complete examination was, however, made of the other fungi also present.

Mr. E. E. Green describes the extraordinary outbreak of snails, *Achatina fulica*, that has occurred in part of the island, and to which reference has already been made in these columns. This snail is large, its shell being about 4½ inches long, and weighs about 4 oz. It has only recently been introduced, but it has not effected nearly so much damage as might have been expected, because it feeds on human and cattle excreta; indeed, Mr. Green considers that, on the whole, it is doing more good than harm, and does not recommend any drastic attempts at extermination. Before long the natural enemies will keep it down.

Messrs. Kelway, Bamber, and R. H. Lock give a preliminary account of their studies on the effect of different intervals between successive tappings in Para rubber. A previous investigator, Parkin, obtained an increase of more than 600 per cent. of latex by increasing the frequency of tapping; Bamber and Lock, on the other hand, find no such marked wound response, although they advise frequent tappings from the practical point of view.

The official correspondence with regard to cotton-growing in Ceylon is also published. Dr. Willis does not think there is much future for the crop; other products yielding larger profits are not likely to be displaced. There is also a useful account of various samples of Cymbopogon grass oils prepared by Mr. Jowitt, of Bandarawela, and examined at the Imperial Institute.

ABSORPTION SPECTRA OF METALLIC SALTS.[1]

THE present volume is designed as a continuation of the work of Jones and Uhler and Jones and Anderson, and gives the results of a detailed study of the absorption spectra of salts of potassium, cobalt, nickel, copper, chromium, erbium, praseodymium, neodymium, and uranium, as affected by various chemical reagents and different temperatures. For the purpose of the discussion some 3000 solutions have been examined. The main points

[1] "L'embryogénèse complète provoquée chez les Amphibiens par piqûre de l'œuf vierge," etc. Par E. Bataillon. C.R., Avril 13, 1910, Arch. de Zool. exp. et gén. (5), vi, Nov. 1910; C.R., 27 Mars, 1911.

"Sur la parthénogénèse expérimentale chez les Amphibiens." Par F. Henneguy. C.R., Avril 3, 1911.

[2] Circulars and Agricultural Journal of the Royal Botanic Gardens, Ceylon. Vol. v.

[1] "A Study of Absorption Spectra." By H. C. Jones and W. W. Strong. Pp. ix+159+98 plates. (Washington, D.C.: The Carnegie Institution, 1910.

of investigation have been the effects of the addition of free acids and foreign salts on the absorption spectra. A notable result is the discovery of well-defined "solvent bands" for various substances, for example, water, alcohols, acetone, glycerol, which do not show any appreciable absorption of visible light.

In general it is shown that the *anions* of the various coloured salts play a much less important *rôle* in modifying the spectra than the solvent. Different salts of the same anion in the same solvent usually have the same absorption spectra. As, however, the absorption spectra of the powdered salts may be very different, it is evident that the solvent has an important part in the mechanism of absorption.

On the other hand, the absorption spectra of the same salt in different solvents are often very different; Jones and Anderson have ascribed this to the formation of *solvates*, more or less stable compounds of the salt and solvent. The persistence of solvent bands varies quite widely for the different solvents, appearing to be greatest for water and less for the alcohols.

Some of the uranous salts in the various solvents, water, alcohols, acetone, and glycerol, show characteristic bands very strongly. An attempt is being made to correlate many of these well-defined phenomena with the results of the Zeeman effect on similar variations of the salts and solutions, and it is considered that the results of such investigations may lead to a much clearer knowledge of the chemistry of compounds. In some cases it is possible to break up the absorption bands into very fine bands by chemical methods, as has been done with uranyl and uranous salts in acetone solutions, the most marked example being the action of hydrochloric acid on an acetone solution of uranous chloride.

A very noticeable result is the action of free acids on the corresponding uranyl salt, *e.g.* acetic acid on the acetate, nitric acid on the nitrate, &c. In most of these cases the presence of these foreign reagents causes the uranyl bands to become more intense, and, in most cases, narrower. The action of all except nitric acid is to cause the uranyl bands to be shifted towards the red. Nitric acid, on the contrary, produces large shifts towards the violet. A very important result of this analysis is that the absorption bands gradually shift as one salt of a metal is transformed into another by the addition of free acid. This is interpreted to mean that a series of intermediate products are formed, each with its characteristic absorption spectrum, although the chemical methods at present at our disposal do not enable us to isolate them.

It is also shown that rise in temperature causes the general absorption of any salt in water to increase, and the bands to broaden and become more intense.

The authors summarise the discussion as to the bearing of this work on the solvate theory of solution.

An excellent series of ninety-eight photographic reproductions of the spectra is included in the volume.

C. P. B.

THE ROYAL SOCIETY CONVERSAZIONE.

THE ladies' conversazione of the Royal Society was held at the rooms of the society in Burlington House on Wednesday, June 14. Many objects and experiments of scientific interest were on view, but most of them were described in our account of exhibits at the previous conversazione on May 10 (NATURE, May 18, p. 394). It is unnecessary, therefore, to refer to these again. Among other exhibits at last week's function were those described in the subjoined summary of the official catalogue.

The Director, Khedivial Observatory, Helwan, Egypt.—Photographs of Halley's comet, taken with the 30-inch Reynolds reflector by Mr. H. Knox Shaw. The photographs exhibited cover the period from April 16, 1910, to June 10, 1910. *Royal Astronomical Society.*—Photographs of the planet Mars, taken by Prof. E. E. Barnard with the 40-inch telescope of the Yerkes Observatory. The photographs of September 24, 1909, show the region of the Fastigium Aryn and Margaritifer Sinus, and those of September 28 the region of the Syrtis Major.

The Director, Royal Botanic Gardens, Kew.—(1) Collection of Euphorbias, showing mimetic resemblance. The following species of Euphorbia, selected from the collections at the Royal Botanic Gardens, Kew, show remarkable resemblance in habit to plants of other natural orders to which they are in no way related botanically. The species of Euphorbia, together with the plants they resemble, were exhibited side by side.

