THURSDAY, JULY 18, 1918.

MALARIA AND ITS TREATMENT.

(1) *Malaria in Macedonia: Clinical and Haematological Features and Principles of Treatment.* By P. Armand-Delille and others. Preface by Prof. Laveran. Translated by Dr. J. D. Rolleston. Edited, with a preface, by Sir Ronald Ross. Pp. xxx+115. (London: University of London Press, Ltd., 1918.) Price 6*s.* net.

(2) *Anti-Malaria Work in Macedonia among British Troops.* By Dr. W. G. Willoughby and L. Cassidy. Pp. x+68. (London: H. K. Lewis and Co., Ltd., 1918.) Price 4*s.* 6*d.* net.

(1) THIS work deals with the parasitology of malaria, the associated clinical manifestations and the treatment, the main and more important part being the clinical. In the section on parasitology the authors enlarge on the importance of parthenogenesis of the gametes as the cause of the persistence of the infection and of the relapses. As J. D. Thomson has pointed out, the so-called parthenogenesis of the malarial parasite is based on a misconception of Schaudinn's of what the term "parthenogenesis" is, and on an error in interpreting the facts observed by him.

The greater prevalence of subtertian infections during the summer, and of benign tertian during the autumn and winter months, is in accordance with the findings of British workers on the Struma and Doiran fronts, and seems to bear some relation to the seasonal preponderance of different species of anophelines.

As stated, the chief portion of the work is devoted to the clinical aspects of the disease. Judging from the number of symptoms and complications described, it would appear that a considerable amount of work has been devoted to these points. Unfortunately, the authors give us no information of the number of malaria cases observed by them, or of the number of cases of the various clinical types they describe. They divide malaria clinically into two categories, primary and secondary paludism, with an intervening apyrexial period associated with relapse and complications.

Primary paludism may manifest itself as a slight febrile attack, or as a febrile gastric derangement, and it may also simulate typhoid, paratyphoid, or what is designated "Mediterranean dengue." Associated with this stage may be anæmia, varying in severity from a barely perceptible pallor to pronounced anæmia, with wasting and jaundice, and, perhaps, complicated with œdema or hæmorrhages, especially epistaxis, which is described as being fairly common. Petichiæ have also been observed. Whereas hæmorrhagic symptoms improved under quinine administration, œdema seemed to be unaffected by the drug.

A great number of symptoms and complications are described as being associated with primary paludism. These are arranged in order according to the organs involved. A condition called "infective icterus," bearing a close resemblance to Weil's disease, but being less fatal than the latter, is described. "Suprarenal insufficiency" appears to have been encountered several times. Acute cachexia was found only in connection with subtertian infections. Albuminuria was present only in a few cases; a definite acute nephritis was rarely seen. Although a few patients developed "hæmoglobinuric fever" early in the disease, this condition generally became manifest during the course of secondary paludism.

The authors state that they have not observed a true amaurosis in connection with malaria or its treatment with quinine; they consider the condition so exceptional as to be no contra-indication to treatment with large doses of quinine. They are also sceptical as to quinine deafness, but they have noted disturbance of the equilibrium, with excitability of the vestibular nerve, in two cases.

Pernicious attacks of malaria are attributed to invasion by large numbers of parasites in individuals whose resistance is diminished. They were met with only in *Plasmodium falciparum* infections, and generally in men suffering from great fatigue following overwork. The term "defaced paludism" is given to various atypical forms of malaria. "Masked paludism" includes cases in which the visceral manifestations are unaccompanied by febrile phenomena.

Secondary paludism, characterised by "disciplined" attacks, occurs in patients not exposed to reinfection by mosquito bites, and is that clinical form met with in cases which have returned to non-malarial countries. Under this heading are described all the ague attacks and their associated clinical phenomena. A short account of hæmoglobinuric fever is given.

The diseases most commonly found complicating malaria were typhoid, dysentery, and "recurrent fever." For the treatment of paludism, quinine hydrochloride is recommended as the most efficient salt. It should be given in 3-gram doses, and may be combined with urethane or antipyrin. The best method of administration, according to the authors, is by intramuscular or subcutaneous injection. Oral quinine is rarely considered advisable owing to the gastric disturbances generally present. Intravenous quinine should be given only as an extreme measure and where there are suitable conditions, as in large hospitals. The drug should be given daily during the febrile attack, six to eight hours before the attack is expected. In mild relapses 2-gram doses are advised, and in bad relapses 3-gram doses. In pernicious attacks great reliance is placed on adrenalin—2 milligrams in 500 to 1000 normal saline. Quinine in relapsing cases should be suspended between the attacks. During treatment absolute rest in bed, substantial diet, and the administration of iron and arsenic are recommended. The authors do not say how long quinine should be continued after the last febrile attack.

The impression left on the reader by this work is one of some confusion, but possibly this may be partly due to the difficulties of translating technical scientific points. Such expressions as "infective

icterus," primary and secondary paludism, the frequent repetition of imposing words like "syndrome," the mistake about the parthenogenicity, do not tend to lucidity.

