NATURE

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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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September 18, 1918.

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WILLIAM COOPER,
Secretary to the Education Committee.

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THURSDAY, OCTOBER 3, 1918.

THE ECONOMY OF NATURE.

La Géologie biologique. Par Prof. S. Meunier. Pp. vii+328. (Paris: Librairie Félix Alcan, 1918, dated 1914.) Price 5.50 francs.

IN the present-day economy of Nature the various associations of living creatures work into one another's hands, so that a moving equilibrium results. One of the main ideas of Prof. Meunier's "Biological Geology" is that analogous associations have existed in the past in similar correlations, the same biocosmic *rôle* being discharged by successive types. After illustrating the geological activity of organisms in forming and weathering deposits, and in the ceaseless circulation of matter, the author takes an interesting survey of the various haunts of life and their interrelations, and brings forward evidence to show that in past ages there was a somewhat similar biocosmic pattern, with hydroplankton, hydronekton, hydrobenthon, aerial animals, terrestrial animals, even commensals, symbionts, and parasites.

Taking the sedimentary rocks in some detail, the author shows the part that organisms have played in the formation of calcareous, siliceous, phosphatic, sulphurous, carbonaceous, and other deposits, and in the erosion of rocks which their predecessors had helped to form. The author's emphasis is all on continuity—a continuity of "terrain," an ocean with the same chemical character since life began (as Silurian salt deposits testify), an atmosphere without any great change, a continuous biocosm since the pre-Cambrian, with "a continuity of *régime*." Obviously the biocosm loses members, but others take their place, so that there is no change in general equilibrium, or in what Prof. Meunier goes the length of calling the "impeccable harmony" of interrelations. In emphasising a truth the author commits an exaggeration.

It is strange that a naturalist who lays so much stress on continuity should be a champion of the theory that new forms appear suddenly. Thus in speaking of the appearance of *Cardium porulosum* in the beds at Grignon he writes: "What Nature seems to show us is a brusque phenomenon, without hint of a precursor of any kind, as the result of which a living creature comes to add itself to the series already existing." What occurs is not a transformation of species, but a replacement. A species has a life and "personality" like an individual: it is born, it develops, it reaches its climax, it wanes, it exhausts its share of "vital force," and disappears, only to have its place taken by another species, slightly different, but likewise in harmonious relation with the constant properties of the environment. Prof. Meunier recognises the profound changes which the intervention of vital activity made in the economy of the earth, but once organisms had firmly established themselves there has been, he maintains, no environmental change of moment, only change in secondary features, such as the distribution of surface temperature. It seems a strange position to recognise that the appearance of organisms changed the whole venue, and yet to deny that the establishment of grasses and mammals, of flowering plants and their insect visitors, and so on, has made no appreciable difference in the animate environment.

The author seems to us to have missed a cardinal fact—the evolution of the environment—and to have failed to realise how complex a system of relations the present-day environment of an able-bodied, active-minded animal is. Yet he lays emphasis on what animals and men are continually doing in modifying their environment. These modifying agencies seem to Prof. Meunier to show how well adapted the general environment is to the exigencies of organic life. The constancy of environmental influences, which we believe he exaggerates, appears to him to form a "decisive objection against every transformist doctrine that supposes organismal transformations to have been determined by external changes." But transformists are not restricted to any crude Lamarckism. To Prof. Meunier vital energy is a dynamic entity, like crystallogenic energy, capable of passing from one heavenly body to another like light or heat, capable also of remaining for a long time latent, but likewise of manifesting itself in favourable environment, and of expressing itself in a "perfectionnement organique" as time goes on.

It seems to us that the day is past for half-hearted evolutionists, and we have no sympathy with Prof. Meunier's extraordinary view that evolutionists are embarrassed by finding among aquatic animals so many different solutions of the problem of respiration, or by knowing that in the course of ages cetaceans have shown no trace of any transformation of lungs into gills. The best idea in the book is that the earth and sea and sky and all that in them is form a sort of organism that grows as a whole with continuity, keeping up a harmonious correlation, a balance, a *systema naturae*, which changes from age to age, and yet remains in principle the same.

WATER SUPPLIES FOR RURAL DWELLINGS.

Rural Water Supplies and their Purification. By Dr. A. C. Houston. Pp. xv+136. (London: John Bale, Sons, and Danielsson, Ltd., 1918.) Price 7*s.* 6*d.* net.

THE private isolated water supplies of the scattered rural population are often dangerously polluted; and there are many who would be glad to do what is possible to remedy matters, if they were informed of the dangers they run and the best practical means of escaping from them. But this small work will not prove of great value to the majority of dwellers in rural districts, whose need is for some simple, detailed expedients for easily reducing the risk and inconvenience attendant upon a water supply which is unsuitable from the point of view of either quality or quantity

(or, maybe, both); for the book is almost entirely devoted to the means available for purification by chemical methods. These methods are the least easy of adoption of all known methods of guarding against water-borne disease in the dwelling, where even simple domestic filters so rarely receive the comparatively little attention they require to maintain satisfactory working conditions.

The author points out in his preface that the expert will find little by way of instruction in a book which is offered more particularly to those who are inexperienced, but zealous to learn. This latter class of reader will be confused and discouraged by all the chemical matter included.

Where the consumer is at risk from specific water-borne infection the domestic methods of sterilising water are so rarely a success that the practical sanitarian advises them only as a *dernier ressort*; he always favours the safer alternative of adopting every available means of preventing such contamination. But the problems of obtaining in rural districts drinking water that is satisfactory in quality and quantity, and of guarding its purity, are so lightly discussed in this work that the reader will look in vain for usefully detailed guidance under this head.

The author is conscious of the shortcomings of his statement, for his final paragraph is as follows: "In this brief account of rural water supplies and their purification, the author has doubtless failed in many particulars, but if the reader cares to write and explain his (or her) difficulties, or to offer any suggestions or criticisms, the author will endeavour to answer any such communications to the best of his ability." If the work is extensively read by the uninitiated, it should bring him much correspondence. The following are among the questions that may be raised even by the well-informed reader: Is it not taking an extreme view with reference to roof-collected rain-water to regard it as "potentially unsafe, if not actually dangerous," from the point of view of water-borne infection, and therefore to maintain with reference to it that "the first thing to consider is how rain-water can be best sterilised"? Is it really "out of place" to describe methods of separating the first washings from the roofs, and of collecting and storing rain-water in bulk; and, if so, why is this done on pp. 124–28?

The book is disappointing, the more so because it is written by one whose practical work upon water supplies has won for him much well-merited recognition.

A NEW ZOOLOGICAL STATION

Tropical Wild Life in British Guiana. By William Beebe, G. I. Hartley, and P. G. Howes. With an Introduction by Col. T. Roosevelt. Vol. i. Pp. xx+504. (New York City: New York Zoological Society; London: Witherby and Co., 1917.) Price 12*s.* 6*d.* net.

THIS handsome volume, profusely illustrated with original photographs of scenery, plants, and animals, is the first-fruits of a new zoological station which has suddenly come to blossom in British Guiana whilst the Old World was already in the midst of the all-absorbing war.

The sub-title explains this unexpected growth: "Zoological Contributions from the Tropical Research Station of the New York Zoological Society." In the words of one of the authors, it marks the beginning of a wholly new type of biological work, capable of literally illimitable expansion. It provides for intensive study, in the open field, of the teeming animal life of the tropics. Cordial hospitality is extended to all naturalists to secure, without jealousy, from whatever source, the most thorough research possible. Every original investigator fit to work in the field is sure of an eager welcome and of all possible aid in his studies.

Mr. Beebe, with his previous experience of British Guiana (*cf.* "Our Search for a Wilderness," New York City, 1908) as directing curator, and Mr. Hartley and Mr. Howes as research associates, established themselves in March, 1916, at Kalacoon House, Hills Estate, Mazaruni River, British Guiana, and stayed there until August, 1916. The place is about 40 miles from the coast, near the Essequibo River, just above the marshy alluvial zone, still within reach of the tide. Schists and outcropping granite, clay subsoil and sand-dunes, are all covered with dense jungle. The field of intense operation was restricted to half a square mile around the station, a clearing for india-rubber. Close by a square mile is covered with second growth, some three years old, already 20 ft. high, affording valuable comparison with the primeval forest, since this new area is composed of its own flora and fauna.

Work was begun at once. The present book is not a traveller's account. It plunges at once into observation and reflection concerning ever so many topics. For example, the jungle is divided into four horizontal zones, each with its characteristic flora and fauna—floor, lower, mid, and tree-tops—of which the middle zone is the heart of tropical life, whilst that above is still a closed book, for the obvious reason that it is hopeless to sit and observe on the top of the jungle. However, the authors hope next time to find ways and means to establish themselves comfortably aloft.

Concerning birds, the favourite study of the director, nearly 300 kinds were observed, half of which were omnivorous, 12 per cent. wholly vegetarian, and 38 per cent. entirely insectivorous. And, mark, "no trace of a butterfly or moth was found in any of the 400 stomachs examined." There are many observations as to diet hitherto unsuspected. The caracara, a reputed scavenger, sated himself with seeds and insects. Swallow-tailed kites, instead of terrorising other birds, lived on small fruit and large grasshoppers. Vultures were rare—at least, careful search of the sky never revealed one—but any carcass left deep in the jungle, out of sight, was within two or three days surrounded by various kinds of these birds. Being devoid of the sense of smell, were they attracted to the spot

by the buzzing of flies, or by the direct droning flight of the great scarabs?

Much is said about coloration. Mr. Beebe's "infallible test" whether a bird is protectively coloured or not is whether it "freezes," counting upon being overlooked, or whether it goes off. Lists of such and other birds are given, and many of the real, or apparent, exceptions are scrutinised. Some explanation is always available where personal bias is not hampered by actual knowledge in this "optical tower of Babel of the tropical forest."

One chapter is devoted to the life of the hoatzin, with excellent photographs of the scenery, nests, and the climbing and swimming of the unfledged babies. All this is glorified into a miracle, with conclusions about the origin of birds rather startling and a little overdone. The staff took no end of trouble about the nesting, eggs, and young of various other birds, especially toucans, about which nothing was known.

Mr. Hartley has contributed chapters on the development of external features. There is a lively chapter on the perai or cannibal fish, the *piranha* of the Brazilians. Mr. Howes treats of the life-histories of bees and wasps, with coloured plates. Mr. Rodway, of the Georgetown Museum, writes on Indian charms, and the Rev. W. G. White contributes notes of the Hinterland of Guiana.

Altogether this is a very valuable first instalment of a most promising enterprise.

DRUGS AND THEIR PREPARATIONS.

The Dispensatory of the United States of America. Twentieth edition, thoroughly revised and largely re-written by Prof. J. P. Remington and others. Pp. cxxii + 2010. (Philadelphia and London: J. B. Lippincott Co., 1918.) Price 2*l.* 10*s.* net.

IT is now three-quarters of a century since the first edition of the United States Dispensatory was published. During that period it has grown from a volume of 1073 pages to one of nearly double that size, and simultaneously enhanced its reputation as a standard work of reference for matters pharmaceutical.

The revision of the work for the present edition was accomplished by the late Prof. Remington, whose loss all pharmacists deplore, and Dr. Horatio Wood, assisted by Prof. Sadtler (Chemistry), Prof. LaWall (Pharmacy), Prof. Kraemer (Pharmacognosy), and Dr. Anderson. It has long been recognised that in the preparation of so compendious a volume, embracing various branches of knowledge, the co-operation of experts in those branches must be enlisted, and this plan has here been followed with most admirable results.

The issue of new editions of the United States and British Pharmacopœias and of the National Formulary, the appearance of many new non-official remedies, and the rapid increase in our knowledge of official remedies, have necessitated a vast amount of work by the compilers. It may at once be said that the compilation has been excellently accomplished, with the result that the United States Dispensatory is now a mine of information on all matters relating to pharmacy. It includes practically all the drugs and preparations of the United States and British Pharmacopœias and of the National Formulary, and also such of the German and French pharmacopœias as are in common use in the United States.

The preliminary pages (122) are devoted to the (American) Food and Drugs Act, to Food Inspection decisions, to the Harrison Anti-narcotic Law, a glossary, an index of diseases, and so on. The body of the work is divided into three parts. Part i. deals with all the remedies in the United States and British Pharmacopœias, part ii. with the National Formulary and non-official remedies, and part iii. with tests, test solutions, weights and measures, the art of prescribing, and cognate matters such as alcohol tables, etc.