(1)	*Euphorbia Bertheloti*	*Cotyledon lineolare.*
(2)	,, *colletioides*	*Rhipsalis micrantha.*
(3)	,, *dendroides*	Willow twigs.
(4)	,, *hystrix*	*Cereus insularis.*
(5)	,, *Intisy*	Prunus twigs.
(6)	,, *polygona*	*Cereus polygonus.*
(7)	,, *Schimperiana*	*Ceropegia fusca.*
(8)	,, *Sipolisii*	*Vitis quadrangularis.*
(9)	,, *stapelioides*	*Stapelia micrantha.*
(10)	,, sp.	Pelargonium sp.
(11)	,, *Tirucalli*	*Senecio junceus.*
(12)	,, *xylophylloides*	*Epiphyllum truncatum.*

(2) *Ficus Krishnae. F. Krishnae*, a remarkable species most nearly allied to *F. bengalensis*, in which the leaves are cup-shaped, the inside of the cup being formed by the under surface of the leaf. *Mr. W. Fawcett.*—A parasitic flowering plant from Jamaica (*Scybalium jamaicense*, Schott and Endl.). This species is one of the Balanophoraceæ, a family of parasitic flowering plants growing on the roots of trees in tropical forests. They do not develop chlorophyll, and are therefore altogether dependent upon their host for sustenance. The seed contains an embryo of the simplest structure, having neither cotyledons nor radicle; it germinates in the soil, the embryo grows in length, thread-like, until it touches the root of a tree, and then penetrates it. When established on the root it forms a tuberous rhizome, from which flowering stems are produced. The flowers are very small, numerous, in heads on a stalk covered with scales—male and female flowers on distinct heads. This species is found in Jamaica, Cuba, and Hispaniola. Other species occur in Brazil and Colombia. *Mr. P. S. U. Pickering, F.R.S.*—Germination of seeds in heated soil. When soil is heated there is formed in it a substance toxic towards the germination of seeds and the growth of plants. Seeds germinate more slowly and in smaller proportions the higher the temperature of heating up to 250°. By exposure to air and moisture the toxic substance is destroyed. Plants grown rapidly in previously heated soil also show the presence of a toxic substance, but after this has become decomposed, such soil, owing to increased soluble contents and altered bacterial conditions, promotes plant growth.

Dr. G. H. Rodman.—A series of stereoscopic transparencies illustrating the life-history and minute structure of the stick insect (*Bacillus rossi*). Stick insects are natives of warm climates (India, Australia, the Malay Peninsula), but with care they may be reared in this country. They resemble, as their name suggests, portions of stick, and they afford an excellent example of mimicry. The various stages during the escape of the insects from their eggs are shown. The feet are provided with a pair of sharp hooks, by which they can cling to rough surfaces, and also with a pad or sucker, which enables them to get a foothold on perfectly smooth surfaces. The eye is a compound one, and faceted. They stand prominently out from the surface of the head, and are covered at will by the insect extending his forelegs directly forward in the long axis of his body. The skin is cast several times during the growth of the insect. It is shown that the antennæ and surface of the eyes share in the desquamation of the insect. *Dr. Francis Ward.*—(1) Photographs of fish life, as seen from below the surface of the water. (2) Photomicrographs of the growth of larval fish (plaice) taken from life. The photographs are taken in a pond specially constructed for the purpose. In one wall of the pond is a large open space which communicates with an observation chamber, and between this chamber and the water in the pond is a sheet of plate glass. Concealed in the chamber, the observer can watch the fish as they appear to each other in the water. In consequence of the darkness in the chamber and the light in the pond, the glass acts as a mirror, and the fish merely sees himself and his surroundings reflected, while the observer can plainly see into the pond. It is thus possible to observe a timid fish without disturbing him. In addition, an instantaneous

photograph can be taken at 1/250th of a second. *Dr. W. N. F. Woodland.*—Microscopic preparations and a model illustrating the mechanism employed in the production of the oxygen used to inflate the gas bladder of bony fishes. Most fishes employ oxygen (usually also nitrogen and carbon dioxide) for the inflation of the gas bladder (incorrectly termed "air" and "swim bladder") when this is present. The presence of oxygen is associated with the power of producing relatively rapid variations of the quantity of gas in the bladder, a power required in deep-water fishes which sink and rise, and so experience considerable changes in external pressure. A special gland, the oxygen gland ("gas gland"), and an equally important and very remarkable supplementary apparatus, the rete mirabile duplex, are developed in the bladder wall for the special purpose of producing the oxygen. The reason why oxygen is the gas employed for the inflation and deflation of the bladder is because of its abundance in the blood stream and the facility with which it is dissociated from (the red blood corpuscles undergoing disintegration for the purpose) and reassociated with the hæmoglobin of the blood.

Miss Dorothy Bate.—(1) Fossil remains of the peculiar goat-like animal *Myotragus balearicus*, Bate, from Majorca. (2) Photographs of the locality and caves in which the bones of Myotragus were found. Nothing is known of the habits or origin of this peculiar animal, which formerly inhabited Majorca in large numbers. Myotragus differs from all other goats, sheep, and their allies in having only two lower front teeth, which are very large and are modified to form a sharp chisel-edge; they grow continuously, like those of a gnawing animal such as the rat or rabbit. It is also remarkable for the shortness and stoutness of its metacarpals and metatarsals, the latter being usually united to the distal row of ankle bones. *Dr. C. W. Andrews, F.R.S.*—Remains of Tertiary mammals from near Lake Victoria Nyanza, British East Africa. The specimens shown are the first remains of Tertiary mammals from Central Africa. They are portions of the lower jaw with teeth, and a calcaneum of a small species of Dinotherium, which is very similar to *Dinotherium cuvieri* from the Lower and Middle Miocene of France. The age of the African beds is not yet definitely known, since it is possible that Dinotherium may have survived in Central Africa long after it had become extinct elsewhere. The specimens were obtained through Mr. C. W. Hobley, C.M.G., Commissioner of Mines. *Mr. G. C. Crick.*—Models of shells of extinct cephalopods. The models represent the shells of three cephalopods which lived in the Silurian seas and possessed chambered shells like that of the living pearly nautilus, but differed therefrom, among other characters, in the contracted form of the aperture of the body-chamber. *Mr. C. Forster-Cooper.*—Part of a collection of fossil mammals from the Lower Miocene beds of Dera Bugti, Baluchistan. (1) Jaw of a specialised type of primitive Rhinoceros; (2) separate lower incisor of primitive Rhinoceros; (3) portion of cranium of primitive Rhinoceros; (4) upper molar tooth of primitive Rhinoceros; (5) astragalus of primitive Rhinoceros; (6) mandible of Aceratherium, sp.; (7) teeth of mastodon, sp.; (8) upper teeth of Rhinoceros; (9) upper and lower teeth of an Anthracothere; (10) portion of a mandible of an anthracothere.