One good result of studying this book may be to impress medical men with the necessity for suspecting malaria either as cause or as complication in all cases of disease, no matter what, occurring in intensely endemic districts or in patients returning from such.

In his preface Prof. Laveran criticises some points in the treatment of malaria. Many of the points mentioned above are dealt with in greater detail in a preface which Sir Ronald Ross has contributed to the English edition.

(2) The purpose of this little book, as explained in the preface, is to help future workers in anti-malarial measures by an account of the author's own experiences in Macedonia. In the first chapter the three parasites causing malaria are mentioned, and a brief account is given of the anopheles prevalent in Macedonia and acting there as hosts for the extra-corporeal phase of the plasmodium. A review of the prevalence of the disease according to the weekly notifications follows. The incidence appears to be at its lowest in January, after which it rises gradually until the latter part of May, when a slight remission takes place until the end of June; a rapid rise then occurs, and the elevation continues until the third week of July. A decline again takes place for a short time, followed by another rise, which reaches its maximum at the end of October. It is gratifying to read that there has been a decrease in the number of cases reported in 1917 as compared with 1916, although it is pointed out that owing to the continuance of relapses and carriers from the latter year it is difficult to guarantee the accuracy of the figures.

Malaria in Macedonia has been responsible for a much higher degree of invaliding than wounds have. The infection is so widespread that even units at the base and on the lines of communication are liable to the disease. The difficulty in dealing with the breeding-grounds of anopheles in "No Man's Land" at the front is responsible for the greater prevalence of malaria amongst the troops in that area.

The description of the topography of the country, with its swamps, rivers, streams, and wells, and the deserted villages, together with the account of the inhabitants, who seem to be almost universally infected with the parasite, renders obvious the magnitude of the task with which the medical authorities are faced. An outline of the general system observed by them in dealing with the problem shows that the measures adopted are both systematic and thorough.

The various means of combating the disease are described in detail. They are too numerous even for enumeration in a short review, but officers engaged in anti-malarial work will find a perusal of this section of valuable assistance. Stress is laid on the necessity for destruction of adult anophelines, which is regarded as being of even more importance than efforts to suppress the breeding-places of the insect.

The methods in use for protecting men from mosquito attack are carefully described, and the mechanism of using and keeping the new and improved mosquito-proof bivouacs and tents is given at length. The importance of educating officers and men in anti-malarial measures is strongly advised. Routine gas-mask drills are carried out, and the authors insist that if this is necessary, then anti-mosquito training is much more so on account of the very much higher percentage of invaliding from malaria.

The authors are guarded on the subject of quinine prophylaxis, but, on the whole, one infers that the administration of quinine (in the doses usually given as a prophylactic) has not been attended with success in the Salonika area. Prophylactic quinine, however, is not believed by them to interfere with the curative value of the drug if given afterwards.

The contents of the book are summed up in the last chapter, and many suggestions are made for the future, including propaganda amongst officers and men by posters and pamphlets as in use amongst our French Allies. Closer co-operation between executive and medical officers and the more rigid enforcement of precautions already ordered are advised.

The whole book provides very interesting reading, and it should be of valuable assistance to combatant officers and laymen as well as to medical officers. It contains evidence of the endurance and courage of our troops in a most difficult country under very trying conditions, and it shows the skill and determination with which the R.A.M.C. is endeavouring to combat a big problem.

F. W. O'CONNOR.

FRENCH WORKS ON RADIOGRAPHY.

(1) *Localisation et Extraction des Projectiles.* Par L. Ombrédanne et R. Ledoux-Leband. Second edition. Pp. iv+305. (Paris: Masson et Cie, 1918.) Price 4 francs.

(2) *Précis de Radiodiagnostic Technique et Clinique.* Par Dr. Jaugeas. Préface de Dr. Béilère. Second edition. Pp. xxviii+563. (Paris: Masson et Cie, 1918.) Price 20 francs.

(1) IN this excellent volume—one of the "Collection de Précis de Médecine et de Chirurgie de Guerre"—the authors set forth the most recent methods employed in the localisation and extraction of foreign bodies. The appearance of a second edition so soon after the first is testimony to the need for such information on the part of the medical profession and also to the high value which the work has attained since its appearance. The appreciation of the work of our Allies in all fields connected with the war is always a pleasure to workers in this country. The estimation in which this book is held is evidenced by the recent appearance of the first volume translated into English. We hope the editor of the first English

edition will soon be engaged on a translation of the second.

In no sphere of war work have our French Allies done better than in that for the relief of suffering caused in the war. The volume before us gives ample evidence of the advances that have been made in surgery and its essential accompaniment, radiography. The fact that the surgeon and the radiographer must work hand in hand is demonstrated in a perusal of the pages of the book.

The letterpress is extremely clear, the descriptions of apparatus and methods being very lucid. The illustrations amply figure the conditions referred to in the text; several are of particular interest, notably two plates of the thorax showing a bullet in the heart. The particular interest lies in the rapidity of the exposure, which must have been instantaneous, if one can judge from the extreme sharpness of the pictures. The value of radiograms of this quality is self-evident.