As part i. comprises more than 1200 pages of closely printed text, it is obvious that the various remedies are comprehensively dealt with. As an example, the account of Acacia (gum arabic) may be utilised to show the extent of the information given and the method adopted for its arrangement. After an enumeration of the various species of Acacia that yield commercial gums, and a brief note on the products other than gum obtained from the tree, the nature and cause of the exudation and the method of harvesting the gum are described. Then follows an elaborate description of official and non-official varieties of gum. The general properties, chemical composition, and tests occupy three columns, the article concluding with incompatibles, adulterations, uses, and official preparations. It will be seen, therefore, that the treatment is very comprehensive and that it is possible in a few minutes and in a single volume to inform oneself very thoroughly about gum arabic. The other preparations and drugs are similarly treated, more or less extensively according to their importance. Here and there one misses the latest researches; thus in the excellent, historically arranged account of the chemical examination of rhubarb the investigations of Tutin and Clewer appear to have been overlooked, as also under "Scammoniæ Radix" those of Power and Rogerson. Such omission is, however, quite exceptional, and reference to the United States Dispensatory may be relied upon for rapid, concise, and comprehensive information on almost any drug or preparation that is or has been used in pharmacy.

OUR BOOKSHELF.

School Entomology: An Elementary Text-book of Entomology for Secondary Schools and Agricultural Short Courses. By E. Dwight Sanderson and L. M. Peairs. Pp. vii + 356. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 7*s.* net.

THIS little book is one of "Wiley's Technical Series," for the use of "various" schools in the United States of America, where such educational

matters of economic importance are well looked after, and a lesson might profitably be learned in this country in that respect. Unfortunately, it deals mainly with insects of the American continent and so cannot fill the want here. It is divided into two parts, the first dealing with general entomology, the second with economic entomology. The junior author is responsible for part i., the senior for part ii.

The illustrations are numerous, and those in part ii. excellent, being mainly reproductions from the publications of the United States Department of Agriculture. Most of those in part i. are photographic reproductions, and this process does not lend itself to this subject, some of the figures being very indistinct and fogged and taken from very badly set specimens. The various orders are dealt with in a clear and simple manner, and there is a chapter on insect collection.

In the economic part the following are dealt with: insects affecting man and domestic animals, including ticks, mosquitoes, fleas, and warble-flies; insects affecting household goods; field-crop insects; and garden and orchard insects. There is also an excellent chapter on insect control, and appendices dealing with useful papers and books on American insect pests. F. V. T.

The Chemical Analysis of Iron: A Complete Account of All the Best-known Methods for the Analysis of Iron, Steel, Pig-iron, Alloy Metals, Iron Ore, Limestone, Slag, Clay, Sand, Coal, and Coke. By A. A. Blair. Eighth edition. Pp. 318. (Philadelphia and London: J. B. Lippincott Co., 1918.) Price 21*s.* net.

BLAIR'S "Chemical Analysis of Iron" has long since made a name for itself among technical manuals. About a quarter of a century has elapsed since the writer of this notice first used the book, the second edition of which had just been published; and it is not surprising to find that so useful a work is still in demand.

Much has happened in the world of iron analysis since those days. Chiefly the changes have been in the increased use of steel alloys containing more or less of the "rare" elements, such as vanadium, uranium, molybdenum, and tungsten; and also of the "alloy metals," such as ferro-tungsten and ferro-molybdenum. Methods of analysing the former group have been brought together in this edition of the book, and a separate section has been allotted to the alloy metals. To chemists who have used former editions it will suffice to say that the present one has been recast and partly rewritten to include improvements of processes, but preserves its former characteristics of concise accuracy and judicious selection of methods. To those unacquainted with the book it may be said that they will find in it all the information necessary for carrying out iron and steel analysis to any degree of completeness that may be desired. The working details are sufficiently full, but not over-elaborated, and users will find the volume a trustworthy, practical guide. C. S.

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 Study of English in Italian Universities.

MY friend, Prof. Piero Giacosa, of Turin, wrote to me some time ago requesting me to hand to you the enclosed paragraph of his letter dealing with the recently initiated attempt to bring about a scheme of educational collaboration between Italy and England. Since he wrote, the announcement has been made public that the Ministry of Public Instruction in Italy has decided upon the establishment of a number of chairs of English in the Italian universities. The suggestion contained in Prof. Giacosa's paragraph has reference to the possibilities of young British graduates acting as "lectors" for a limited period under the regular Italian professors of English, and doing work in this way as assistants to the professor.

The paragraph in question runs as follows:—

"Il Ministro della Pubblica Istruzione in Italia ha chiesto al Consiglio Superiore della Pubblica Istruzione, di dare il suo parere sulla proposta di fondare nelle università italiane cattedre di letteratura inglese. Il Consiglio ha applaudito al proposito del Ministro dichiarandolo di grande utilità per la elevazione della coltura universitaria. Gli studiosi inglesi che intendessero approfittare di queste disposizioni del Governo italiano per fare un corso di lezioni di letteratura inglese in una università italiana, possono dirigersi al Professore Piero Giacosa, Università di Torino, per avere schiarimenti al proposito."

[*Translation*:—"The Minister of Public Instruction in Italy has invited the Higher Council of Public Instruction to express its opinion on the proposal to establish a number of chairs of English literature in the Italian universities. The Council expressed its approval of the proposal, declaring it to be of the utmost value for the development of university studies. English graduates who would desire to avail themselves of these arrangements set up by the Italian Government should apply to Prof. Piero Giacosa, University of Turin, for information."]

EDWARD BULLOUGH.

6 Huntingdon Road, Cambridge, September 25.

The "Salary" of the Lecturer.

MAY I venture to direct attention to a curious inconsistency which appears to have escaped the notice of scientific men as much as it has that of the general public? Men of science and educationists are emphasising the need for a larger number of men and women with scientific training to carry out research, technical and academic, and to aid in the ordinary conduct of affairs, both now and after the war; while, judging from official educational advertisements, men with the highest qualifications are expected to train this new generation for a "salary" that compares most unfavourably with the "wages" of a factory hand. We demand that many shall receive a sound scientific education, and that able teachers for the purpose shall be provided; but either we are not prepared to pay a price which will attract any but mediocre or inefficient teachers, or we expect that those who teach will do so for the

love of teaching alone, and will obtain elsewhere the wherewithal to live.

It is not necessary to cite passages from the lectures and writings of our most distinguished scientific men dealing with the paramount necessity for more, and yet more, training in pure and applied science; the columns of NATURE provide, and always have provided, numerous examples. At the same time, any column of educational advertisements will provide numerous examples similar to the following, which are quoted from a recent list of "official advertisements." A well-known Scottish college asks for "an assistant lecturer for physics department; salary 150*l*." A "chemistry tutor for a large teaching institution in London" is required; he must be "a high honour man, with teaching experience"—so that a youth who has just left college is *not* indicated—and 240*l*. is offered! Thus, either we are satisfied that a large proportion of university and college teaching shall be in the hands of men and women whose market value is only about 200*l*. a year—less than a moderately intelligent manual labourer in a munition factory can earn—or we expect our best-trained and keenest men and women, just because they happen to have the ability to teach or a liking for teaching, to accept a wage which will not allow them to live in a manner fitting to their station, and renders the proper feeding and schooling of their children a constant anxiety, and sometimes almost an impossibility. Certainly there is a third possible explanation: that no one has ever troubled to think about the matter! Is it not time for something definite to be done to remedy this state of affairs—a state which is obvious to anyone who happens to read both the text *and* the advertisements of any scientific journal? Moreover, the outlook for science teaching is serious, because one result of the war will be to open many promising careers to men and women with scientific training, and it is quite safe to say that, unless the position of the university teacher is very much improved, no one who can possibly obtain an appointment elsewhere will undertake the work of teaching unless he or she be a person of independent means. E. R. MARLE.

B.E.F., September 17.

The Arboreal Descent of Man.

PALÆONTOLOGICAL evidence for the arboreal habit of the stem Placentals has been adduced by Matthew (1904). In particular, for the Primates the derivation of the order from large-brained arboreal Insectivores resembling in many ways Tupaia and Ptilocercus is indicated by many considerations (Gregory, 1910). Therefore, there are two possibilities: either the Hominidæ are directly descended from such a stock, and this is what Prof. Wood-Jones holds, or indirectly—that is, through an intermediate anthropoid stage, as is held by American palæontologists; but even in this case, as monkeys are arboreal animals, it is evident that Hominidæ never passed through a quadrupedal stage. V. GIUFFRIDA-RUGGERI.

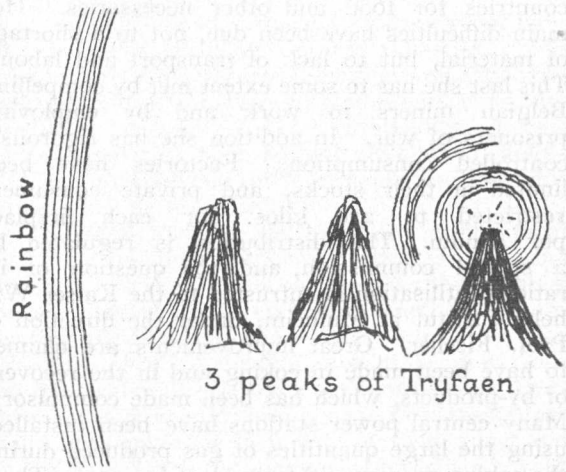
Istituto di Antropologia, R. Università,
Napoli, September 17.

A Curious Rainbow.

IN North Wales, on August 20, about two hours before sunset, I saw a rainbow-effect which was quite new to me.

The summit of Tryfaen (some four miles north-east from that of Snowdon) has three sharp, rocky peaks running roughly north and south.

We had climbed up the eastern cliff in a south-westerly gale, which brought up much cloud with some light showers, and were sitting just below the top of the southern peak. The Holyhead road lay north-east and 2000 ft. below us. From it rose the upright portion of a brilliant rainbow. At the centre of its circle was the shadow of our peak with those of the other two peaks to the left of it, all sharply defined. Around the shadow of our peak was a most vivid and persistent bow, the smallest I have ever seen, the radius of the inner edge being about half that of the outer. The central space changed a good deal, being frequently almost filled by a diffused yellow glow, which sometimes appeared to condense towards the centre until it resembled a nebulous sun on a whitish ground, while at intervals little yellow



streamers seemed to radiate from it to the inner edge of the bow. Outside this bow (which had the colours in regular rainbow order, red outside) was part of a third bow of perhaps double the diameter, but dim and intermittent.

We stood up and made gestures, expecting some sort of Brocken effect, but could detect none. However, as we were not on the extreme summit, and the cloud was very distant, our shadows would at best have been extremely minute.

Out of many "Brockens" that I have seen in different parts of the world the most vividly coloured was in Arctic Norway, the most curious and unexpected was on a blazing August day at sea-level in Portugal, and the most realistic on the Mendip Hills in Somerset.

The last was all the more effective for being within an uncoloured and inconspicuous ring.

W. P. H.-S.

GERMAN INDUSTRY AND THE WAR.

II.

IN addition to explosives and what are ordinarily comprised under the term munitions, war requires for its prosecution a great variety of other articles, all of them more or less essential. Chief among these are coal, metals, alcohol, petrol, oils and fats, soap, glycerin, textiles, leather, wood, rubber, turpentine, lubricants, food, surgical appliances, and medicaments. It is of interest to learn how Germany has hitherto managed, in

spite of her isolation, to provide herself with these necessaries.

Coal, of course, is needed for motive power, for the production of coke for metallurgical purposes and the by-products of its distillation are required for the manufacture of explosives. Germany, in 1912, produced 175,875,000 tons of coal, and imported 10,480,000 tons, almost exclusively from this country. As regards lignite, in the same year her deposits furnished 80,934,800 tons; in addition she imported 7,276,000 tons from Austria. During the war she has seized large quantities of combustibles in Belgium, the occupied provinces of France, and Luxemburg, some of which she has been able to exchange with neighbouring neutral countries for food and other necessaries. Her main difficulties have been due, not to a shortage of material, but to lack of transport and labour. This last she has to some extent met by compelling Belgian miners to work and by employing prisoners of war. In addition she has rigorously controlled consumption. Factories have been limited in their stocks, and private consumers restricted to 250 kilos. for each fireplace per annum. The distribution is regulated by a special commission, and the question of its rational utilisation is entrusted to the Kaiser Wilhelm Institut at Mulheim, under the direction of Prof. Fischer. Great improvements are claimed to have been made in coking and in the recovery of by-products, which has been made compulsory. Many central power stations have been installed, using the large quantities of gas produced during the coking process and from blast furnaces. There can be little doubt that these measures will permanently benefit industry. It will be found that we shall have much to learn from Germany concerning the scientific use of coal, and we can only hope to maintain our position by bettering her example.