Nubian Archaeological Survey.—Objects found in the area to be submerged on the raising of the Aswan Dam. (Exhibited by the late Director-General of the Survey Department of Egypt, Captain H. G. Lyons, F.R.S., and the present Director-General, Mr. E. M. Dowson, on behalf of the Egyptian Government.) (1) Decorated pottery and other objects of the early dynastic period in Nubia (Dynasties I. and II. in Egypt, *circa* B.C. 3000), at which date Nubia was occupied by the Egyptian race. The hand-made pottery differs from that of the same period in Egypt in form and decoration, possibly owing to the geographical position of Nubia and to the rarity of stone vessels, the manufacture of which appears to have checked the development of fine hand-made pottery for funerary purposes in Egypt. (2) Decorative pottery and other objects illustrative of the non-Egyptian culture of the race (C group) which occupied Nubia from about the close of the old kingdom until it was expelled or absorbed by the military expeditions of the twelfth dynasty and the Egyptian colonies of the early new Empire. The incised pottery and steatopygous dolls show marked analogies with similar objects of the pre-dynastic Egyptian period of nearly 2000 years before.

Mr. Albert Bruce-Joy.—Bronze statue of the late Lord Kelvin by Mr. Albert Bruce-Joy, to be placed in Belfast. The likeness represents Lord Kelvin as he appeared about twenty years ago. The statue will ultimately be placed on a granite pedestal.

SHELL-FISH AND THEIR RELATION TO DISEASE.[1]

THE connection between the consumption of edible shell-fish (molluscs) and certain diseases, in particular typhoid or enteric fever, has in recent years attracted the attention of epidemiologists, and several valuable contributions on the subject have been published in this country. In 1894 Dr. Bulstrode reported to the Local Government Board on "Oyster Culture in Relation to Disease," in which he concluded that there remains "much to be done before the public can consume oysters, bought promiscuously, with a reasonable degree of safety." The danger of oysters was again brought home to the public by the outbreaks of enteric fever following banquets at Winchester and at Southampton in 1902, on which Dr. Bulstrode also reported.

Cockles and mussels have likewise been implicated in the dissemination of enteric fever in and about London and elsewhere.

The matter has assumed such importance that a further report on the subject by Dr. Bulstrode has been communicated to the Local Government Board, and brings up to date and extends our knowledge of the relationship between the consumption of shell-fish *other than oysters* and the occurrence of disease among those consuming the shell-fish. The molluscs of chief importance are cockles and mussels, and the beds are found all round our coasts, particularly in the estuaries of rivers, which are frequently liable to sewage pollution; but a part of the supply is obtained from abroad, America and Holland chiefly. In the report, the distribution of the shell-fish is shown on maps, and also the relation of the beds to the neighbouring sewer outfalls. The possibility of contamination is critically surveyed from a consideration of all the local factors, for the proximity or otherwise of a sewage outfall to a bed does not necessarily imply contamination or purity respectively; much may depend, for instance, on tidal conditions, on the absence of water at low tide, on the period at which the sewage is run out, &c. Again, even if the shell-fish beds themselves are remote from sources of pollution, the shell-fish may be brought to polluted waters for cleansing or storing, and several examples are given of this in the report. Bacteriological investigations have been excluded from the report, because it was considered that the topographical test would, on the whole, afford the least conflicting evidence.

Although shell-fish such as cockles are cooked before use, the "cooking" is often a very perfunctory affair, and by no means sterilises. At Leigh-on-Sea, however, owing to definite proof of the conveyance of enteric fever by the fish, the cockle merchants have provided forms of sterilisers or autoclaves in which the fish are exposed to steam under pressure. In the coppers in which the cockles are ordinarily boiled, while the bottom layers may be sterilised, the upper layers very often certainly are not.

The epidemiological evidence connecting the consumption of shell-fish with the subsequent occurrence of enteric fever or gastro-enteritis is detailed in chapters vi.–x. of the report. While in numerous instances it has been possible to connect the consumption of shell-fish with a subsequent direct outbreak of enteric or gastro-enteritis, it is more difficult to connect a part of the ordinary and sporadic incidence of these diseases with the general con-

[1] Report on Shell-fish other than Oysters in relation to Disease. By Dr. H. Timbrell Bulstrode. Pp. viii+243. Supplement in continuation of the Report of the Medical Officer. Thirty-ninth Annual Report of the Local Government Board, 1909-10; (London: Wyman and Sons, Ltd.; Edinburgh: Oliver and Boyd, Dublin: E. Ponsonby, 1911.) Price 8s.

sumption of shell-fish. The evidence marshalled by Dr. Bulstrode for this connection must, however, go a long way to dispel any doubt, if such exist, of its reality. The evidence, of course, is largely indirect, and comprises such details as these: the greater incidence of enteric among those who eat shell-fish than among those who do not; diminished incidence of enteric coinciding with diminution in the amount of sewage emptying into estuaries, &c.; the "cooking" of shell-fish diminishing the incidence of disease; reduction in enteric fever prevalence coinciding with limitation of the consumption of shell-fish; and (sometimes) seasonal variations in the shell-fish supply coinciding with seasonal variations in disease.