The subject is dealt with widely from all points of view, particularly from the surgical, and all, or practically all, methods of localisation are described. The description of the principles underlying the practice of localisation is very clear, and cannot fail to be instructive and helpful to all.

The useful methods of localisation are well dealt with, and attention must be directed to the combined method which is referred to as "extraction à l'aide de contrôle intermittent." The method so named is carefully described and must be of great value to surgeons at the present time. Surgeons and radiographers are recommended to read these chapters carefully, particularly those dealing with the dangers accompanying the method.

An interesting feature of the book is the description of radioscopic stereoscopy, which has been perfected in France by Dr. Lièvre. This is a most important advance in technique, and if the method is accurate and protective measures are assured, it should enable the operator to remove foreign bodies under screen observation in the minimum time, thus saving his time and ensuring the safety of the radiologist, who may have to do screening for a large number of operations.

(2) The title of this book admirably covers the full subject-matter of the volume, which is an excellent précis of the technical and clinical side of radiography. An interesting historical *résumé* of the discovery of the X-rays, and the subsequent development of the technique resulting from their use in medicine, forms the opening chapter of the work. Instrumentation is well described, and detailed descriptions are given of the most important pieces of apparatus. We note with approval a good description of the Coolidge tube. The question of protection against the injurious effects of X-rays is entered into fully. There is an excellent discourse on the physics of radiography—the physical facts underlying the use of the rays are fully considered. It will well repay the advanced radiologist to read these chapters carefully.

The chapter dealing with "application à l'homme normal" is particularly good. It deals successively with the technique of examination of the normal parts, and gives good descriptions of the composition of each picture. The whole is a very complete account of what the radiographer must be familiar with before he proceeds to an investigation of the abnormal.

The third section of the work deals exhaustively with "le radiodiagnostic en clinique." Many valuable plates illustrate this section, which will prove to be a most useful guide to the many workers in radiography at the present time.

Radioscopy is dealt with thoroughly.

The almost strict adhesion to French types of apparatus will strike the British reader forcibly. It would have been a useful addition to the value of the book if a number of American and British models had been described; but this is almost exclusively a French book, and from a perusal of its pages readers here will be able to understand what our Allies are doing in this important branch of science, and to appraise the value of their war effort in the field of radiography.

Naturally, at the present time our energy on both sides of the Channel is devoted to the discovery of the damage done by projectiles, their localisation and removal from the body, and the diagnosis and treatment of injuries to bone and the vital organs. It is with pleasure that we recognise that our French confrères are in this, as in all other branches of medicine, occupying a position which is worthy of their great past and promises a still greater future.

Normal radiography is gone into fully, and a number of good plates illustrate this section. Various abnormalities are described. The diagnosis of gastro-intestinal diseases, diseases of the thorax and of the urinary system, and the diseases and injuries of bones receive adequate description.

The book, as a whole, is a good one, and can confidently be recommended to British readers as a first-class production and a trustworthy guide to the practitioner and specialist—embodying in its pages the best work of a distinguished French radiologist.

THE EDUCATION OF ENGINEERS.

The Education of Engineers. By H. G. Taylor. Pp. vii+64. (London: G. Bell and Sons, Ltd., 1917.) Price 2*s.* net.

THE author of this little book endeavours to maintain the thesis that engineering is an art and not a science, and that since mechanical arts cannot be taught at a university, courses in engineering in universities are, in consequence, futile, and fail to contribute to the training of an engineer. This point of view is not novel, but it is surprising to find it supported by a university lecturer in civil and mechanical engineering.

The author's criticisms of university engineering training revolve around its academic character and lack of relation with practice. While, in a large measure, this view is correct, it is not necessary to return to the primitive methods of training engineers in order to find a remedy. Such

methods, in which knowledge was acquired by experience, were admirably suited to the days when engineering practice was largely empirical. To-day, however, a lengthy period of technical training is essential, but it should preferably be preceded by at least one year in the works, and followed by a two or three years' apprenticeship. Technical training will never make indifferent students into good engineers, and able students may succeed without it, but the average man finds it a necessity. The remark that a man must first be an engineer by nature applies equally effectively to all walks of life.

The author's gravest error, however, is the inexcusable manner in which the requirements for and characteristics of engineers and artisans and of engineers and inventors are confused. Industry has long since lost that individual craftsmanship which distinguishes art; and the parallel drawn between artists and engineers no longer holds good. In the case of dentists—to which special reference is made—the field of work is so broad that a distinction is now being made between the dental mechanic, who learns his trade much as does the engineering artisan, and the dentist proper, who is frequently university-trained, as is the engineer. Clearly, the author has not fully comprehended the difference now existing between trade education and technical education for manual workers and for professional engineers respectively.

The book is written in a very attractive manner, although it is marred by several examples of slip-shod phraseology. We are unable to see in it any adequate result for the four years' research admitted by the author, or the call which prompted him to write it.