As regards *liquid combustibles* she is much less favourably situated. In 1913 she produced only 71,300 tons, and imported 745,000 tons, of which the United States furnished 574,800 tons, and Austria-Hungary 119,700 tons. The invasion of Galicia by the Russians in 1915, of course, greatly aggravated the situation, and the destruction effected by them on their retreat prevented the Germans from immediately utilising the Galician sources. They have now, to a large extent, recovered them, as well as those of Rumania. The consumption of petrol is severely restricted. So serious was the deficiency at one period that from May 1 to August 31, 1917, its sale by retailers was absolutely forbidden. The institute at Mulheim studied the methods of extracting the hydrocarbons from lignite-tar, but with what success does not appear. Germany even before the war made use of mixtures of alcohol and benzol as motor-fuel usually in the proportion of 75 per cent. of alcohol and 25 per cent. of benzol. Such a mixture cannot, however, be safely used for aviation work, especially in winter.

The exploitation of the stores of *natural gas* known to exist in Transylvania has been actively pursued, aided by subsidies from the Deutsche Bank and the powerful Hungarian banks. The gas is already distributed to Budapest, and is used as a source of power at the cyanamide works of Szentmarton.

The provision of the various *metals* needed for the purposes of war has, however, taxed Germany's energies and her powers of organisation to the utmost.

As regards *iron*, in 1913 she raised 36 million tons of ore, and imported nearly 12 million tons, of which nearly $7\frac{1}{2}$ million tons came from France and Spain, and $4\frac{1}{2}$ million tons from Sweden. She has, however, more than recouped herself for the loss of the French and Spanish ore by her occupation of the Briey basin, which produced 15 million tons in 1913. This ore is highly phosphatic, and yields a basic slag of considerable value for agricultural purposes. The production of cast-steel in Germany has gone up by leaps and bounds during the war. In September, 1914, she produced 663,000 tons, 900,000 tons in the following month, and 1,650,000 tons at the same period two years later. For a time she was able to barter her manufactured iron with neutral countries in exchange for commodities of which she had more urgent need.

Germany possesses only very small deposits of *manganese ore*; in 1913 she imported 680,000 tons, of which 447,000 tons came from Russia, and 178,000 tons from India. She had, however, considerable stocks in hand on the outbreak of war, which sufficed for her needs for some twenty months of hostilities, thanks to the successful efforts of her metallurgists to diminish the proportion of ferro-manganese needed for the production of steel. At the present time the greater amount of manganese needed for German industry comes from Siegerland. The limonites and braunites of Nassau, as well as the deposits of Giessen, Bingerbruck, and the Hartz, are also actively worked. Manganiferous ores have been recently discovered in Carniola and in the Elbogen district. Thanks to the economies in the use of manganese in the manufacture of steel, due mainly to the action of the Mining and Industrial Society of Germany and Luxemburg, and of the Hasper Company, which have gratuitously placed the results of their investigations at the service of her steelmakers, Germany was able to reserve the Thuringian and Hartz deposits exclusively for her chemical industries.

Of all the metals she needs, none has caused her greater concern than the provision of *copper*. In 1913 she imported 225,000 tons, of which 185,000 tons came from the United States, the rest being furnished by England, Serbia, Sweden, and Belgium. In this case she soon felt the influence of the blockade. As is well known, she has remorselessly requisitioned all articles of copper and brass, not only at home, but in Belgium, Serbia, Rumania, Russia, and wherever her armies have penetrated or her submarines have been able to operate. She has substituted iron for copper whenever possible, as in electric conductors and tele-

graph and telephone wires. She has reopened abandoned workings at Mansfeld and in the Siegerland, at Oberstein, Niedermohr, etc., and of course she has not neglected to utilise the mines of Maidanpek in Serbia. Her internal production of copper grew from 25,300 tons in 1913 to 35,000 tons in 1916; but she has felt the wastage of war with increasing severity, and there is no doubt that the continued provision of copper is becoming practically an insoluble problem.

For *aluminium* Germany before the war was almost wholly dependent upon foreign supplies. In 1913 she consumed about 12,500 tons, of which she imported 4000 tons from France and 6000 tons from Switzerland. As this metal was wholly derived from French bauxite, the exportation of which was forbidden, Germany had to seek elsewhere for the mineral. Bauxite equal to the French material was found in Hungary and Carniola, and works have been established to treat the produce of the valley of the Zud, Bihar, and Kolosz. The Swiss manufactories now use this bauxite, as well as the affiliated German works, at Neuhausen, Mühldorf-on-the-Inn, and elsewhere. The Central Powers are therefore independent of outside sources of supply, and their output of the metal is sufficiently large to enable them to use it in lieu of other metals of which they are deficient. The manufacture of aluminium is now an established German industry.

Germany obtains considerable amounts of *lead* from Upper Silesia and from the left bank of the Rhine. In addition, before 1914, she imported notable amounts of ore from Australia and Belgium. Whenever possible zinc was substituted for lead, and water-pipes were even constructed of papier-mâché. As regards *zinc* she suffered from no special shortage, and its price experienced no very great increase. *Antimony* was largely replaced by other metals, although the works at Przibram, Pernek, and Jaszy still continued to furnish supplies. Most of her *tin* ores before the war came from Bolivia and the Dutch Indies. On account of the blockade she worked some small deposits of cassiterite in the Hartz mountains, but there is no question that she suffered greatly from lack of the metal. All tinning was prohibited, and, indeed, much ware was detinned. It will be remembered that some 181,000 lb. of tin was among the return American cargo of the submarine *Deutschland* in September, 1916. Germany was no less short of *nickel*, for which she was dependent, before the war, on New Caledonia and Canada. Nickel deposits were, however, discovered at Crajova, and have since been actively worked. The *Deutschland* brought back from the United States 752,600 lb. of this metal in September, 1916. Germany obtained all the *mercury* she needed from Austria-Hungary and from Asia Minor. Asia Minor also furnished her with small quantities of *chrome* ore. *Tungsten* and *molybdenum* ores were discovered and worked in Austria-Hungary.

Owing to the necessity of using large quantities of potatoes for food, and as a consequence of the shortage of sodium nitrate as a fertiliser, the production of *alcohol*, so necessary for the manufacture of munitions, experienced a very serious set-back, and a number of methods of meeting the deficiency were employed. Abandoned processes were resuscitated, and new schemes, such as that of working up the sulphite liquors in the manufacture of wood-pulp, already in operation in Sweden, were established. The cellulose factory at Königsberg at the end of 1917 was producing about 1½ million litres of 95 per cent. alcohol by this process. Attempts have been made to effect the synthesis of alcohol from acetylene, itself derived from calcium carbide. As a war measure this may be possible, as also that due to the saccharification of wood by means of dilute sulphuric acid, but such processes can have no permanent effect on German industry. It is only by the most rigorous methods of economy, such as limiting or even forbidding its consumption as a beverage, and by withholding it from certain industries, such as that of celluloid, unless working for the war, that Germany has been able to meet her necessities.

As is well known, the continued provision of oils, fats, and their associated products, soap and glycerin, has occasioned our enemies the greatest concern, and almost every known method of augmenting the supply from internal sources has been resorted to, such as the oxidation of lignite-tar oils and the treatment of ozonides. Various substitutes for soap have been devised, made of clay, kaolin, chalk, etc., mixed with silicate of soda, glue, and an antiseptic such as boric or salicylic acid, with sufficient saponin (usually quillaya bark) to produce a lather. The Kriegs Anschuss placed on the market a soap consisting of fatty acids and saponified resins with clay and sodium carbonate at a maximum price of 20 pfennigs for 50 grams per head per month. This is supplied to hospitals, doctors, and certain groups of workmen. Such industries as textiles, leather, bleaching, and dyeing have been seriously incommoded, and recovery processes have been rigorously insisted upon. The deficiency of fats has of course affected the production of glycerin. Its therapeutic employment has been practically forbidden, and its recovery whenever possible is compulsory. A solution of calcium chloride is employed as a substitute in certain industries. Ethylene glycol has replaced it as a medicament, and in the preparation of films, in printing, and in lithography. Various vegetable decoctions stabilised by antiseptics are also used. Concentrated solutions of lactate of soda and of potash, under the names of "perglycerin" and "perkaglycerin," have been introduced into pharmacy.

The space at disposal does not allow of any account of the methods to which our enemies have been driven in dealing with the urgent problems of textiles, leather, and paper. For *turpentine* they were wholly dependent upon supplies from America, France, and Russia, and a variety of substitutes

had to be devised, chief among them "lignite-resin" and "coumarone-resin," the manufacture of which has assumed considerable proportions since the war (11,000 tons in 1916).

Germany had accumulated large stocks of *rubber* prior to the outbreak of war. In 1915 she placed its sale and use under stringent regulation. Various substitutes, such as "Ruttenlattich," the exudation from *Euphorbia palustris*, have been employed. Recovery processes have been largely developed, and foreign gums introduced into the recovered material. It is known also that synthetic methods have been worked out, and are said to be in operation on a large scale. It has been asserted, indeed, that Germany has thereby made herself independent of foreign supplies. At the same time it is known that her commercial submarines brought her upwards of 800 tons of rubber in 1916.

MM. Jaureguy, Froment, and Stephen conclude their interesting account with an appreciative recognition of the services which German chemists have rendered to their country. It is largely owing to their activity that the Central Powers have been enabled to meet the deficiency of *matériel* which the stringent blockade of the Entente has caused them.

THE WAR AND PSYCHOLOGY.

THE effect of the events of the last few years upon any science may be regarded from two points of view. First, it may be asked: In what ways has the science rendered help in the solution of the problems raised by the war? Secondly: How far has the appearance of these problems tended to change the outlook and the future programme of work for the science itself? With regard to psychology, it is now possible to attempt an answer to these questions. We may consider, first, the relation of psychology to medical treatment.

By this time there exist numerous publications dealing with the nature and treatment of the protean malady which is inadequately termed "shell-shock." The methods of treating this complex of disorders are almost as numerous as the disabilities themselves. It may fairly be said, however, that these methods either are psychical in nature, or, if accompanied by physical auxiliaries, contain a relatively generous admixture of mental treatment. They range from *force majeure* in one direction to sympathetic persuasion in another, and to subtle psychological analysis and re-education in yet a third. Let us ask our first question: In what way has psychology helped in the alleviation of these conditions?

A simple, straightforward exponent of "firmness" methods might reply that no knowledge of psychology at all has been needed, but merely the will power and personality of the physician. On examination, however, this answer would be found to refer to his successes only. Not only a particular type of physician, but also an equally specific variety of patient and of malady are required for the achievement of simple victories of this kind. Such treatment is often strikingly successful in the class of case which presents obvious objective disabilities, such as the various kinds of "functional" paralysis. Its value is definitely less in those numerous cases the troubles of which are entirely or mainly of a subjective nature. Such disorders as inability to concentrate attention, loss of memory, insomnia, terrifying dreams, emotional instability, and morbid anxiety may on occasion yield to the "firmness" method. Usually, however, if treated in this way, they merely demonstrate the existence of reciprocal firmness on the part of both physician and patient. As a result of experience, too, it is found that sympathy alone will not suffice to cure many of these patients. A penetrating analysis of the tangle of causes which have led to their present condition, followed by thorough "re-education," is often necessary. In such treatment a knowledge both of psychological theory and of technique has proved to be indispensable.

Moreover, the physician who is at the same time a psychologist has found ample scope for his activity in another direction, the reassuring of his patient. To the ordinary man the idea that other people's minds may work in ways different from his own is usually quite foreign. When, therefore, a great shock causes his mind to develop a new trick he is usually quite unprepared for it, and frequently develops the fear of impending or actual insanity: a fear which, for many very cogent reasons, he keeps to himself as long as possible. This fear may be dispelled if his medical officer is able to impart to him some knowledge of the considerable transient and normal variations in the mental happenings of different individuals.

It is important to point out here that, while a knowledge of the "normal" psychology expounded in the ordinary English text-books has been of no little use, especially in the direction last described, much more help has been obtained from the writings of those workers in the sister science, psychopathology. As is well known, their indefatigable industry and prolific speculation have aroused considerable discussion in recent years. Informed criticism of this work, however, is at present very rare, and it is only fair to say that little of it is to be found in English journals. A change of attitude towards the psycho-analytic movement is now clearly noticeable among psychologists. While at one time psychology dealt merely with the description and classification of "states" of consciousness, there is now universal acknowledgment of the fact that many of our thoughts, beliefs, and actions are due wholly or in part to motives and causes of which we ourselves may be partly or wholly unconscious. To correct such thoughts and beliefs necessitates the discovery of the factors which were originally responsible for them. Hundreds of cases of mental and nervous disorders arising from war

experience have demonstrated this truth, which is now clearly realised. Methods owing their origin to the pioneer investigations of Freud, Jung, and others are now being widely used even by workers who do not necessarily agree with the theoretical views held by these writers.