Finally, one of the most important parts of the subject, the administrative control of contaminated shell-fish, is dealt with. The difficulties in this direction are very great. Ineffective efforts at legislation have been made, and, failing success, the authorities concerned have fallen back on the publicity secured by local posters, &c., which, of course, affects the sale of wholesome, as well as of unwholesome, shell-fish. The Fishmongers' Company and several corporations have done excellent work, and one or two local Acts have been obtained (*e.g.* by the Corporation of Blackburn in 1908) to deal with the matter, but otherwise practically no control, in a sanitary sense, has been exercised over the beds, laying, and cleansing and storing places. Probably the local application, as required of the powers contained in the Public Health (Regulations as to Food) Act, 1907, would generally suffice.

The whole report is a very valuable one, and should arouse public attention to the necessity for taking definite action to deal with the subject of the contamination of shell-fish. The report is prefaced by a lucid introduction by Dr. Newsholme, the Board's medical officer, from which we have drawn freely in writing the above.

R. T. H.

THE CHEMISTRY OF MUMMIFICATION.

MR. A. LUCAS has rendered a great service to all who are interested in the customs of the ancient Egyptians and in the history of the methods adopted for the preservation of the body by collecting into one convenient volume the results of his investigations concerning the "Preservative Materials used by the Ancient Egyptians in Embalming," which has been issued as Survey Department Paper No. 12 (Cairo: National Printing Department, 1911).

More than seventy years ago Dr. Pettigrew published an exhaustive account of the chemistry of mummies, so far as this was possible at that time, and he had the assistance of Michael Faraday in his investigations. Since then the whole subject of mummification had fallen into the hands of archæologists, who invented a curious alchemy of their own for the purpose of interpreting the accounts of Egyptian embalming given by the ancient Greek writers; but during the last ten years this era of sensationalism has received its quietus, and a serious attempt has been made to elucidate by recognised scientific means the nature of the methods of mummification.

Recent investigators have had the immense advantage of having many hundreds of mummies of known age and provenance for every unknown mummy that came into Pettigrew's hands; and the enormous strides in chemical knowledge that the last seventy years have witnessed have made it possible to obtain much more information from the material than was possible before. Most of the embalming materials thus rescued have been analysed by Prof. W. A. Schmidt, of the Cairo School of Medicine, and Mr. Lucas, analyst to the Egyptian Survey Department, and the results of their work have been published in various scientific journals published in Egypt and Europe. Mr. Lucas has collected all this scattered information and added to it in this valuable report. He has also given an extensive bibliography, which, though not quite complete, will be of very real service to archæologists, who in the past have been at a loss to obtain accurate information upon such matters as are discussed in this work.

AN IMPERIAL BUREAU OF ANTHROPOLOGY.

WE print below a memorial relating to the formation of an Imperial Bureau of Anthropology, received from the Royal Anthropological Institute. The memorial was sent a few days ago to the secretary of the conference, to Mr. Asquith and each of the other Prime Ministers, and to the Colonial Secretary. Though the matter did not appear on the agenda of the Imperial Conference, we learn that the individual members of the conference are cognisant of the facts, and one or two are desirous of obtaining more information. We trust it will be possible for some action to be taken on the lines suggested by the memorial.

Memorial on the Establishment of an Imperial Bureau of Anthropology presented to the Imperial Conference by the Royal Anthropological Institute.

The Council of the Royal Anthropological Institute desires to submit the following facts for your consideration:—

(1) An important and an integral portion of the problem of Empire is that which is concerned with the relations of the Imperial race with dependent peoples whose history, religion, social structure, and habits of life and thought are far removed from ours.

(2) The social characteristics of the dependent races are being profoundly modified by contact with our civilisation, and experience has shown that habits of life and thought, the products of long ages, have a tendency to disappear under modern conditions.

(3) The council urges, also, that on administrative grounds an exact and an intimate knowledge of the mental attitudes and modes of life of these races is essential to those whose duty it is to govern them.

(4) As the body representing the premier scientific institution in Great Britain whose object it is to promote the organised study of mankind, the council is much concerned with the inevitable loss to science consequent on the extension of our civilisation; but the manners and customs of many semi-savage tribes in the Empire still survive, and are worth the serious attention of the scientific anthropologist. It urges, therefore, that the resources of modern science should be thoroughly and systematically employed in order to record those customs which are of such value and interest to the student of anthropology.

(5) Another important problem of Empire is the physical improvement or deterioration of all the races of the Empire. This can only be ascertained by periodic measurement of children and adults. It is obvious that this work must be controlled from a single centre in order to secure uniformity.

(6) The council desires to point out that the scientific study of anthropology at the universities has made great and marked progress in late years, a gratifying fact which is due in no small measure to the efforts and example of distinguished fellows of the Royal Anthropological Institute.

(7) The number of trained investigators is steadily increasing, and every year sees an advance in the accuracy and thoroughness of the methods of anthropological investigation.

(8) While it is the duty of the universities to organise the study of anthropology, it is the task of the Royal Anthropological Institute to coordinate all branches of that study by the exercise of functions in regard to it analogous to those performed for science in general by the Royal Society.

(9) In these circumstances the Council of the Royal Anthropological Institute seeks the support, moral and financial, of your Governments for a scheme to establish in London, in association with the institute, an Imperial Bureau of Anthropology, in order to secure the systematic investigation by scientific methods, according to a uniform plan, of the anthropology of the dependent and independent races within the British Empire.

(10) The council recognises that this project can be carried to success only if local cooperation and support be freely accorded to it. The methods and procedure of investigation very often must be adapted to local necessities of which the investigator on the spot is alone competent to judge. But it is clearly desirable that within limits there should be uniformity of method for the sake of the com-

parison and collation of the results garnered in so many parts of the Empire.