OUR BOOKSHELF.

Field Book of Insects. By Dr. F. E. Lutz. Pp. ix + 509. (New York and London: G. P. Putnam's Sons, 1918.) Price 12*s.* 6*d.* net.

THE author of this handy little volume offers something of an apology for adding to the large number of books—"popular, semi-popular, and unpopular"—on insects, but he has produced a general guide to entomology which will prove uniquely valuable to the amateur collector and observer. "I have been governed in the choice of subject-matter," he writes, "not so much by what I think ought to be in a book on insects as by what the public seems to want to know." He gives summarised characters for the discrimination of the various insectan orders, diagnostic tables for the principal families, and in some cases also for the genera, and mentions a number of species—1400 in all—which may be found commonly in the northern United States, naturally paying especial attention to those of economic importance. On the hundred small plates—many of which are effectively coloured—a good selection of these species is clearly figured. The result is that the student can scarcely fail to identify, approximately at least, the insects which he captures during an ordinary country ramble, while he finds in this volume (which would slip easily into a side-pocket) interesting information about their habits and importance.

Although the book deals specially with the North American fauna, it will prove of service to British and European collectors, as so many of the species and nearly all the genera are common to the Eastern and Western continental lands. Nevertheless, a work somewhat on these lines, compiled for the benefit of our own people, would be a most desirable addition to our entomological literature, for it certainly contains "what the public seems to want to know," and "the public" that is mildly interested in entomology has a particular desire for coloured figures which render comparatively easy the identification of conspicuous insects, like the popular Lepidoptera, to which Dr. Lutz devotes more than 100 pages. A special chapter on galls, with four plates of outline drawings, furnishes an introduction to a highly interesting aspect of insect bionomics. G. H. C.

The Grapsoid Crabs of America. By Mary J. Rathbun. (Smithsonian Institution, U.S. National Museum, Bulletin 97.) Pp. xxii + 461. (Washington: Government Printing Office, 1917.)

THIS volume, by an author who has earned a high reputation by previous work on Decapod Crustaceans, is part of a systematic treatise dealing with the crabs of the whole of the New World, to be completed in four parts, the main purpose being to give a brief description, with figures, of each species, together with a detailed catalogue of the specimens in the United States National Museum.

The work has evidently been prepared with great care. When the author took up the subject the collection under her charge had been partly worked out, but the nomenclature stood in need of revision, and in order to overcome the difficulties connected with a correct interpretation of the types of so many species described by Fabricius, Herbst, de Saussure, the two Milne Edwards, Miers, and others, she spent much time in the museums of Copenhagen, Kiel, Berlin, Geneva, Paris, and London, where not only fresh descriptions and photographs were taken, but arrangements were made for exchanges whereby many co-types and specimens directly compared with types were secured for the American museum.

The classification adopted is that of Borradaile for the higher groups; the definitions of families and sub-families are copied or adapted from those given by Alcock.

Illustrations add greatly to the value of a work of this kind; the numerous text figures and 161 plates, on which examples of nearly all the species dealt with are represented from photographs, deserve the highest praise.

Now that such an excellent guide is available, it is to be hoped that attention will be directed to the life-histories, which, the author tells us, have not been worked out in more than a dozen American species. G. A. B.

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.]*

Weeping Forms of Trees.

IN NATURE for July 11, on "Weeping Forms of Elm," Mr. W. H. Shrubsole refers to two distinct factors: (1) the "weeping" of the shoots, and (2) the peculiar contorted appearance of the older branch-systems. A fine specimen of the weeping ash, grafted, as usual, standard high on a common ash stock, in the Oxford Botanic Garden, shows a clear "umbrella" of weeping branches, while the head of the tree is a similarly twisted and contorted mass of large boughs.

The weeping effect is due to weak geotropic sensitivity, but to a greater extent to congenital enfeebled response to the action of light. The weeping shoots on bending branches grow out in the direction impressed on them in the bud, without any attempt at correction, and thus pass out and down, almost vertically, as sub-etiolated shoots with very long internodes (a foot or more), the shoot of the current year being as much as 6 ft. long. It is obvious that they cannot go on for ever, as they soon touch the ground, while they receive the less illumination as they pass down from the crown of the tree.

But not all the branches are of this type, as in other freak-forms the normal type of strongly positively heliotropic shoot with erect habit and short internodes (6 in.) is still freely produced. Since these get into the more illuminated regions they progress, after all, better than the others; and as they twist round on the drooping branches to straighten up, the surviving branches of the tree ultimately consist only of such "contorted" shoots, and the central trunk-system takes on the peculiarly twisted mass of boughs.

The effect is, however, only an exaggerated expression of the same causes which produce the erecting curvatures in a tree formed of branch-systems bending down under the weight of their foliage; and all weeping trees tend to show it more or less, the weeping ash, with decussate foliage and long annual shoots, perhaps most clearly. To make a more shapely "umbrella," the non-weeping shoots may be cut out, but the tree continues the space-form by "natural causes." A. H. CHURCH.