We may now consider the way in which the medical problems of the war have affected the outlook of psychology. It seems certain that after the war greater emphasis will be laid upon the importance of instinctive and emotional factors and upon the power of non-rational beliefs to influence conduct. "Individual" and "social" psychology can no longer be regarded as separate departments. The rather exclusively intellectualistic viewpoint of psychology will be enormously modified and supplemented. In justice to psychology it should be pointed out that in the years preceding the war the beginning of this change of aspect in England was clearly apparent in the writings of such workers as Hart, Ernest Jones, McDougall, Shand, Trotter, and Graham Wallas.

This newer psychology, if properly taught, will be of distinct help to medical men in enabling them to deal more scientifically with the enormous and daily increasing number of mental and nervous disorders which are attributable, directly and indirectly, to the war.

In conclusion, brief reference should be made to another problem the urgency of which is great, but towards the solution of which almost nothing has yet been attempted in our own country. We refer to the scientific selection and training of persons for important tasks demanding special innate and acquired aptitudes and capacities. The war has demonstrated, and is demonstrating, in a depressingly convincing way the ease with which square pegs may be placed—and kept—in round holes. The physical capacities of recruits for the Army have usually been tested before they have been allotted to their special work; but in scarcely any case has there been any scientific attempt to determine how far they are mentally fitted for the exacting tasks allotted to them.

As this article is being written an instructive contrast comes to hand from the Surgeon-General's Office at Washington. In the *Psychological Review* for March, 1918, Major Robert M. Yerkes describes "the history of the organising of psychological military service" in the United States. We may mention here one point of interest. The lowest 10 per cent. and the highest 5 per cent. discovered in the psychological examination of recruits were subjected to a searching individual examination, on the basis of which a special report was made to the medical officer. The example of such a rational attempt to discover the incompetent and the specially competent before, and not after, valuable time has been wasted may be recommended to the consideration of all who are anxious to further the best employment of our human resources.

T. H. PEAR.

THE TOTAL SOLAR ECLIPSE OF JUNE 8, 1918.

OBSERVATIONS of the solar eclipse of June 8 appear to have been very successful on the whole, notwithstanding the general prevalence of cloudy conditions along the path of totality, extending from the State of Washington to Florida. Preliminary accounts of the work of the parties of observers from the Lick and Mount Wilson observatories are given in the August issue of the Publications of the Astronomical Society of the Pacific (vol. xxx., No. 176), and of those from the Yerkes and numerous other observatories in the August-September issue of *Popular Astronomy* (vol. xxvi., No. 7).

Prof. Campbell's party was located at Goldendale, Washington, and on an otherwise completely cloudy day the sun was seen in a perfectly clear gap from less than a minute before totality to a few seconds after the end of totality. With a lens of 6-in. aperture and 40-ft. focal length, pointed directly at the sun, photographs of the corona were obtained which are described as surpassing in definition any previously obtained by the Lick observers. The corona was remarkable for the sheaths of streamers which surrounded all the principal prominences, and Prof. Campbell remarks that "it seems impossible to question that the forces in the sun responsible for the prominences are the forces which are responsible for the coronal streamers situated near the prominences." Excellent photographs of the corona were also obtained with other instruments, and streamers to the east of the sun were recorded to about three solar diameters. Special cameras were employed for registering the brighter stars in the region near the sun for the purpose of testing the Einstein effect, and as stars fainter than 8th magnitude are shown on the plates it is possible that measurements may lead to important results. A spectrogram obtained with a three-prism spectrograph, showing the spectrum of the corona east and west of the sun, with iron comparisons, was taken for the accurate determination of the wave-length of the well-known green line of "coronium," and a preliminary measurement has shown that the wave-length differs very little from 5303·0 A. With a single-prism spectrograph, the well-known coronal lines 3601, 3987, 4086, 4231, and 5303 were photographed, and seven other bright lines were suspected. On these plates the coronal spectrum only extends 6 or 7 minutes of arc from the edge of the sun, and no absorption lines appear in this region; the inner corona thus appears to be radiating its own light, and does not reflect sufficient sunlight to impress the Fraunhofer lines on its continuous spectrum. The irregular distribution of "coronium" was successfully recorded by the use of an objective-grating adjusted for the green line in the third order spectrum. Five observers gave attention to the "shadow band" phenomena at the beginning and end of totality, with results which appear to be more definite and accordant than on any previous occasion. With reference to the

origin of these bands, Prof. Campbell considers that the rapid cutting off of the sun's rays before totality, and the reverse process following totality, may conceivably produce temperature or density gradients in the earth's atmosphere which may be favourable to effects upon the solar rays analogous to diffraction.

Prof. E. P. Lewis, who was associated with the Lick observers, employed a large quartz spectrograph, an objective prism with double-image prism for studying possible polarisation in the lines, and a double-image camera for investigating the integral polarisation of the corona. Strong polarisation of the corona was recorded to a distance greater than the solar diameter.

At Green River, Wyoming, where the Mount Wilson observers were stationed, the sun was partly covered by clouds during totality. A fairly good photograph of the corona, however, was secured by Mr. Ellerman with an 8-in. objective of 30-ft. focal length, and Dr. St. John was partially successful in his work on the spectrum of the corona. The scale of the spectrograph employed was 6 A per millimetre in the region of the green line, and the slit coincided with the sun's equator on an image 2 cm. in diameter. An iron arc comparison impressed on the plate leads to the wave-length 5303·204, on Rowland's scale, for the green coronal line on the east limb of the sun, but the west limb was unfortunately obscured by clouds. If it be assumed that the rotation of the corona is of the same order as that of the chromosphere, the corrected wave-length becomes 5303·239. It is important to note that the photograph gave the impression that the green line might have appeared less simple with a stronger exposure. Some valuable records of the spectra of the prominences and upper chromosphere were also secured with a concave grating objective spectrograph.

The principal station occupied by the Yerkes observers was also at Green River, Wyoming. Prof. Barnard obtained photographs of the corona and prominences with a 6-in. lens of 60-ft. focal length, and others with a photographic objective of 12-in. aperture, which are stated to show the prominences with an excellence of definition rarely equalled. An extensive programme of spectroscopic work was planned by Prof. Frost, but the clouds were too dense to permit of successful results in all cases. The chief novelty was the use of a moving-picture camera for recording the successive changes in the chromospheric spectrum near the beginning and end of totality, the ordinary lens of this apparatus being replaced by an objective prism and a lens of 40-cm. focal length. Exposures were made at the rate of sixteen per second, and, in spite of some interference by clouds, many hundreds of interesting spectra were obtained. Photometric measures, and photographs of the coronal rings for measurement of the intensity and distribution of light within the corona, were obtained by Prof. Parkhurst.

An expedition from the Lowell Observatory, under the direction of Dr. V. M. Slipher, was located near Syracuse, Kansas, and here also the sun was covered by thin cloud during totality. The large-scale photographs, however, show much delicate detail, and the shape of the corona is described as lying between the maximum and minimum types. Arches of coronal matter above the brighter prominences were conspicuous, apparently showing the influence of the prominences upon the structure of the corona, as also noted by Prof. Campbell. Numerous spectroscopic photographs were obtained, and one of those taken with a single prism shows the solar absorption lines in the outer corona in addition to the emission lines and continuous spectrum of the inner corona. A preliminary measure gave 5303·0 for the wave-length of the green line. Photographs of the green ring with a slitless instrument show that the irregularities have no relation to those of the hydrogen and helium rings, and there is no obvious correlation between the prominences and the inner corona.

Successful observations were also made by expeditions from the United States Naval Observatory, the Smithsonian Astrophysical Observatory, the Sproul Observatory, and other institutions. The only permanent observatory in the belt of totality was the Chamberlin Observatory at Denver, and it is unfortunate that the 20-in. refractor and other instruments assembled for the occasion could not be utilised on account of dense clouds.

MODERN STUDIES IN SCHOOLS.

THE report (Cd. 9036, price 9*d*. net) of the Committee appointed to inquire into the position of modern languages in the educational system of Great Britain, published shortly after that of the Committee on the position of natural science, which was summarised in NATURE of April 18, p. 135, was awaited with peculiar interest. It was expected to put new life into the modern sides of schools, so that modern language teaching should afford some gift which the study of languages can best provide. The questions really are: What is the part which the study of modern languages shall take in the creative life of the world, and what is its distinctive message? Without some high purpose the modern sides of schools must be dull and mechanical. We looked for inspiration, but have been disappointed. The members of the Committee are not themselves inspired with enthusiasm for the part that modern studies shall take—which the studies alone can take—in the uplifting of the world.

The truth is that with the authors of the report the study of modern languages is their second love. So we are met at the threshold with business and diplomacy. It is true that, later, the report seeks some higher purpose, but only half-heartedly and without the enthusiasm of conviction. Commerce, we are gravely told, "is one of the principal ends of education, if it is not the whole of it"; and the Committee has consulted a large number of commercial firms. But ideals which are springing into life, which it is the essential work of education to foster, may transform the whole of our commercial

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system—may, indeed, make an end of it. After the war, the report says, "keen emulation will be encountered, lost ground must be recovered, new openings must be found," and so on; and modern languages must be taught so that boys may be prepared to join in this commercial warfare or in the higher warfare of diplomacy. Though it may be questioned whether the success of a nation is due entirely to these things, the Committee leaves no doubt as to its own views. The value of business is stated quite candidly and unconsciously. "Our foreign trade does not comprise the whole of our activities, but the whole of our activities depend upon it." "After the war we shall want it more and more if we are to enter into the commercial conflict and succeed in the struggle" To the honour of schoolboys be it said, they will not be inspired with a consuming zeal for study by these business outlooks on life.

We submit that the duty of the Committee was not to supply service of this kind, or to satisfy the demands of either commerce or diplomacy. Its privilege was to impress new ideals into the service of the State; to inspire and send forth new workers into all parts of the national life. Whatever views we may hold on the historical, social, or economic questions of this or any other country —and the Committee does not conceal its own views—we might have expected in the report nobler foundations for these new modern studies.

The report is on pleasanter ground when it considers the special value of modern languages in the interchange of knowledge and ideas between the nations of the world. The Committee reminds us that no country can afford to rely on its own domestic stores of knowledge and ideals; and scientific workers are advised to make themselves familiar with as many modern languages as possible. "The whole civilised world is a co-operative manufactory of knowledge" and of ideals. "New researches are constantly leading to new discoveries, new and fruitful ideas are giving new pointers to thought, new applications of old principles are being made, and in this work all civilised countries can collaborate." We would that the Committee had made these fruitful thoughts more pronounced and more vital in its report, and that it had shown how to apply them in the school life. It is possible that this union of thought and endeavour between the nations is the gift for which we are searching.

When, however, the Committee definitely turns to the value of modern studies in education it becomes apologetic, and has no advice to offer but that the modern language master should copy his classical colleague and try to live up to his standard of culture. The value of classical studies is set forth in the well-known form, and the search for the new spirit which the study of modern languages might invoke is abandoned.

The opinions of the Committee on educational methods are astonishingly reactionary, and would be alarming if they proceeded from men who were themselves trained in modern studies; but the surprising, and to that extent reassuring, fact is that most of the Committee are men who have gained their inspiration from the classics, and not from modern language study. They lament that "instruction cannot be universal; it must proceed from the more instructed to the more ignorant." Or, again: "Modern studies can only work through the few to the many, through the many to the multitude." This is certainly contrary to natural methods of progress, and is opposed to the modern methods of education which have been suggested by science. It is to be regretted that the Committee did not include any representative of science. The sister Committee on science had the help of at least two modern language scholars.

The report is influenced by the Board of Education. This is easily traced in the appearance of "coherent" education and co-ordination. Coherence appears in most of the Board's circulars. It has worked woeful ruth with evening schools, continuation classes, and technical education. It reaches its sublime limit in the advocacy of classics as the dominant study for admission to the Higher Civil Service—for which the classical education is described as the most coherent of courses of study.

INSURANCE AND ANNUITIES FOR COLLEGE AND UNIVERSITY TEACHERS.

THE recently issued twelfth annual report of the president and treasurer of the Carnegie Foundation for the Advancement of Teaching is one of much importance in connection with the question of life insurance and pension provision for college and university teachers in America. Twelve years ago the above corporation was founded in order to provide pensions for the college and university teachers in the United States, Canada, and Newfoundland, and during this period it has, without doubt, not only proved a boon to the beneficiaries, but also increased the attractiveness of the teaching career. But the experience of the past twelve years and a careful study of the whole problem have led the trustees of the foundation to the conclusion that the principles on which they have acted in the past have been unsound. While insisting that the payment of pensions to men who, like college and university teachers, are in receipt of fixed and rather modest salaries must be regarded as a matter of right, and not of favour, the trustees have become convinced that no system of free pensions can be devised which will not in the end affect the teacher's pay, and that the contributory system of annuities is the only one which society can permanently support.