(11) The council therefore proposes (*a*) that there should be established in London an Imperial Bureau of Anthropology; (*b*) that the bureau should be managed by a committee constituted of the Council of the Royal Anthropological Institute, and containing representatives of the Governments of the British Dominions, of the India and Colonial Offices, and of those Universities in Great Britain, in India and the Colonies and Dependencies of the Empire where anthropology is systematically studied.

(12) The council further proposes that in each of the British Dominions, in India and in the Crown Colonies, there should be established local committees on which the local university or universities and scientific associations should be represented: that these committees should maintain close touch with active workers, superintend the collection of anthropological data in accordance with the plans and methods formulated by the Central Committee and transmit them to the Imperial Bureau, where they would be collated, printed, and issued from time to time in suitable form.

(13) Too much cannot be said as to the importance from a scientific standpoint of such a scheme. The council thinks it is justified in urging that from the aspect of practical utility such a bureau would render most valuable service for many years to come to all who are engaged in the task of spreading civilisation, whether as servants of the Empire, as traders, or as missionaries and travellers.

(14) The council therefore asks for financial assistance to enable it to provide and equip the bureau with a well-trained and competent staff, and to publish as may be necessary the information collected by local committees with funds at their disposal, to enable them to employ trained investigators when desirable.

(15) The council estimates that for the first five years the cost of maintaining and equipping such a bureau would be

	Staff	Maintenance and Publication	Equipment	Total
	£	£	£	£
1st year ...	300	100	200	600
2nd year ...	300	150	50	500
3rd year ...	400	200	50	650
4th year ...	500	250	50	800
5th year ...	500	250	50	800

(16) The Council recognises the value and importance of the work which has already been accomplished by Government aid in Canada, Australia, India, in Southern Nigeria, Ceylon, and the Anglo-Egyptian Sudan, and desires very earnestly that this work should be carried on with greater continuity over a wider area in accordance with a uniform plan by standard methods of investigation which should be laid down by the Royal Anthropological Institute, the only scientific body which is entitled by its standing to speak with authority on such matters.

A. P. MAUDSLAY, *President.*
J. GRAY, *Hon. Treasurer.*
T. A. JOYCE, *Hon. Secretary.*
(*For the Council of the Royal Anthropological Institute.*)

TECHNICAL EDUCATION AND INDUSTRIES.[1]

THE widefelt need for drastic improvements in our systems of education makes the present period a critical one. We are on the verge of important changes which will probably be made by the Board of Education in its rules and regulations, and this naturally makes the present an anxious time to us as teachers. In addition, we are threatened with what may almost be called a revolt of the ratepayer, who is often far from realising fully the intimate relationship between industrial progress and technical education. Though this subject has been discussed almost *ad nauseam*, I propose to put before you some striking figures derived from the recently published Census of Production, of 1907.

The following tabular statement gives details of net output, number of salaried persons and wage-earners employed, and the net output per head of the nine leading industries already published in the summaries of the census, coal mining being omitted, as this is of a very different character from the other industries. The net output represents the value added to the raw material during the processes of manufacture. For purposes of comparison, I have added the percentages of salaried persons and wage-earners respectively in each industry. A glance at the table at once reveals the important fact that the net output per head broadly rises throughout with an increase of the percentage of salaried persons. Although this conclusion is derived from a comparison of different industries, we are probably safe in assuming that it will hold good in a similar way when applied to different branches of one and the same industry. This suggests that, within certain limits, the employment of a large number of skilled technologists will develop the industry into higher forms, which is accompanied by an increase of productivity. This must in course of time react on the prosperity of the country as a whole, and determine its position in the industrial struggle between the nations of the world.

SUMMARY FROM CENSUS OF PRODUCTION, 1907.

TRADE.	Net Annual Output.	Number of Persons Employed.			Percentage of Persons Employed.		Net Annual Output per head.
		Salaries.	Wages.	Total.	Salaries.	Wages.	
	£						
1. Engineering Factories (including Electric. Eng.)	49,425,000	33,384	416,924	455,561	7·3	92·7	108
2. Cotton Factories	46,941,000	12,391	560,478	572,869	2·2	97·8	82
3. Iron and Steel Factories (including Smelting, Foundry, Rolling)	30,948,000	14,064	248,161	262,225	5·4	94·6	118
4. Woollen and Worsted Factories	19,452,000	9,097	247,920	257,017	3·5	96·5	76
5. Shipbuilding Yards and Marine Engineering Works (Private Firms)	17,678,000	9,452	175,105	184,557	5·1	94·9	96
6. Railways (Construction, Repair, and Maintenance of Permanent Way, Plant and Rolling Stock.....	17,103,000	8,790	232,736	241,526	3·7	96·3	71
7. Bleaching, Dyeing, Printing, and Finishing Factories ...	10,369,000	6,154	96,457	102,611	6·0	94·0	101
8. Chemicals, Coal Tar Products, Drugs, and Perfumery Factories	9,464,000	5,981	45,107	51,008	11·7	88·3	185
9. Jute, Linen, and Hemp Factories	9,338,000	3,619	149,845	153,464	2·3	97·7	61
Average	—	—	—	—	4·5	95·5	93

Scientific Research in Industry.

Beaconsfield is credited with having once stated that the chemical trade of a country is a barometer of its prosperity, a statement for which we see there is some justifi-

[1] From the Presidential Address delivered before the Association of Teachers in Technical Institutions at the Southport Conference, June 5, by Mr. Barker North.

cation, considering that it heads the list in net output per head.

There are many problems that are awaiting solution, but these will only be solved by scientific methods applied by the technologist trained in research.

Although in 1907 we were employing, as compared with other English industries, a relatively high percentage of salaried persons in the chemical industries, a large proportion of whom would be technical chemists, it is when we inquire into the type of chemist employed that we find a remarkable difference from the practice adopted in Germany. In England, the work of our chemists is almost entirely of a more or less routine character, whereas the astounding number of research chemists employed forms a distinguishing feature of the German chemical industry. The suggestion recently made that we are incapable in this country of producing technological organic chemists, trained in research methods, is an absurd one; the fact is that the manufacturer, requiring an immediate turnover for his capital, does not, as a general rule, encourage the training of such men by demanding their assistance in the works. His policy, however, is a short-sighted one, as the following contrast of the chemical trades of England and Germany will show the valuable results accruing from the German method.