Botanical Laboratory, Oxford, July 15.

The Mineral Wealth of Germany.

IN NATURE of July 4 Prof. Louis criticises my paper, "Germany's Natural Wealth," which appeared in the *Fortnightly Review* of June. In that paper I pointed out that the wealth of Germany in coal, iron-ore, and potash amounts to at least 240,000,000,000*l.*, taking the value of coal and of potash at 10*s.* per ton and that of iron-ore at 5*s.* per ton. Prof. Louis, on the other hand, tries to show that the value of Germany's three principal minerals comes only to 700,000,000*l.*, and asserts that I have overstated Germany's mineral wealth more than three hundred times.

With all respect to the scientific eminence of Prof. Louis, I am afraid that he has made a great mistake. The value of a nation's natural resources can be estimated either from the point of view of the capitalist, who wishes to exploit mines, etc., for his personal profit, or from that of the nation as a whole. A nation has two characteristics. In the first place, it must be considered practically immortal. In the second place, it consists not merely of a few capitalists, but of the whole population. From the point of view of the company promoter, the capitalist, or the shareholder the value of a ton of coal *in situ* is, of course, not 10*s.*, but only a few pence which form the capitalist's margin of profit, provided the coal be immediately available, and merely a small fraction of a penny if it be available fifty years hence. Every child knows that. On the other hand, from the point of view of an undying nation the value of a ton of coal *in situ* is, of course, 10*s.*, or whatever is a fair average price at the pit's mouth; for although 9*s.* 6*d.* may be required in wages and expenses to extract that ton of coal, this 9*s.* 6*d.* goes to the nation. Therefore a ton of commercially exploitable coal *in situ* is worth 10*s.* from the national point of view, whether it will be extracted in the present year or a century hence. The same reasoning applies, of course, to iron-ore and potash.

My article dealt exclusively with Germany's national wealth from the national point of view. I did not even mention the profit of capital, which is a minor consideration. While Prof. Louis's estimate capitalises and sums up the immediate value of the profits of capital, my estimate of the value of Germany's mineral resources is taken from the point of view of the nation. Of course, it is absolutely non-permissible to say, as Prof. Louis does, that the value of a ton of coal is 6*d.* because that is the capitalist's profit. If coal-mining in Great Britain would return only sufficient to pay expenses, cost of management, etc., the British coalfields, the basis of the country's wealth, would, according to Prof. Louis, be worth exactly nothing, while by my calculation they would be worth 100,000,000,000*l.*

In view of the probable increase in the price of coal, iron-ore, and potash in the future, my estimate of the value of Germany's minerals was probably a great understatement. POLITICUS.

July 6.

THE above comments of "Politicus" are marred by two notable fallacies. In the first place, he holds that my valuation of the minerals is based upon the profit to be derived from mining them. This is quite wrong; my valuation of the coal, etc., *in situ* is based upon the only true criterion of value, namely, the price which it will fetch in the ordinary open market, the sum which those who wish to mine the coal are prepared to pay for that coal in its unsevered condition, *i.e.* in this country the average royalty which the coalowner can get for it. The profit which those who mine it can make out of it has nothing whatever to do with the valuation, except indirectly, in the sense that coal which cannot be mined at a profit is unsaleable, and therefore has no value. The other fallacy is, perhaps, best shown by pointing out that, according to "Politicus," the unsevered coal in the bowels of the earth is worth as much as the same coal at bank, so that in his view the nation gets the labour and materials expended on raising the coal for nothing! It is surely obvious that if coal at bank, after 9*s.* 6*d.* per ton has been spent upon getting it, is worth 10*s.* per ton, it cannot be worth 10*s.* before anything has been spent upon it, and that this is equally true whether such expenditure be looked upon as national or as individual.

The further contention that money realisable in fifty years is worth as much as money realisable to-day is surely not worth discussion; nations as well as individuals have to pay interest on their loans. According to "Politicus," the 15*s.* 6*d.* war savings

certificate would be to-day worth 1*l.* because the nation will pay 1*l.* for it in five years' time. I fear that he stands alone in this valuation. H. LOUIS.

Man's Ancestry.

IN relation to your reviewer's interesting notice in NATURE for June 27 of Prof. Wood-Jones's booklet, "The Problem of Man's Ancestry," it is appropriate to remember that the "blood-reaction test" shows the relationship of man to the ape to stand exactly as that of the horse to the donkey; the latter have had a common ancestor. Taking man as equalling 100, the ape comes at 70; the numbers for the horse and the donkey are the same. But this test shows no blood relationship whatever between man and the lower animals, thus confirming Klaatsch's view that the human line became separated very far down at the basis of the vertebrate phylum. W. WOODS SMYTH.

Maidstone, July 3.