The trustees are, therefore, driven to the conclusion that the policy of free pensions which has been pursued during the past twelve years is unsound, and they have decided to act sincerely and courageously on the strength of their newly formed convictions, while at the same time acting justly towards those present teachers who have come to regard the present rules of the foundation as in the nature of a contract. An additional

reason for reconsidering their policy is found by the trustees in the fact that the very considerable additions which have in recent years been made to the ranks of the teachers promise to impose a strain on the funds of the foundation far beyond their powers to support.

The purpose of pensions is to ensure to the teacher economic independence at the close of his productive life. Without such provision the work of the teacher cannot be carried on without undue care and apprehension, which lower the quality of the teacher's work. But there is another point to which attention is less often given—namely, the necessity of freeing the teacher from the apprehension of the economic dependence of wife and family in the event of his death. In the case of the young married teacher this apprehension is probably more powerful and more detrimental to good work than the former. As the present report emphasises, however, the problem of the annuity cannot be financially separated from the problem of life insurance during the productive period of the teacher's life.

It is of much interest to notice that the conclusions reached here are fundamentally quite similar to those arrived at by the commission on the superannuation system for the federated universities of Great Britain. Whereas, however, in Great Britain, owing to the comparatively small number of teachers involved, and for other reasons, the insurance and annuity contracts are carried out through the agency of existing insurance companies, the trustees of the Carnegie Foundation have decided to found a special teachers' insurance and annuity association to be organised, under the laws of the State of New York, so as to represent primarily the interests of the policyholders, to whose scrutiny and oversight it would be subject. In this way insurance can be effected at a lower rate than is possible with insurance businesses carried on for profit, and the benefits to be derived under the proposed scheme appear to be appreciably greater than those accruing under the British scheme. With regard to the combination of life insurance with annuity provision, the trustees point out that this can be effected best by a combination of so-called term insurance with deferred annuity insurance. By this means, by the payment of the same total sum as is contributed under the pension scheme a much greater protection is given to the dependents of the insured during his productive life, without greatly diminishing the value of the annuity should the insured live to the pensionable age. The suggestion is well worth the consideration of authorities in this country.

ON COLOUR SENSITISED PLATES.

UNDER the above title, in the issues of NATURE of February 18 and 25, 1915, we described the general character and some of the typical uses of colour sensitised plates—that is, plates made sensitive to colours to which the simple gelatino-bromide of silver is practically insensitive. The additional sensitiveness is produced by the incorporation of dyes with the emulsion or by their application to the finished plates, and we pointed out that when a continuous spectrum was photographed on such plates, there was clearly shown the original maximum of sensitiveness of the silver bromide and the new maximum or maxima added as the result of the special treatment. Plates made sensitive to all the colours of the visible spectrum would thus have three or four maxima, instead of only one. This irregularity was obviously one cause of the difficulty of getting the complete control of the colour effect that is desirable.

Shortly after those articles were written, the "Wratten Division" of Messrs. Kodak improved their panchromatic plate so effectually that it showed an almost even sensitiveness to the normal solar spectrum. Messrs. Ilford make a plate with similar characteristics. In these plates there is slight evidence of maxima in the greenish-blue and in the red, but these are so slight that it is often scarcely necessary to take notice of them.

It is obvious that a plate of even sensitiveness is theoretically, and one may add practically, the best and simplest where the general and various control of colour effects is necessary. For three-colour reproduction purposes, for example, where the spectrum has to be divided into three regions —roughly, red, green, and blue—the exposure for each colour is very nearly equal. For orthochromatic work—that is, where it is desired that the degrees of whiteness in the print shall correspond in proportion with the degrees of luminosity in the object that produces them, irrespective of their colour—it is clear that we must use a colour filter that will gradually tone down the action of the red and the blue, giving a curve of transmission similar to the luminosity curve of the spectrum—and such a filter will be green. The general idea that a yellow filter is the proper one to improve the rendering of colour sensitised plates, which was correct with the older plates that were deficient in red sensitiveness, appears still to predominate. A yellow filter with modern panchromatic plates will darken the representation of the blues, but will leave the reds, and colours such as yellow, of which red is a component, too light. The difficulty is to find a suitable green filter, for it is, as a rule, much more trouble to get a green filter to suit one's needs than that of almost any other colour. Of the well-known dyes, naphthol green seems the nearest approach to what is wanted, so far as absorption is concerned. As Prof. Pope has been so successful in his work on dyes, perhaps he will be able to find one that gives a better curve and that absorbs less of the colour that it is desired should be transmitted. Of course, theoretically, for orthochromatic results there is the alternative of reducing the sensitiveness of the plate to red to a proper degree, leaving only the action in the blue excessive, and to be reduced by a yellow filter.

We have just received from Messrs. Ilford a portfolio containing a set of comparative prints

produced from a strikingly coloured original, which is included, that demonstrates the great power that one has in the use of their panchromatic plates. A similar portfolio will be sent post free to anyone interested in the subject who applies for it. The first print is from a negative on an ordinary plate, and shows yellow and yellowish green much too dark, red black, and dark blue very light; and a panchromatic plate, without a light filter, gives the red and yellow, especially the red, too light instead of too dark, and the blues are a little improved. The interposition of a light filter that increases the exposure by only three times darkens the blues, strikingly, though not quite enough. Presumably this is a yellow filter, as it leaves the red and yellow and yellowish-green too light. A green filter would have corrected the reds, as well as the blues, as explained above, and a photograph taken through one would have been a most instructive addition to the portfolio. CHAPMAN JONES.

NOTES.

OWING to the greatly increased cost of production caused by the conditions of war, it has been found necessary to increase the price of weekly issues of NATURE from 6*d*. to 9*d*. The change in price will take place with the issue of October 24. For particulars of the new subscription rates see p. xxxiv.

THE following is a list of the foreign delegates appointed to attend the Inter-Allied Conference on the Future of International Scientific Organisations, which is to be held at Burlington House, Piccadilly, next week:—*Belgium:* M. Lecointe, Prof. Massart, and M. de la Vallée Poussin. *France:* MM. B. Baillaud, G. Bigourdan, A. Haller, Lacroix (permanent secretary, Académie des Sciences), C. Lallemand, Moureu, and E. Picard (permanent secretary, Académie des Sciences). *Italy:* Prof. V. Volterra (Member of the Italian Senate). *Japan:* Prof. Joji Sakurai and M. A. Janakadate. *Portugal:* Prof. B. Freire. *Serbia:* Prof. B. Popovitch and Dr. Zoujovitch. *U.S.A.:* Dr. E. Bumstead, Col. J. J. Carty, Dr. W. J. Durand, Dr. S. Flexner, Prof. G. E. Hale, and Dr. A. A. Noyes. The British delegates are to be nominated during the present week.

THIS year's meeting of the American Association is to take place in Baltimore, Ma., under the auspices of the Johns Hopkins University, from December 27 to 31. Boston had previously been selected as the place of meeting, but as so many men of science are at present working in Washington with matters connected with the war, Baltimore has been chosen to take its place. The activities of the meeting will be mainly directed to the applications of science to the present great struggle.

A WAR Committee of Technical Societies has been formed in the United States of America, with representatives from the following societies and institutes: American Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, American Gas Institute, American Electrochemical Society, Illuminating Engineering Society, Mining and Metallurgical Society of America, American Society of Refrigerating Engineers, and American Institute of Chemical Engineers.

A MEETING of the Optical Society will be held at the Imperial College of Science and Technology, South Kensington, on Thursday, October 10, at 7 p.m., when the following contributions will be submitted for discussion:—(*a*) "Sources and Magnitudes of Centring Errors in a Sextant," by Naval Instructor T. Y. Baker; and (*b*) "Astigmatism: Interchangeability of Stop and Object," T. Chaundy.

AT the general meeting of the Institution of Mechanical Engineers, to be held at 6 p.m. on Friday, October 18, the following papers will be read:—"A Law Governing the Resistance to Penetration of Metals which are Capable of Plastic Deformation, and a New Hardness Scale in Fundamental Units," Prof. C. A. Edwards and F. W. Willis; "The Value of the Indentation Method in the Determination of Hardness," R. G. C. Batson; and "The Ludwik Hardness Test," Dr. W. C. Unwin.

THE first general meeting of the National Union of Scientific Workers (for the determination of its constitution and to elect its first representative council) is to be held in London in the last week of the present month. Information as to the time and place of the meeting can be obtained from the secretary, Dr. Norman R. Campbell, North Lodge, Queen's Road, Teddington.

MR. A. E. BERRIMAN, chief engineer to the Daimler Co., has been appointed Deputy Controller of the Technical Department of the Department of Aircraft Production of the Ministry of Munitions, in succession to the late Prof. Bertram Hopkinson.

WE regret to have to announce the death of Dr. Henry Dyer, the former first principal of the Imperial College of Engineering at Tokyo, Japan.

BISHOP MITCHINSON, Master of Pembroke College, Oxford, whose sudden death at the age of eighty-five was announced in the *Times* of September 26, was a warm friend of science and a naturalist of the good old-fashioned kind. In 1855 he passed out of the schools at Oxford with two first classes, one in Lit.Hum., the other in natural science. When he went to Barbados as its bishop he was already well grounded in botany, and his knowledge of the British flora was extensive and precise. In Barbados he found a new plant-world to conquer, and sent many trophies home to enrich our national collection. But it was geology that proved his favourite hobby, and the collection of fossils which he amassed and lately presented to University College, London, contains some very interesting forms. A friend recalls with admiration and delight his courage on one occasion as a collector when, with the assistance of some quarrymen, but without official sanction, he blasted down many tons of cliff at Porth-y-rhaw in search of Paradoxides, hoping that this giant Trilobite might retain some traces of its limbs. Fine specimens rewarded his enterprise, but never a sign of a limb, which sufficiently proves that this big creature did not progress by walking. Bishop Mitchinson was a fellow of the Geological Society, and served on its council. Many of the older members still retain a happy memory of their friendly reunions in the Master's lodge, cheered by the genial hospitality of the most genial of hosts.

THE death is announced of Mr. A. S. Esslemont, late Controller of the Optical Munitions, Glassware, and Potash Production Department of the Ministry of Munitions.

THE death is announced, in his sixty-seventh year, of Dr. Byron D. Halsted, who was professor of botany

at Iowa Agricultural College from 1885 to 1889, and has since that date occupied a similar chair at Rutgers College, New Jersey. At one time Dr. Halsted was managing editor of the *American Agriculturist*. He was president of the Society for the Promotion of Agricultural Science in 1897, and of the Botanical Society of America in 1900.

THE Salters' Company is establishing an institute to be called "The Salters' Institute of Industrial Chemistry," in connection with which there will be two types of fellowships for which post-graduate students of any recognised university will be eligible, viz. fellowships to enable post-graduate students to continue their studies at an approved university or other institution under the general supervision of the director of the institute; and industrial fellowships to enable suitably equipped chemists to carry on research for any particular manufacturer, under an agreement which will be entered into between the institute, the manufacturer, and the fellow. The Salters' Company is open to receive applications for the post of director of the institute from persons possessing exceptional knowledge of scientific and industrial chemistry.

THE Glaziers Company's luncheon on Wednesday, September 25, to which were invited a number of gentlemen taking a prominent part in the glass industry, was of more than ordinary interest, for the Master, Mr. G. Paget Walford, announced a new policy for the Company. He said that he had determined, when entering on his new term of office, that the Company should assume once more its responsibilities to the industry, and bring its prestige and history and influence to the support of all movements devised to promote the industry's interests. With this object he foreshadowed the formation of a reconstruction committee of the Company and a representative gathering of the trade at an early date. The importance of technical training and research as the foundation on which the industry could be successfully rebuilt was emphasised by the presence and the speeches of the Vice-Chancellor and the senior and junior Pro-Chancellors of the University of Sheffield, and also by Dr. W. E. S. Turner, the head of the department of glass technology, who, in addition, gave some encouraging statistics of the growth of new branches of the glass industry. A letter from Mr. H. A. L. Fisher, Minister of Education, apologising for non-attendance, also strongly urged the claims of technical education and its application to the glass trades.

THE Dodman headland on the Cornish coast has been secured for the National Trust for Places of Historic Interest or Natural Beauty. The donor prefers to remain anonymous.