In 1907 the gross value of the output of the chemical trade in the United Kingdom was 23½ millions sterling, and of this amount a little more than one-third of a million represents the total value of the coal-tar dyestuffs. Germany in 1909 produced aniline colours alone equal to 15 millions sterling in value, approximately two-thirds of the whole of our chemical trade. The imports of coal-tar dyes into England in 1909 increased by 16 per cent., and in 1910 by 10 per cent. The irony of the whole situation is that we celebrated, a few years ago, the jubilee of Perkins's epoch-making discovery of the first aniline dyestuff.

Ten years ago, practically all the indigo put on the market was of natural origin and supplied by British possessions, but certain German firms set out to capture the indigo market by the production of artificial indigo. In spite of the statement that the natural product possesses certain intrinsic valuable properties not possessed by the artificial variety, and despite the attempts of the English Government to bolster up the Indian indigo trade, in ten years the annual value of indigo imported into this country from India has fallen from a million sterling to less than 50,000*l*. Germany in 1909 exported to Asia alone, the home of the natural indigo, indigotin to the value of 1,900,000*l*. This again is now being followed up by the production of vat dyes, many of them products derived from artificial indigo. These colours being extremely fast, in many cases even to bleaching agents, may yet revolutionise our cotton-dyeing industry. We have not only lost our indigo trade, but in these developments our colour manufacturers are again allowing the German firms to forge ahead.

This forward movement is not confined to the colour trade alone, for the adoption of new processes of manufacture often reacts advantageously on older processes, creating an increasing demand for other products, notably in the heavy chemical trade. At one time Lancashire produced practically all the sulphuric acid of the world; some ten years ago about one million tons were said to be manufactured annually principally in this part of the country, whereas, according to the recent census, the total amount manufactured in the United Kingdom in 1907 was 473,000 tons. This is largely due to the commercial development in Germany and other countries of the "contact process" for the manufacture of sulphuric acid, the initiation of which is principally due to the demands created by the dyestuff industries. It is again interesting to note that the first patent for this process was taken out by Dr. Squires, an English chemist, though the process has been converted into a commercial success in other countries.

This is typical of the advancement and development which has been such a marked feature of the chemical trade of other countries. Examples might be multiplied to prove that in England we are engaged to a large extent in tinkering up the old processes of manufacture, whilst other countries avail themselves of new lines of thought and experiment. The great German industrial concerns, knowing the value of the scientific expert, will often wait for years for the final results of researches which they realise may ultimately revolutionise an industry, or may provide entirely new industries.

Germany has developed a scheme of practical education of the masses which will provide her industries with an army of well-trained workers, and at the same time she has developed to the highest pitch the scientific training of original technologists. It may be that we require more Dreadnoughts, but no number of battleships will prevent our being left far behind in the race of industrial progress if we continue to rest self-satisfied on the laurels of the past.

The more one inquires into the various suggestions that have been made for England's failure to take the lead in industrial developments, the more one is driven to the conclusion that lack of the spirit of organisation and system in both industrial and educational matters is the root of the evil.

In discussing reforms that are necessary in the work of our technical schools and universities, we have to recognise clearly that provision must be made for two distinct types of students, namely, (1) the rank and file of the industrial army; (2) the officers, who will have to organise and direct the work of the rank and file. The ideal principle which should govern the whole system is that the second type should be evolved from the first by means of natural selection. In the earlier years, the training of the two types may therefore be identical, and can be efficiently carried out by part-time instruction in technical schools, as far as possible in the daytime. With regard to higher technical work, this cannot be adequately dealt with in evening classes. We have a unique system of evening classes in this country, doing undoubtedly far better technical work than most people realise, but this system will have to be developed even further if we are to keep pace with the improvements which are bound to follow the increasing application of science to industry.

Higher technological instruction is at the present time given in some six or seven universities, a few university colleges, and many technical colleges and schools.

With respect to our day technical institutions, the following points may be urged in connection with the higher instruction given by them at present:—

(1) The students are too young at entry, and coming mostly direct from secondary schools at the age of fifteen or sixteen, during the first two years they are not old enough to appreciate the necessity for serious study, and have little sense of responsibility.

(2) The student when he has completed his three or four years' training is still without any practical experience such as is gained as an employee in a works. Through lack of this practical experience, he has often an inflated opinion of his own ability and immediate industrial value.

(3) It is only the occasional man who displays the ability requisite for the highest technological positions. Only a comparatively small percentage of those entering the day technical institutions finally display that initiative which is required in the trained technologist. The greater number are only suitable as routine men for second-rate positions, and would receive a more suitable training by entering works and attending evening classes. The explanation for this is that the day students are at present not being chosen by the process of natural selection.

(4) There are too many institutions at the present time all attempting the highest form of technical training in numerous branches, resulting under the existing conditions of selection and supply in small classes and in the unnecessary duplication of expensive equipment for the most advanced work.

(5) The small number of students in each institution does not justify the engagement of the numerous staff of specialists really necessary for the highest form of technological training.

All these defects will be remedied by drafting the most promising of evening students systematically into day courses, and by concentrating them for the highest class of work in specialised institutions, each of which could then afford the necessary elaborate equipment and specialist staff.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ON July 15 the King will lay the foundation stone of the new Welsh National Library at Aberystwyth.

DR. SHAND, of the Royal Scottish Museum, Edinburgh, has been appointed by the council of Victoria College, Stellenbosch, South Africa, to the recently instituted chair of geology.

IT is proposed to start in September next, at the Horticultural College, Swanley, Kent, a year's course in natural history for intending teachers of nature study and gardening. The course is designed to give students an insight into field work in natural history based on sound laboratory instruction, and enable them to impart their knowledge to others in simple and intelligible language. The work will be thoroughly practical, and students will be shown how to prepare their own material and construct any necessary apparatus. The course will extend over one session of three terms, thus giving opportunities for field work in all seasons.