THE similarity in the reaction of human and anthropoid blood is the most convincing evidence we have of man's close relationship to the gorilla, chimpanzee, and orang. The classical experiments on blood immunity and blood relationships carried out by Prof. Nuttall, of Cambridge, in the opening years of the present century assured him that those anatomists were right who brought man and anthropoid apes from a common stock. All the biological evidence collected since 1904 has supported Prof. Nuttall's conclusion. When attempts have been made to transmit diseases which are peculiar to man, such as syphilis and typhoid, it has always been found that the great anthropoid apes are more susceptible than any other primate, and much more than any other mammal. When physiologists wish to discover the action of any particular part of the human brain they invariably select an anthropoid ape as the subject most likely to yield the information which is being searched for. But I do not know of any anatomist who has claimed that the relationship between man and the gorilla or between man and the chimpanzee is as close as that which exists between the horse and ass. The structural difference between the gorilla and chimpanzee is greater than that which differentiates the horse from the ass; the structural difference between man and the gorilla is still greater.

It is for those who hold that man has arisen by an independent line from a primitive mammalian stock to explain why man's blood gives no reaction with the blood of lower animals. If it is true that man is a primitive form and retains primitive characters, then we should expect his blood to yield such reactions. The fact that it does not supports the usually accepted hypothesis that man has arisen from an anthropoid stock. THE REVIEWER.

POSITION AND PROSPECTS OF THE HOME TIMBER SUPPLY.

THE utility of forests to a nation is one of the economic factors to its well-being which have been brought to an unforeseen prominence during the world-war; and perhaps to no other European nation has this unlooked-for development proved so startling, because so totally unsuspected, as to ourselves.

Our woods were not grown from the commercial aspect—sport, amenity, and shelter to crops and stock were their main *raison d'être*. We did not consider it necessary to grow woods for purely commercial reasons—that is, for the sake of the timber and pit wood and paper pulp, etc., they would yield. We obtained our requirements in these commodities by importing them from abroad, and relied on the Navy being able to safeguard these imports. We have now discovered our mistake and are paying for it. The timber purchased in 1915 and 1916 cost 37,000,000*l.* more than it would have done in 1909–13.

On the Continent it was thought that the utility of the forest to a nation was thoroughly understood, but a study of Continental text-books discloses the fact that, so far as modern warfare is concerned, even there the value of the forest and its close connection with the operations of the contending armies were but dimly foreseen. It may be on record, perhaps, in the archives of the German War Office that an exceptionally large demand for timber might prove one of the essential factors to the successful waging of a great war. But it is doubtful whether the Germans even foresaw the magnitude of the demands; and, in any event, they would have calculated on obtaining their requirements in this respect from the countries they overran—as, in fact, has been the case in France, Belgium, Poland, and elsewhere. Nor was it anticipated that the destruction of forests would be so heavy in the fighting zones. In the western provinces of Russia, for instance, from which the Baltic ports were mainly supplied, some 16,000,000 acres of forest have been destroyed! This in itself will limit the amount we are likely to receive from the Baltic in the future. Destruction and heavy fellings are, then, taking place throughout Europe, and, with our timber imports reduced to a negligible amount, we have now been felling heavily for some time past in our own small area of 3,000,000 acres of woodlands, of which probably not much more than half will be commercially exploitable. It will be alike useful and of interest to consider briefly the present position and future prospects of this timber question.

Almost from the outbreak of war we have been living a hand-to-mouth existence so far as timber supplies are concerned. The first troubles arose with the pit-wood requirements of the collieries, and the matter has remained a difficult one throughout. Our position as the coal producer and coal merchant of the Allies has rendered it essential to keep the collieries working at full pressure. Previous to the war three-quarters of our pit-wood supplies came from Russia and France; this amount was cut off at a moment's notice with the closure of the Baltic ports and the calling to the colours of the French woodcutters. The price at once rose, and though the imports continued for some time, the increasing demands made upon tonnage for other purposes, coupled with the German submarine campaign, gradually reduced them to a very small figure. We had to fall back upon our home woods for this product. A demand also quickly arose for ash with which to fashion the handles of entrenching tools; but the use of

this wood for the purpose was afterwards altogether eclipsed by its introduction into the construction of aeroplanes. The country is now being ransacked for ash of high quality, and the price has greatly increased.

During the first eighteen months of the war the hutting of the New Armies absorbed large amounts of soft timber, the material consisting mostly of imports. With the improvement in trench construction, dug-outs, lines of communication, and so forth, large orders for sleeper material, planks, etc., had to be fulfilled, and considerable areas of old forest and young pole forests were felled (the pole woods at a sacrifice). The latter were used for wire-entanglement posts, field telephones, corduroy roads, and gun-pits, of which numerous illustrations have appeared in the pictorial Press. Packing cases for stores also absorbed large amounts of wood. Later on a new demand arose: for the building of the network of light railways behind the front sleepers were required in enormous numbers, and by then we had been driven almost entirely to rely on our own home woods, inadequate and poorly grown as they were, and such areas of forest in France as our Ally made over to us. In Great Britain we have become acquainted with Canadian and Newfoundland lumbermen and their methods, with Portuguese, German prisoners, and others, companies of whom are at work throughout the length and breadth of the country.