THE expedition to Barbados and Antigua of a party from the State University of Iowa has returned safely and with good results. The object was not only to secure collections in marine zoology, entomology, and geology from a region in which little work had hitherto been done, but also to study the living forms in and around the islands visited and thus to supplement the future more intensive work based on the collections secured. A number of reports are to be prepared; that on Mollusca by J. B. Henderson, the reef fishes by Dr. B. W. Evermann, and the Asteroidea and Holothuroidea by Prof. W. K. Fisher. The Hydroida and Alcyonaria will probably be dealt with by Prof. C. C. Nutting.

SIR JAMES FRAZER in "The Golden Bough" has collected numerous accounts of the deification of kings and priests. The Sumerian people of the dynasty of Ur (2475–2358 B.C.) developed this phase of religion to an extent almost unparalleled in the subsequent history of mankind. By them this belief was connected with a fundamental doctrine of ancient civilisation, the conception of a dying god, Tammuz, the soul of vegetation. The *Museum Journal* for September, 1917, lately received, publishes a series of hymns devoted to the cult of Dungi, the first of these men-gods, found in the Nippur Library. This song-service describes the miseries of life and the solicitude of the man-saviour who intercedes to propitiate the wrath of the gods aroused by sin. This new tablet thus occupies a place of peculiar importance in cuneiform literature.

DR. WALTER HOUGH has republished from the Proceedings of the United States National Museum (vol. liv.) an account of the Hopi Indian collections in the museum. This tribe occupies stone-built dwellings in north-eastern Arizona. It was first visited by white men in 1540, and, owing to the isolation of the country, it has preserved to a greater degree than other tribes the arts and customs of the Pueblos. The Hopi live by farming, and the arts in which they are most skilful are weaving, basket-making, and wood-carving, while their proficiency in cookery is widely known among other Indian tribes. The present collections give a vivid picture of their artistic productions and technology. The report is well illustrated by drawings and photographs, and brings together in an interesting way a large amount of information on one of the most remarkable existing Indian tribes.

THE *Brooklyn Museum Quarterly* for July, 1917, only recently received, describes an exhibition of students' work from the various high schools in the city. It consists of models of stage settings, designs, and drawings illustrating the scenic art of the theatre. During the past century the art of scene-painting has held, in the estimation of the public, a position between that of the mural and that of the sign painter, in spite of the fact that during the eighteenth century the art was highly developed in Italy and France. Among the most interesting exhibits are four scenes designed for the recent production of "The Canterbury Pilgrims" at the Metropolitan Opera House in Brooklyn, and those for "Giaconda" and "The Willow Tree." These settings are designed to assist the actor in realising the "atmosphere" of the piece which he is engaged in representing, and to initiate new developments of character. The scheme is interesting, and suggests new developments in art teaching.

MR. J. REID MOIR, in a contribution reprinted from the *East Anglian Daily Times* of September 17, describes an interesting addition to the collections of the Ipswich Museum, which already possesses a fine series of stone weapons. The casts recently purchased are exact copies, both in colour and form, of the most notable discoveries of ancient human bones which have been made both in this country and on the continent of Europe. One cast represents the strange ape-man (*Pithecanthropus erectus*) of Java, others the Heidelberg jaw (*Homo heidelbergensis*), the Piltdown skull and jaw (*Eoanthropus dawsoni*), the Galley Hill skull and jaw, two examples of *Homo neanderthalensis*, and the famous Cro Magnon skull and jaw. So far as is known, this is the only collection of the kind in Great Britain, and it deserves the attention of anthropologists.

A CRITICAL survey of what is known of the sense of hearing in fishes appears in the Proceedings of the American Philosophical Society (vol. lvii., No. 2). The author, Prof. G. H. Parker, after a careful study of the literature of the subject, considers it probable that in the ears of the higher fishes, where utriculus

and sacculus are well differentiated, the sacculus has to do with hearing and the utriculus with equilibrium. The sense of hearing is, however, of a very limited kind, amounting to little more than a bare ability to distinguish sound. The ears of the lower fishes are of a more primitive type, and are probably responsive only to relatively loud noises, such as have been shown to be effective stimuli for the skin.

PROF. I. IKEDA and Mr. Y. Ozaki give an interesting account (Journ. Coll. Sci., Imp. Univ., Tokyo, vol. xl., art. 6, 1918) of the structure and conjugation of *Boveria labialis*, a new species of ciliate protozoon found living in the respiratory trees of two Japanese Holothurians (sea-cucumbers). Each Boveria has a meganucleus and, near its aboral end, one micronucleus. Conjugation occurs periodically, and hence, if this process is taking place at all, the majority of individuals in the same host are in conjugation. The conjugation differs in several remarkable features from the well-known corresponding process in Paramœcium. The two conjugants, which are similar (isogamous), become attached to each other by their aboral ends, and the meganucleus does not disappear, but persists throughout and subsequent to the conjugation. The micronucleus of each conjugant undergoes two successive divisions, the first amitotic and the second mitotic; of the four nuclei so produced, three degenerate and disappear, while the fourth divides mitotically into two—a stationary nucleus and a migratory nucleus. The migratory nucleus of one conjugant passes over to and fuses with the stationary nucleus of the other, and the synkaryon so formed in each individual divides twice, giving four nuclei, one of which becomes the new micronucleus, while the other three undergo degenerative changes and become incorporated into the persisting meganucleus, but they can be traced in the first and second fissions of the now separated Boverias. The authors record examples with two, three, four, and six meganuclei, but in these cases all the meganuclei except one sooner or later disappear. Encystment of the ciliates in the subepithelial connective tissue of the respiratory trees is also described, but has evidently not been fully traced.

IMPORTANT contributions to the exploration of Labrador by Mr. R. J. Flaherty are described in a paper in the *Geographical Review* for August (vol. vi., No. 2). Mr. Flaherty in 1912 made two crossings of the unknown northern part of the Ungava Peninsula between Hudson Bay and Ungava Bay. The first was eastward by Lake Minto and the Leaf River. Part of this route was traversed by A. P. Low in 1898. The second crossing from east to west was through the unknown heart of the peninsula in about lat. 60° N. Mr. Flaherty followed the Payne and the Povungnituk Rivers, and crossed a barren country almost deserted by the present generation of Eskimo since the herds of caribou moved further south. The only natives encountered on the northern traverse were a small group on the Payne River about thirty miles from the coast. The paper is accompanied by a map of the route surveys on a scale of 1 : 506,880, and a smaller-scale map of the Ungava Peninsula.

IN the Proceedings of the United States National Museum (vol. liv., p. 308, 1918) Prof. T. D. A. Cockerell strengthens his highly interesting determination of the presence of Glossina in the Miocene shales of Colorado. Two new species are described, and the author reviews the living forms and their distribution. Osborn's suggestion that many large Cainozoic mammals in America may have been destroyed by fly-borne parasites is rendered highly probable by the wider range of tsetse-flies now indicated by Prof. Cockerell.

MUCH importance is justly attached to the insect fauna of the Upper Carboniferous strata of Commentry (Allier), and literature on the scattered specimens appears in various lands. It may be well, then, to direct attention to a criticism by Mr. R. J. Tillyard of two of Mr. H. Botton's descriptions of specimens at Bristol (Proc. Linn. Soc. N.S.W., vol. xliii., 1918, p. 123). Mr. Tillyard contributes comparative observations on recent and Permian species from Australia.

MR. LE ROY JEFFERS (*Scientific American*, August 24, 1918) has explored the Great Onyx Cave, which was discovered about two years ago to the north-east of the Mammoth Cave of Kentucky. The most interesting feature is the great development of gypsum, which produces a rich variety of crystalline growths. We have a suspicion that the word "helectites," used for twisted groups, should be written "helictites," from ἑλικτός.

A "GEOLOGICAL Handbook of Northern France" has been prepared by Prof. W. M. Davis for the use of American soldiers in France. The book has been approved by the Geographical Committee of the U.S. National Research Council, and copies are being distributed free to the Army cantonments, etc.

DR. C. FENNER, a graduate of the University of Melbourne, contributed a physiographic paper of unusual interest and importance at the July meeting of the Royal Society of Victoria. The paper deals with the physiography of the whole basin of the Werribee River, which includes the Permo-Carboniferous glacial deposits of the Bacchus March district, known to most geologists. Interesting correlations are made connecting the topographic units of the area with their history and settlement, economic conditions and accessibility, rainfall and water-supply. The rocks of the area include Lower Ordovician sediments, Lower Devonian granitic rocks, Permo-Carboniferous glacial deposits, a mixed Tertiary series comprising older basalts, Tertiary leaf-beds, and newer basalts, while recent alluvium forms the fertile deposits of Bacchus Marsh. The area after peneplanation was subjected to differential uplift in the mid-Tertiary period. After the older basalt was poured out, trough-faulting along east and west lines commenced forming the Ballan "sunk-land," with elevated blocks of the Lerderderg and Brisbane ranges to the north and south. Following the extensive newer basalt outpourings, further faulting, involving a western uplift, formed the Rowsley scarp with a north and south trend; and an east and west fault, with uplift to the north, elevated the Gisborne highlands. Between these elevated blocks the south-eastern part of the area forms the "sunkland" of the Werribee plains. The relations of the older and newer basalts to the various fault-lines are utilised as elements in establishing the ages of the earlier and later faults. The Werribee River with its tributaries, including the Lerderderg River, are younger than the newer basalts, and their courses were established before the later faulting. As a result of the formation of the Rowsley fault scarp the rivers have developed deep gorges cut into the elevated earth-blocks, the Werribee gorge being in places 600 ft. deep, while the Lerderderg gorge, in a region twice elevated, is in places 1000 ft. in depth.

THE Scientific Proceedings of the Royal Dublin Society for June and August contain communications by Mr. R. G. Allen, of the Royal College of Science, Dublin, on the effect of temperature on the electrical resistances of porcelains, red fibre, and a new insulator known as erinoid—a by-product of milk. The

porcelains were investigated up to 300° C., and the fibre and erinoid up to 100° C., the results in most cases being checked by the use of the leakage method, the galvanometer, and the megger. Of the porcelains the Portland china and Royal Worcester were found to be the best insulators. On the insulation of some of the samples change of voltage had no effect. On all the effect of rise of temperature was a large decrease of insulating power, the resistivity R following closely the law, $\log R = a/T + b$, where T is temperature on the Absolute scale, and a, b are constants for each sample. Erinoid is not so hygroscopic as red fibre, and the resistivities of both change with temperature according to the above law.

THE *Journal für Gasbeleuchtung* for May 18 last states that the United States produced in 1917 670,000 hectolitres of "solvenaphtha," *i.e.* heavy benzol distilling over at between 160° and 180° C., and from which may be derived 90,000 hectolitres (nearly two million gallons) of toluene by using solvenaphtha in place of oil in water-gas plants. In an industrial trial with the Lowe apparatus, where solvenaphtha was substituted for gas-oil, the production of carburetted gas being 14,000 cubic metres in twenty-four hours, the expenditure of solvenaphtha was two litres per cbm. of gas, the equivalent expenditures of coke and steam being respectively 74 kg. and 60 kg. per 100 cbm. gas, with a temperature of 825° C. at the superheater and 15·5° C. at the condenser outlet. Light oil, condensed and separated by cooling, represented 57 per cent. of the solvenaphtha employed, and it contained 14·5 per cent. of benzene and 23·7 per cent. of toluene, which corresponds with 8·3 per cent. and 13·6 per cent. of the initial quantity of solvenaphtha.

AN account of some interesting studies on the formation of coke, of considerable importance from both the theoretical and practical points of view, is given by G. Charpy and M. Godchot in the *Comptes rendus* of the Paris Academy of Sciences for August 26. Starting with a Brassac coal containing only 11 per cent. of volatile matter and not forming a coherent coke, and a Durham coal with 24 per cent. of volatile matter giving alone a very friable coke, mixtures of these two were carbonised in variable proportions. The crushing strength of the resulting coke varied greatly with the composition of the mixture, first becoming appreciable with 20 per cent. of the Durham coal—24 kg. per sq. cm. with 25 per cent., 45 kg. per sq. cm. with 44 per cent., 80 kg. per sq. cm. with 51 per cent.—and then falling to zero when the proportion of Durham coal was increased by a further 5 per cent. to 56 per cent. This rapid and unexpected variation shows the importance of determining exactly by experiment the best proportion when carbonising mixtures of two coals. The same Brassac coal mixed with pitch in certain proportions also furnished a hard coke, and tar could replace the pitch. Results of high interest were obtained in experiments on the effects of a preliminary heating to a low temperature. With a Durham coal containing 28·1 per cent. of volatile matter, direct carbonisation at 700° C. gave a voluminous, soft, friable coke, and this was also the result if the coal had been submitted to a preliminary distillation at 450° C. for thirty, sixty, or ninety minutes before raising to 700° C. But if the preliminary distillation at 450° C. were carried out for 105, 130, or 150 minutes, further heating at 700° C. gave coherent cokes with strengths of 41, 98, and 25 kg. per sq. cm. respectively. Prolonging the preliminary heating to 450° C. for a further fifteen minutes (165 in all) gave again a pulverulent coke. Thus this coal, completely useless for coking purposes in its natural state, gives a coke of normal quality if about one-third of its volatile matter is removed by a preliminary distillation at 450° C. The authors point out that this unexpected result is difficult to reconcile with current theories as to the cause of coke formation.