PROF. W. A. HERDMAN, F.R.S., will hold a vacation course on oceanography at the Port Erin Biological Station in September this year, probably in the two weeks following the meeting of the British Association. The exact dates and further particulars will be announced shortly. The practical work of the course will, as last year, be conducted by Dr. W. J. Dakin (as zoologist) and Dr. H. E. Roaf (as physiologist). Prof. Herdman's new steam-yacht *Runa*, which is being fitted up for oceanographical work, will by that time have returned from her contemplated plankton cruise in the Hebrides, and will be available for demonstrations of apparatus and method on board in Port Erin Bay.

THE second volume of the 1910 report of the U.S. Commissioner of Education shows that 494 of the institutions of higher learning which report to the Bureau at Washington admit men students, 352 admit men and women, and 108 women only. The report includes much interesting information as to the property and income of the various colleges and universities. We notice that the 494 colleges admitting men students have libraries valued at 3,850,000*l*. The value of their scientific apparatus, machinery, and furniture is given as 6,550,000*l*.; of their grounds, 3,538,000*l*.; and of their buildings, 42,300,000*l*. The productive funds of these institutions amount to 51,875,000*l*. Their income for 1910 reached 16,088,000*l*., of which 2,320,000 was from productive funds. From the same source much can be learnt concerning the growth of secondary education in the United States. For twenty years the rate of increase in the number of secondary-school pupils has been greater than the rate of increase in population. In 1890 the number of secondary-school pupils was 367,003, or 5900 to the million of population; in 1900 the number was 719,241, or 9500 to the million; and in 1910 it was 1,131,466, or 12,300 to the million. The per cent. of increase in population since 1890 has been nearly 47, while the per cent. of increase in secondary-school pupils has been 208.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Meteorological Society, June 14.—Dr. H. N. Dickson, president, in the chair.—Dr. C. **Chree**: Discussion of the barograph records kept by the late Mr. P. Bell at Castle O'er, Dumfriesshire, during the seven years 1902–8. The records show a well-marked principal maximum and minimum at 10 p.m. and 5 a.m. respectively. Every single year agrees in this except 1908, which puts the maximum at 7 a.m. The existence of a secondary maximum and minimum is unmistakable, but while the hour of occurrence of the former is clearly 11 a.m., that of the latter is less distinct. It seems to be 4 p.m., but a longer series of observations would have been necessary to confirm this.—Spencer C. **Russell**: Experiments carried out at Epsom during the last two years in order to obtain a permanent record of the variations in the size of raindrops as and when they occurred. The first method employed was the exposure of a number of ruled slates divided into ¼-inch sections, and gently brushed over with an even coating of oil. This was not altogether satisfactory, as during heavy rain the drops impinged upon the slate with such force as to become broken up into a series of drops composed of one large and a number of small ones. The most satisfactory results, however, have been given by the use of plaster of Paris. Mr. Russell exhibited to the meeting a number of these raindrop models. He stated that the sizes of the drops which he had already collected were:—7 of 6 mm., 44 of 5 mm., 73 of 4 mm., 222 of 3 mm., 257 of 2 mm., 175 of 1 mm., and 107 of less than 1 mm.—A. J. **Makower**, Dr. W. **Makower**, W. M. **Gregory**, and H. **Robinson**: Experiments carried out at Ditcham Park to investigate the electrical state of the air at different heights above the ground by means of kites and balloons.

DUBLIN.

Royal Irish Academy, June 12.—Rev. Dr. Mahaffy, president, in the chair.—R. Lloyd **Praeger**: Phanerogamia and Pteridophyta. Part I. Dispersal and distribution. (Clare Island Survey.) In connection with the study of the vegetation of Clare Island, particular attention was paid to the questions of the origin and the age of the flora. The question as to whether the flora could have immigrated across the existing strait which separates it from the mainland was decided in the negative, on the grounds, among others, of its variety and complexity in relation to that of the mainland, the equal abundance of species with or without dispersion devices, and the non-applicability in this case of certain usually potent methods of dispersal. The influence of man upon the flora was also dealt with fully.

NEW SOUTH WALES.

Linnean Society, March 29.—Mr. C. Hedley, president, in the chair.—C. **Hedley**: Presidential address, a study of marginal drainage. Previous to the present cycle, it is believed by geologists that a peneplain extended from New Guinea in the north to Tasmania in the south. Probably this peneplain extended eastwards beyond the limit of the present coast, and was continued seawards by a broad continental shelf. The theory is advanced that the present cycle commenced by the sinking of the ocean-floor, and by pressure upon the border of the continent. In the zone of compression folding ensued, by which the continental shelf was depressed and the coastal range elevated simultaneously. Where the margin of the shelf approaches the coast, so does the divide. From this it is inferred that a broad shelf serves as a buttress to that portion of the continent that lies behind it. Sheltered by this buttress, radial rivers persist as relics from the peneplain epoch. To show that the continental shelf is still being diminished, an instance is furnished by Captain Sharp of how the shelf has retreated from five to ten miles within forty years near Break Sea Spit. A feature of many rivers of our Pacific slope is that, for part of their course, they run in valleys parallel to the shore. Then they are apt to break away and run direct to the sea. Of where and what were the rivers of the preceding cycle, the peneplain times, there is no record. It is obvious that no peneplain could have carried such crooked rivers as the Clarence or the Shoalhaven. Of necessity the peneplain rivers were longer, slower, and straighter than these. How were those peneplain rivers succeeded by an entirely diverse scheme of drainage? The explanation offered is that the crooked rivers lie in a zone of compression; that movements from the pressure-trough threw the coastal area into irregular folds; that these broke and caught the radial rivers, which, turning aside, flowed along their furrows; then at once denudation played on elevation. At every opportunity the river burst through the obstacle which held it back from the shortest way to the sea. Finally, the old channel, chopped in lengths by cross-streams, appears as an empty river-bed. Every stage in this performance is illustrated by the rivers of New South Wales. It is clear that as these great meridional valleys, marginal to the coast, are undergoing rapid dis-

integration by the ordinary agents of denudation, that they cannot have endured such attack for long. Consequently these valleys themselves are geologically recent.—Ordinary meeting, Mr. W. W. Froggatt in the chair.—*Papers read:* D. **McAlpine**: Description of a new smut in a new genus of grass.—T. Harvey **Johnston**: (1) The entozoa of Monotremata and Australian Marsupialia, No. ii.; (2) new species of avian cestodes.