Many ask, What is to be the end of it all? The answer is not difficult. We shall have to be prepared to sacrifice all the woods in this country which are commercially exploitable. This is the present position. If the war lasts long enough they will go into the war furnace and the material be lost to us so far as any future utility is obtainable from it. If the war comes to an end in the latter part of this year or early next year, still the balance will have to go in the course of a few years. For the demand for timber after the war will be as great for some years, so far as can be foreseen, as it is at present, and the supplies, owing to tonnage difficulties, short of the demand. Practically all our timber-using industries, where not employed on war work, are non-existent, of which house-building occupies a prominent position. We are all aware of the difficulties with which the paper trade, publishers, and the Press have to contend. These troubles have become chronic. It will be necessary to restart all these industries after the war. Timber prices will remain high, and fellings in our home woods will have to continue to help supplies. This is the present position so far as it can be foreseen.

Now as to future prospects. From what has been already said it is obvious that British woods will only be able to supplement the supplies which will be required during the period immediately following the peace. Even if we undertake, as it is to be hoped we shall, a large afforestation scheme in these islands when the war is over, the woods will not yield pit wood before twenty to thirty years after formation, and timber in fifty to sixty years. We require, therefore, to make some arrangement to ensure adequate supplies during the next forty to fifty years. The old conditions in the North European timber markets, in which we reigned supreme at the outbreak of war, will not return. Some of our present Allies, previously nearly self-supporting, will be our competitors in these markets in the future. What arrangement is, then, necessary to ensure supplies for the above period at a reasonable figure? The problem requires to be faced and settled at an early date. It is one of the urgent problems in connection with reconstruction work. In the past, Russia, Norway, and Sweden sent us the bulk of our imports of soft woods, pine, spruce, and larch, Russia being the chief supplier. It is known that Norway and Sweden are nearly cut out. A few years will see their exports dwindle to a figure far below the pre-war one. We shall have to face competition in markets which will be shrinking. It is therefore imperative that new sources of supply should be tapped. So far as Great Britain is concerned the two countries where such new sources exist are Canada and Russia.

Canada.—Canada has long been looked upon by Great Britain as a timber El Dorado. We know for a fact that she has a gigantic reserve of untapped timber. All agree that the Douglas fir forests of British Columbia are magnificent. It may therefore be admitted at once that we can reasonably hope to obtain a certain portion of our requirements from Canada during the period under consideration. But there are certain factors in this matter which should not be overlooked. The chief are, first, the extent to which the forests accessible to us—*i.e.* accessible from the point of view of the price to be paid for the material—have been cut out; and, secondly, the manner in which the future great competition by America, who has mostly cut out her gigantic forests and is an enormous consumer of timber, will be likely to affect the Canadian market and its prices. Canada and Newfoundland together sent us only about one-tenth of our coniferous timber and pit wood before the war. In the future these imports may be increased, but any increase must inevitably be guided by the ordinary laws of supply and demand. Canada, we may infer, will sell her material, or the greater bulk of it, in the best market. This market, because the closest, will be the American. The timber imported from Canada in the past was practically all water-borne, cut on the banks of the rivers and floated out, this being the cheapest form of carriage. The freights on long railway and road carriage would kill Canadian timber exports to this country, since we could not afford to pay the price. Opinions differ a good deal as to the amount of Canadian timber which remains accessible to us—*i.e.* accessible at a price we can afford economically to pay.

The other point, the competition with America, is a more difficult and delicate one. In the early years of this century America endeavoured to negotiate with Canada a preferential tariff on

wood pulp. This question may be expected to crop up again. America must in the future be a very large importer of Canadian timber; and although we may hope to obtain a certain proportion of our requirements from Canada during the next forty years, it would not be a good policy, or even economically sound if another way out can be found, to stand in Canada's way by asking her to forgo a certain part of a large and profitable market at her door in order to bolster up a more distant one at a financial loss to herself. On the other hand, our timber industries could not afford to pay the same price as American ones *plus* the additional transit charges to this country. The question of tonnage does not affect the matter save in so far as the shorter the distance the material has to be carried, the simpler the tonnage arrangements.

Russia.—I have given some study to the Russian forests for the past decade and more, and had an opportunity last year of discussing the problem of their exploitation with several members of the Russian Provisional Government and assistant Ministers. Russia has an enormous area of undeveloped forests. Those of interest to us are situated in the Archangel, Vologda, and Olenets Governments, Archangel and Alexandrovsk being the ports of shipment, the chief species being pine, spruce, and larch. Before the war our chief imports from Russia came from the Baltic ports. I have already given the reasons for regarding the revival of these imports after the war as improbable. What remains of those forests, I was credibly informed, Russia will require to keep for herself. I have long held the opinion that, with the inevitable decrease of the exports from some of the countries supplying Great Britain, which were all felling primeval forest, we should have to go to Russia for an increasing amount of our requirements. The war has brought about this condition and rendered our position more difficult owing to the fact that we shall now have to face competition to a degree previously non-existent. It has become an economic necessity for us to obtain a proportion, the larger proportion, of our requirements in soft woods from the Russian forests during the next forty to fifty years. The only point for consideration is, Are we going to make arrangements to obtain them direct, or are we going to obtain them from middlemen and pay the middlemen's profits?