WE have received a reprint of an article in *De Natuur* by Mr. J. W. Giltay, of Delft, dealing with Mersenne and his ideas on acoustics. Marin Mersenne (1588–1648), Franciscan friar, friend of Descartes, Gassendi, and Thomas Hobbes, "profond philosophe musicien," according to Constantine Huygens, was, in the opinion of Poggendorff ("Geschichte der Physik," p. 327), not a physicist of the first rank, but remarkable for his active correspondence, which at the time replaced to some extent the scientific journals of our day. Mr. Giltay illustrates Mersenne's ideas by quotations from his two principal works, "Harmonie Vniverselle" (1627) and "Traitez des consonances, des dissonances, des genres, des modes & de la composition" (1635). In spite of the undeveloped state of physical knowledge, the Franciscan sometimes approaches near to our present notions, as in his explanation of beats. At times he is still under the influence of Aristotle, as, when discussing the pendulum and the fall of bodies *in vacuo*, he writes, "l'on ne scait si le vuide est possible, ny s'il est quelque chose de réel." His writings abound in sudden digressions into theology and philosophy, but his interest in music was scientific rather than artistic.

AS is generally known, in pre-war times our supplies of glass apparatus for laboratory use were largely obtained from what are at present enemy sources. Now that we are thrown on our own resources, manufacturers in this country have taken steps to meet the demand for such glassware. Measuring instruments, such as burettes, pipettes, flasks, and graduated cylinders, made and calibrated in this country, are obtainable—presumably with no more difficulty than is due just now to questions of priority as regards war requirements. We have recently had an opportunity of inspecting specimens of such laboratory instruments manufactured by Messrs. Gallenkamp and Co., Ltd. A correspondent who has seen them remarks that they are well-made articles, and appear to be quite as suitable for laboratory work as the apparatus formerly obtained. The only suggestion to be made is that the thicker parts of the figures (enclosed between two fine lines) might with advantage be roughened, to make the figures more conspicuous. It may be recalled that, as noted recently in these columns, arrangements have been made by the National Physical Laboratory to test and certify glass measuring instruments sent by manufacturers, so that reliance can be placed on the accuracy of any apparatus thus certified.

IN a recent issue of the *Elektrotechnische Zeitschrift* it was stated that the magnetic properties of nickel-steel caused it to be used by the German Navy for the construction of parts of ships near to the compass in order to prevent variable effects on the compass-field. Anschütz and Co. now write a letter (*Elektrot. Ztschr.*, June 20) to state that this use of nickel-steel is by no means new, and, in fact, is a very costly method of obtaining good "compass-fields," and that the method has been almostly completely discontinued. The compasses are now almost entirely gyroscopic. The use of this type of compass has the further advantage of saving large quantities of nickel, which is so expensive and difficult to obtain.

THE smallest and lightest practical set of portable testing ammeter, voltmeter, and wattmeter has been constructed by the American General Electric Co. According to the *Electrical Review and Western Electrician* (June 15 last), the ammeter and wattmeter are

equipped for current capacities up to 20 amps. The ammeter is of the iron vane type, the voltmeter and wattmeter being dynamometric instruments. All windings are magnetically shielded and a new type of air-damper is fitted, rendering the needle very dead-beat. The weight of the instrument, complete in case, is less than 2 lb.

A RECENT German patent (*Glückauf*, August 3, 1918) describes a process for rendering powdered coal and charcoal insensitive to moisture. Finely ground and well-dried coal or charcoal powder is mixed with finely divided powdered peat, which, before grinding, is dried artificially at not less than 100° C.

OUR ASTRONOMICAL COLUMN.

OBSERVATIONS OF SOLAR PROMINENCES.—A summary of the observations of prominences made at Kodaikanal during the second half of the year 1917 is given by Mr. Evershed in Bulletin No. 58. The mean daily frequency, mean height, and mean extent along the sun's limb were respectively 20·0, 37·5″, and 3·58°, differing but little from the corresponding figures for the first half of the year. There were three principal zones of activity: one about the equator, a mid-latitude zone between ±30° and 40°, and a high-latitude zone between ±70° and 80°. More than half of the nineteen metallic prominences recorded were observed during December, which was also the most active month magnetically. In observations on the disc of the sun, 239 bright reversals of H_α and eighteen dark reversals of D_3 were noted, and photographs of H_α absorption markings were obtained on 117 days. The areas and numbers of the absorption markings showed a large increase on the previous half-year, indicating an increase in the density of the prominences except in the case of those occurring about latitude 60°, which have seldom given evidence of their presence on the disc. The distribution of the markings showed the usual excess on the eastern side of the central meridian.

Details of the observations of prominences made at Catania during 1916 have recently been published by Prof. A. Riccò (*Mem. Soc. Spett. Ital.*, vol. vii., series 2*a*). The mean daily number of prominences was 9·8, the mean height 49″, and the mean extent of base 3·1°. There was a considerable increase in the frequency as compared with 1915.

PARALLAXES OF HELIUM STARS.—The recent determinations at Greenwich of the proper motions of stars down to 9th magnitude in the zone +24° to +32° have been utilised by Sir F. Dyson and Mr. W. G. Thackeray in an investigation of the parallaxes and intrinsic magnitudes of some of the B (helium) stars (Monthly Notices, R.A.S., vol. lxxviii., p. 651). The region studied is that portion of the galaxy intercepted by the zone between 4h. and 8h. R.A. The stars near 6h. have a large parallactic factor almost wholly in declination, and on the assumption that they have no systematic motion other than that due to the sun's motion, the mean parallaxes of B stars of different magnitudes can be calculated. For 113 stars of types B8 and B9, ranging in mean apparent magnitude from 1·78 to 8·46, the mean proper motions in declination range from 0·1770″ to 0·0066″, the mean parallaxes from 0·05″ to 0·02″, and the intrinsic magnitudes (corresponding with the parallax 0·1″) from +0·4 to −0·5. The extension of the investigation to faint stars thus confirms the view that stars of types B8 and B9 have not a great range in absolute luminosity. A similar conclusion is derived from the fainter stars of type A0, the mean intrinsic magnitudes having values ranging from +0·9 to +1·5 for 212 stars of apparent magnitude 5·32 to 8·67.

STELLAR DISTANCES AND SPECTRAL TYPES.—A paper on "The Mean Distances of Stars of Different Spectral Types," by Mr. Shin Hirayama, appears in the *Annales de l'Observ. Astron. de Tokyo*, appendix 7. The purpose of the author is to test Kapteyn's formulæ connecting a star's parallax with its magnitude, spectral type, and proper motion. He uses 322 stars, for which both measured and spectroscopic parallaxes are available; as the latter are wanting for types A and B, he uses van Rhijn's constants for them. For stars of magnitude 4·8 he finds the mean parallax 0·029″ for type M; as the type changes from M through K to G_0 it rises steadily to a maximum of 0·054″, and then falls again as we pass through types F and A, being 0·008″ for type B_5. His values agree with those of Kapteyn for types B_8 and A_0, but for the remaining types they are about twice as great.

ENTOMOLOGICAL RESEARCH IN AUSTRALIA.

MR. R. J. TILLYARD, whose admirable book on "The Biology of Dragonflies" was recently reviewed in NATURE, has made a further contribution of importance to the study of this order of insects in a series of papers on "The Morphology of the Caudal Gills of the Larvæ of Zygopterid Dragonflies," published in the Proceedings of the Linnean Society of New South Wales (vol. xlii., 1917, parts 1 and 3). Zygopterids are the slender-bodied dragonflies, often distinguished as "demoiselles," the larvæ and nymphs of which are provided with three conspicuous appendages, at the hinder end of the body, traversed by branching air-tubes. A careful comparative study of the structure of these organs in various genera and in successive stages of growth has been made by the author, who concludes that the median dorsal gill-plate in these insects is analogous with the telson in Crustacea, while the paired lateral appendages are cerci, and "therefore the true homologues of the uropods of Crustacea." These latter are compared with the filamentous cerci of the well-known stonefly (Perlid) larvæ and nymphs, which they resemble in form in the early stages, becoming more highly specialised as growth proceeds. From his comparative studies Mr. Tillyard is convinced that in the evolution of this group of dragonflies a primitive filamentous condition of the larval telson and cerci was succeeded by the "saccoid" type, which persists in a few genera such as Diphlebia and Neosticta, this by the "triquetro-quadrate" type, found in the Calopteryginæ, where the median gill is trapezoidal and the lateral ones are triangular in cross-section, and this by the specialised "lamellar" type characteristic of the larvæ of the great majority of the group, including the familiar Agrioninæ. The author promises further studies on the physiology of these interesting structures, for although their function is doubtless respiratory, the aquatic larvæ which possess them continue to breathe in some way when artificially deprived of them.

The remarkable insect-fauna of the Australian region has provided material in other orders for Mr. Tillyard's researches. In Tasmania, New South Wales, and New Zealand he has discovered various species of small scorpion-flies (Mecoptera), which he describes (Proc. Linn. Soc., N.S.W., vol. xlii., part 2, 1917) as representing a new family (Nannochoristidæ), with the jaws apparently piercing and suctorial, closely parallel to the condition found in many Diptera, and combining remarkably archaic with specialised characters. In a paper on Permian and Triassic insects from New South Wales (*t.c.*, part 4) Mr. Tillyard describes a closely allied extinct type

from the Upper Coal Measures of Newcastle (N.S.W.). Much light on the phylogeny of the Insecta may be expected from such studies in Australian palæontology, and the author gives us (*t.c.*, part 1) an example of this in the type of a new order, the Protomecoptera—"a very remarkable fossil from the Ipswich [Queensland] beds . . . the direct connecting-link between the Palæozoic Palæodictyoptera on one hand, and the recent Mecoptera on the other."

In describing these primitive metabolous insects, and comparing them with Neuroptera, Trichoptera, and Lepidoptera, Mr. Tillyard lays stress on the presence in the Mecoptera and Planipennia of a frenulum or group of wing-coupling bristles, comparable with the well-known organ on the hind-wing of most moths, and argues thence in support of Dr. Handlirsch's contention for a close relationship between all these orders. In a very short but important note (*Entom. News*, vol. xxix., p. 99) Mr. Tillyard points out that a frenulum of simple type is present in those minute primitive moths the Micropterygidæ, which have usually been regarded as devoid of that organ. In thus enforcing evidence for the relationship of archaic members of various orders of insects, the author well justifies his use of the morphological method in entomology. G. H. C.

THE PROMOTION OF TEXTILE INDUSTRIES.[1]

THE Departmental Committee appointed by the Board of Trade to consider the position of the textile trades after the war has presented a most interesting report, which is unanimous except for small details concerning certain tariffs.

The report sets out very clearly the dominant position of the Allied countries in respect of the raw materials of the more important textile trades, and lays special emphasis on the exceptional and powerful position which the British Empire holds with regard to the production in particular of wool, jute, and the finest qualities of cotton. The Committee is particularly insistent that this position must be safeguarded by continuous and systematic *scientific* research on the raw materials to improve production both in quality and yield. A striking illustration is quoted to show how scientific sheep-breeding in Australia has improved the quality of wool clipped per head; whilst special emphasis is laid on the urgent necessity for the systematic and scientific study of the growing of cotton. The fringe of this latter subject has only just been touched, and there are immense possibilities in the production of cotton modified by the grower to suit the user.

The Committee, moreover, advocates scientific research on the fundamental principles underlying the various manufacturing processes of the several textile industries, and it is significant that this Committee, composed mainly of prominent manufacturers, emphasises so strongly its belief that such research will stimulate the development and prosperity of the industries represented on it. Three important lines of inquiry are suggested:—

(1) Scientific research in connection with raw materials.

(2) Scientific research in connection with the improvement of processes such as carbonising, carding, spinning, weaving, dyeing, bleaching, printing, and finishing.

(3) Technical investigation with regard to the improvement of machinery.

[1] Report of the Departmental Committee appointed by the Board of Trade to consider the Position of the Textile Trades after the War. 1918. (Cd. 9070.) Price 1*s.* 3*d.* net.

The machinery and methods of the present day are adapted to suit the various types of textile fibres commonly produced, but it is considered that scientific research in connection with the raw materials will evolve and select special types suited to the products required, and that then the cultivation of these types might be encouraged. In manufactures the discovery of the mercerising process of cotton and the production of artificial silk are quoted as instances to show that great improvements can be effected in existing processes and in the discovery of entirely new ones.