April 26.—Mr. W. W. Froggatt, president, in the chair.—Dr. J. M. **Petrie**: The *rôle* of nitrogen in plant metabolism, parts iii.–v. (iii.) The distribution of nitrogen in the seeds of *Acacia pycnantha*. The seeds contain 4·51 per cent of N in various forms. The changes in the solubility of the protein are examined in various stages of partial neutralisation. A study of the action of various protein precipitants is made. Quantitative precipitation by alcohol of increasing strength brings out a differentiation of the N values, and shows the presence of at least two different proteins. The protein-free solution contains (1) substances which easily set free ammonia when distilled; (2) compounds which liberate ammonia only when hydrolysed with dilute acids; (3) compounds which are only decomposed by boiling with strong acids for prolonged periods; (4) basic compounds. (iv.) The nitrogen of ripening seeds. Experiments on the wild tare, *Vicia sativa*. The seeds, as ripening progresses, gain in protein and also in non-protein N compounds, the mature seeds containing the largest amount of each. The view that the proteins are formed at the expense of non-protein N compounds is not supported. All ripe seeds examined contain non-protein N, which remains unaltered throughout the dormant state. A series of experiments on *V. faba* showed that when the seeds are left enclosed in the isolated pods, a transference of material takes place from the pods to the seeds. This results in an increase in total N and protein N, and a small increase in non-protein N. The seed-protein could only have been augmented by the addition of protein or protein derivatives, and the only possible source is the pods. (v.) The occurrence of potassium nitrate in plants. The occurrence of an unusually large amount of potassium nitrate in the leaves of *Solandra grandiflora*, 2·01 per cent. of the plant dried at 100° C., is recorded.—R. J. **Tillyard**: Studies in the life-histories of Australian Odonata. No. 4. Further notes on the life-history of *Petalura gigantea*, Leach. The account of the life-history of *P. gigantea* is completed. The living nymph, hitherto undiscovered, was found in a swamp at Medlow, Blue Mountains. These larvæ appear to be at least two years in reaching maturity.—E. W. **Ferguson**: The Amycteridæ of the Voyage de *l'Astrolabe*, 1835. The author has had the opportunity of examining Boisduval's types of ten species, from Coll. Dejean, out of a total of nineteen described, the descriptions of the remaining nine being sufficiently full for satisfactory recognition.—W. W. **Froggatt**: Description of a new lac-coccid (genus Tachardia) from New South Wales.

VICTORIA.

Royal Society, April 13.—Mr. Walcott in the chair.—J. **Shephard**: A list of Victorian rotifers, with description of two new species and the males of two species. H. H. Anderson and the author published a Victorian list in 1892. *Brachionus lyratus*, n.sp., and *B. dichotomus*, n.sp., and males of *Lacinularia reticulata* and *L. elliptica* are described.—A. J. **Ewart**: Fruiting of "Blackfellow's Bread" (*Polyporus Mylittae*, Cooke). Sporophores do not form without the stimulus of light.

May 11.—Prof. Skeats in the chair.—W. Baldwin **Spencer** and R. H. **Walcott**: The origin of cuts on bones of Australian extinct marsupials. Bones from localities in Victoria, New South Wales, and South Australia have cuts and marks on them into which the teeth of Thylacoleo will fit, thus confirming its carnivorous habit.—Jean **White**: Bitter-pit in apples. Results of one season's work are given. Several diseases are confounded under the name; the one investigated is caused by spraying with lead arsenate.

CAPE TOWN.

Royal Society of South Africa, May 17.—Mr. S. S. Hough, F.R.S., president, in the chair.—Miss D. F. **Bleek**: Note on the language of Bushman tribes north of the Orange River, illustrated by gramophone records.—L. **Péringuey**: Note on the result of investigations of a Strand Looper Hottentot rock-shelter, with exhibition of the objects found.—R. **Marloth**: Some new South African succulents and other plants, part iv.—J. **Burtt-Davy**: Segregation of two pairs of characters in a cross-bred maize ear.—T. **Muir**: Sylvester's axisymmetric unisignant.

DIARY OF SOCIETIES.

MONDAY, JUNE 26.

VICTORIA INSTITUTE, at 4.30.—The True Temper of Empire: Sir Charles Bruce, G.C.M.G.

TUESDAY, JUNE 27.

ZOOLOGICAL SOCIETY, at 8.30.

WEDNESDAY, JUNE 28.

ROYAL MICROSCOPICAL SOCIETY, at 8.—(1) On the Structure of Scales from *Thermobia domestica*; (2) A Description of a Model producing Optical Effects similar to the Cuneate Markings in Insect Scales: J. Strachan.—Rotifera of New Zealand and S. Africa: J. Murray.

FRIDAY, JUNE 30.

PHYSICAL SOCIETY, at 5.—On the Effect of a Narrow Saw-cut in the Edge of a Conducting Strip on the Stream Lines in the Strip and on the Resistance of the Strip: Prof. C. H. Lees, F.R.S.—The Capacity Coefficients of Spherical Electrodes: Dr. A. Russell.—Exhibition of the Benkö Primary Battery: W. R. Cooper.

MONDAY, JULY 3.

ARISTOTELIAN SOCIETY, at 8.—Emotional Experiences of some Higher Mystics: Rev. A. Caldecott.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Explorations in Dutch New Guinea: Capt. C. G. Rawling, C.I.E.

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