The Committee feels unable to recommend the compulsory adoption of the metric system at the present time so far as the textile trades are concerned. The great British textile trades, more particularly the cotton trade, are so predominant in the world that similar industries in other countries have had, in the main, to follow their lead and accept their technical standards, whilst all the textile machinery used in this country and supplied by British manufacturers to foreign manufacturers is based upon British measures. The yard is the standard of measurement for textile goods in almost all the great markets of the East, of the United States of America, and throughout the British Empire, and the larger proportion of our textile export trade is done with non-metric countries. In fact, it is considered that the adoption of the metric system can be brought about in this country, so far as the textile trades are concerned, only with the full concurrence and co-operation of the whole British Empire and the United States of America.

The report criticises the British system of technical and art education, which, in the opinion of the Committee, has failed to supply the textile industries with a sufficient number of highly trained workers and managers. It is suggested indirectly that the Education Act of 1902 is partly responsible for this, in that the management of the majority of technical schools was then vested in municipal bodies, which are elected for quite different purposes, and rarely prove attractive to local manufacturers—a drawback not corrected by the co-option from outside the local education authorities of manufacturers on school management sub-committees. It is noteworthy that this Committee, composed mainly of large employers, considers that it is urgently necessary to awaken the employers of the textile industry to the value of adequate education, particularly of their higher staffs. R. H. P.

IRISH SEA PLANKTON.[1]

THE importance of studying the common plankton organisms is shown by Prof. Herdman in his "Spolia Runiana," where, basing his results on more than ten years' systematic collecting and working out of standard plankton hauls in the Irish Sea, he points out how the results depend mainly on the presence of only a few genera and species which appear at certain seasons with great regularity and constitute the bulk of the food supply available in the sea. He therefore makes a careful analysis of the quantitative distribution of the six commonest copepods as representative of the zooplankton, each belonging to a separate genus, and the seven commonest diatom genera as representative of the phytoplankton, and the results show that the seasonal distribution of these forms is remarkably constant. Thus the diatoms have two maxima in the year, the larger in spring, the lesser in autumn, the copepods always increasing after and not with the diatoms, so that their maximum is in the summer. The diatoms are thus the forerunners of the small

[1] "Spolia Runiana." III. "Distribution of Certain Diatoms and Copepoda throughout the Year." By Prof. W. A. Herdman. Journ. Linn. Soc., Botany, vol. xliv., p. 173, 1918, and Zoology, vol. xxxiv., p. 95, 1918.

plankton animals, including the copepods, which feed on the diatoms, the copepods in their turn serving as food for nearly all young fish and certain adults, such as the herring and mackerel.

The maxima of the various genera show much agreement with the records from the English Channel, but the interesting fact is brought out that Skeletonema, a coastal diatom enormously abundant at Kiel and very common in the Channel, is apparently quite rare in the Irish Sea even close to land, whilst it is the commonest form in some of the lochs in the west of Scotland.

The copepods Calanus and Temora, which contain a large amount of oil, occur at times in enormous numbers and form an important food for the herring and mackerel, which follow them in shoals and feed voraciously on them, disappearing when the copepods go. This is a good illustration of the prominent truth brought out by this plankton investigation that, although there is a very large amount of food available in the sea, it is not evenly distributed, and that all animals feeding on the plankton must seek out the food they require. The varying distribution of the plankton is thus the chief cause of the movement and migrations of those animals which feed on it.

In the concluding remarks various theories of the origin of these plankton maxima are discussed, the author inclining to the view that here sunlight plays the most important part, and that increased alkalinity of the sea being due to the reduction of carbon dioxide is the result, and not the cause, of the activity of the plankton.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. F. G. Chandler, of Jesus College, has been awarded the Raymond Horton-Smith prize for his thesis on "Empyema."

LONDON.—A Mitchell studentship of 100*l*. is offered to a graduate having the necessary qualifications to study and investigate some definite feature of business or industrial organisation at home or abroad. Applications will be received by the Academic Registrar not later than December 31 next.

The following are among the public lectures at University College arranged for during the new term:—"Economy of Fuel in Private Households," A. H. Barker, on Wednesday, October 9, at 7 p.m.; "The Scientific Problems of Radio-telegraphy," Prof. J. A. Fleming, on Wednesdays, October 30, November 6, 13, 20, and 27, and December 4, at 5 p.m.; "The Nature and Use of 'Tones' in Chinese and Other Languages," D. Jones, on Monday, October 21, at 5 p.m.; "The Nature of Language," H. E. Palmer, on Thursdays, October 10, 17, 24, and 31, November 7 and 14, at 5 p.m.; "The Problem of International Language" (with special reference to Esperanto and Ido), H. E. Palmer, on Thursdays, November 21 and 28, December 5 and 12, at 5 p.m.; "Wound Shock," Prof. W. M. Bayliss, on Fridays, November 22 and 29, at 5 p.m.; and "French Science" (with lantern illustrations), Prof. H. L. Joly, on Tuesdays, October 22 and 29 and November 5, at 5 p.m.

MR. C. E. ASHFORD, headmaster of the Royal Naval College, Dartmouth, has been appointed Adviser on Education to the Board of Admiralty for the duration of the war, continuing in his former position.

DR. W. M. POLK, late dean of the Medical College of Cornell University, has bequeathed the sum of 1000*l*. to the University for the continuation of the John Metcalf Polk scholarship in medicine.

THE current calendar of the Edinburgh and East of Scotland College of Agriculture, copies of which can be obtained on application to the secretary, 13 George Square, Edinburgh, contains full details of the various available courses of instruction in agriculture, horticulture, and forestry. All the courses of study, it may be noted, are open to women.

THE following lectures have been arranged for delivery at the Royal Sanitary Institute by the Child-Study Society:—Thursday, October 10, "Training the Children for Citizenship in America," Mrs. K. Boulker; Thursday, November 7, "The Girl Guide Movement," Lady Baden-Powell; and Thursday, November 28, "Sight-saving Schools," N. Bishop Harman.

THE Universities Bureau of the British Empire has compiled a handbook of the "Universities of the United Kingdom of Great Britain and Ireland," which the Board of Education has published as No. 33 of its Educational Pamphlets at the price of 9*d*. net. In the spring of 1918 the Council of National Defence of the United States invited the universities of the United Kingdom to send delegates to visit American universities so as to establish relations of co-operation and co-ordination. The present handbook was prepared to place the delegates in a position to supply information about the organisation and resources of the individual universities of the United Kingdom. The descriptions in it relate to normal times, and the figures as to the number of teachers and students are for the last normal session 1913–14. The pamphlet states that inquiries regarding any matters connected with university education may be addressed to the Hon. Secretary of the Bureau at the Imperial Institute, London, S.W.7.

SOCIETIES AND ACADEMIES.

CAPE TOWN.

Royal Society of South Africa, July 17.—Dr. A. Jasper Anderson in the chair.—A. **Ogg**: The electrostatic deflection in a cathode-ray tube. In the ordinary Thomson cathode-ray tube for determining the value of e/m for cathode rays, the irregularity of the electrostatic field near the edges of the charged plates has to be allowed for. It is interesting to find the electrostatic deflection when the rays are projected parallel to the plates, but at some distance from them. Methods for making the calculation were given.—Prof. J. D. F. **Gilchrist**: Note on a disease in the snoek (*Thyrsites atun*). The snoek, one of the most important Cape fishes from an economic point of view, is well known to be found frequently in a "pap" or soft condition. This is attributed by the fishermen to the fact that it has not been properly killed on capture, the consequence being that it struggles about in the bottom of the boat, and, in doing so, bruises the flesh to such an extent as to produce the condition mentioned. This condition may occur a few hours after the fish has been caught, and may quickly become so marked that the whole of the muscles, especially of the back, appear quite soft and liquid. The process is believed to be totally distinct from decay by putrefaction or by softening of the flesh by exposure to the heat of the sun, which also frequently occurs. As it was suspected that this condition might be brought about by the presence and rapid multiplication of some protozoal parasite in the muscles, the diseased tissue was examined microscopically, and after staining with methylene-blue and other reagents the presence of very numerous spore-like bodies was

detected. These were all arranged in groups of four, and occasionally, on fixation by heat, long filaments were shot out from them, showing that they were Protozoa belonging to the group of Cnidosporidia, which are known to produce diseased conditions in the muscular and other tissue of fish. The groups of four bodies with filaments suggest the family of the Chloromyxidæ with their four polar capsules, but there is reason for believing that they represent spores, not polar capsules, and, if so, they probably belong to a new form of the Microsporidia.—Ethel M. **Doidge**: Mycological notes. I.

CALCUTTA.

Asiatic Society of Bengal, August 7.—Maude L. **Cleghorn**: A note on the vitality and longevity of silkworm moths during the cold and rainy seasons in Bengal. An account of experiments carried out during the past two years on the vitality and longevity of silkworm moths. It is shown that moths which emerge in December and January live longer, while those bred in the rains and hatched out in August and September exist for only a few days. The results of the experiments, which are shown in tabular form, are compared with Tower's observations on the effect of temperature and moisture on certain Chrysomelid beetles.—Dr. B. **Prashad**: Zoological results of a tour in the Far East. Echiuroids from brackish water, with the description of a new marine species from the Andamans. Three species of the genus Thalassema have already been recorded from brackish water on the coasts of the Bay of Bengal and the Gulf of Siam. The anatomy of these is described in detail, and special attention is paid to the structure of the proboscis, which exhibits certain peculiarities in these forms. A progressive modification can be traced in the three species, probably in connection with life in peculiarly dense mud. A new marine species of the genus from the Andamans is also described.—L. **Chopard**: Zoological results of a tour in the Far East. Les Orthoptères cavernicoles de Birmanie et la Péninsule Malaise. All the Orthoptera at present known from limestone caves in the Malay Peninsula and Burma were discussed, and most of them figured. In this fauna one species of earwig, five species of cockroaches, and seven species of wingless Phasgonuridæ are included.—Dr. N. **Annandale** and Dr. B. **Prashad**: Note on the taxonomic position of the genus Camptoceras, Benson, and *Lithotis japonica*, Preston (*Mollusca pulmonata*). The genus Camptoceras was described by Benson in 1843 to include a remarkable fresh-water mollusc from Rohilkhand; two other species were described by Blanford in 1871 from near Dacca. The genus has not been rediscovered in India, but a species has recently been found in Japan. Particulars are given as to the animal and the radula of this species, and the conclusion is drawn that the genus is allied to Planorbis and belongs to the suborder Basommatophora. The shell, recently described by Preston under the name *Lithotis japonica*, is shown to have no relation to the Indian species of Lithotis, but to be closely allied to Limnæa. A new genus is proposed to include it and the Sumatran species *Limnaea brevispira*, von Martens.

BOOKS RECEIVED.

Equilibrium and Vertigo. By Dr. I. H. Jones. With an Analysis of Pathologic Cases by Dr. L. Fisher. Pp. xv+414. (Philadelphia and London: J. B. Lippincott Co.) 21*s*. net.

The Ledge on Bald Face. By Major C. G. D. Roberts. Pp. 255. (London: Ward, Lock, and Co., Ltd.) 5*s*. net.

Eastern Exploration: Past and Present. By Dr. W. M. Flinders Petrie. Pp. vi+118. (London: Constable and Co., Ltd.) 2*s*. 6*d*. net.

Tri-lingual Artillery Dictionary. By E. S. Hodgson. Vol. i., English-French-Italian. Pp. viii+92. (London: C. Griffin and Co., Ltd.) 5*s*. net.

Modern Fruit-growing. By W. P. Seabrook. Pp. xliii+172. (London: The Lockwood Press.) 4*s*. 6*d*. net.

A Bibliography of Fishes. By B. Dean. Vol. ii. Enlarged and edited by C. R. Eastman. Pp. 702. (New York: American Museum of Natural History.)

Contouring and Map-reading. By B. C. Wallis. Pp. 48. (London: Macmillan and Co., Ltd.) 2*s*.

Macmillan's Geographical Exercise Books. vii., Physical Geography, with questions. By B. C. Wallis. Pp. 48. (London: Macmillan and Co., Ltd.) 1*s*. 6*d*.

Annual Chemical Directory of the United States. Second edition. Pp. 534. (Baltimore: Williams and Wilkins Co.) 5 dollars net.

Simplified Method of Tracing Rays through any Optical System of Lenses, Prisms, and Mirrors. By Dr. L. Silberstein. Pp. ix+37. (London: Longmans and Co.) 5*s*. net.

Differential Equations. By Dr. H. Bateman. Pp. xi+306. (London: Longmans and Co.) 16*s*. net.

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