In March, 1916, I put forward the suggestion that we should come to an arrangement with the Russian Government whereby areas of a sufficient size to furnish us with a definite proportion of our requirements should be leased to us. With this end in view I went to Russia last year. I visited portions of the forests in the Archangel and Vologda Governments, and discussed the matter thoroughly with members of the Government. This Government had decided upon an arrangement under which it was prepared to favour the Allies as against the Central Powers with reference to granting facilities to capital for the development of the valuable unexploited resources of Russia, of which her forests will prove the easiest to commence with. The Government was proposing to grant concessions in the big forests of the north-east in blocks of 500,000 acres, each concession to be for a period of thirty to thirty-five years. The working of these blocks would be granted to foreigners who were prepared to provide the necessary capital and would undertake to fashion the material in Russia before export—*i.e.* convert it into sawn material, wood pulp, etc. I was informed that the Provisional Government was prepared to come to an agreement with the British Government on these lines, that, in fact, we could acquire an area or areas of Russian forest which would enable us to assure a proportion of our future requirements, our necessities, in the soft woods which are of such great importance to our industries.

This was the position when the Provisional Government was swept away and the Bolsheviks came into power. The present phase in Russian politics may be regarded as a transition stage. When a stable Government supervenes we should be ready to take advantage of this opportunity to remove all anxiety on the score of the future timber supplies of this country. If we do not seize the opportunity we may be certain that others will do so, in which case, since the material is essential to our wood-using industries, and, therefore, must be obtained, we shall have to pay middlemen's profits to the foreigner, the Swede, Norwegian, and so forth, who, having exploited their own forests, would wish to maintain their exports to Great Britain by felling in the Russian forests.

E. P. STEBBING.

INDIGO IN BIHAR.

THE present position and future prospects of the natural indigo industry in India have of late been the subject of renewed and intensive study. Two interesting articles, in which the actual situation is partly summarised, have recently appeared.[1] These papers supply a concise review of the growth of the synthetic indigo industry and of the displacement since 1897 of natural indigo by the synthetic product. By 1910 the cultivation of indigo in Java had almost become extinct, the crop there being largely replaced by sugar. By 1914 the manufacture of indigo had practically ceased in all the provinces of India except Bihar, where alone the industry was in European hands and was conducted in well-equipped establishments. The area under indigo, which in 1895 was nearly 1,700,000 acres, had shrunk to less than 150,000 acres. The price per lb., which in 1897 was still from 7*s.* to 8*s.*, had fallen, in the early part of 1914, to 3*s.*

With the cessation of the supplies of German synthetic indigo which accompanied the outbreak of hostilities, the prices of Indian indigo were nearly quadrupled, and this high figure was main-

1 "The Present Position and Future Prospects of the Natural Indigo Industry." By W. A. Davis, Indigo Research Chemist to the Government of India. *Agricultural Journal of India*, vol. xiii., parts i. (January) and ii. (April), 1918.

tained throughout 1914–15. There was a slight fall during 1915–16, but 1916–17 saw a reversion to the 1914–15 standard, which has continued. There was a corresponding increase in the area under the crop; this, during 1916–17, was three and a half times as great as the average for the preceding five years. There has been a similar rise in the quantity of indigo exported from India; four times as much was dispatched abroad in 1915–16 as had been shipped during 1913–14. But the total area under the crop in 1916–17, which exceeded 756,000 acres, still remained less than half what it had been in 1895, while the total production in 1916–17, which amounted to 95,500 cwt., was little more than half the output of 1896, which had been 187,000 cwt.

The view held in circles well qualified to judge is that this marked increase in the production of the natural dye since the war began can be regarded only as temporary, the synthetic dye being now too well established ever to be displaced. There is much to be said for this view. Since the war began, the actual output of the dye from the various Indian provinces in which by 1914 the industry had practically become extinct has exceeded that from Bihar. Yet in these provinces the industry had been in the past, and is now being, conducted in a somewhat primitive fashion by methods that result in a relatively poor yield of a product of low quality. The author of the papers before us nevertheless hazards the suggestion that, provided certain improvements in actual practice can be effected, the natural product may "be able to put up an interesting fight with the synthetic dye." It is, however, admitted that the possibility of maintaining that contest must depend upon the retention or the capture of an Eastern market.

An equally lucid and well-illustrated review of the methods of manufacture which obtain in Bihar is given in the second of the articles under notice. The indigo plants there cultivated are two in number: *Indigofera sumatrana*, an Asiatic form, which is still the chief source of the dye in Bihar, first introduced to north-eastern India as a crop in the later years of the eighteenth century; and *I. arrecta*, an African species, first brought to India from Java so recently as 1899. The latter species as a rule yields more green plant per acre than the former, and always produces far more dye per 100 maunds of plant. The two demand different treatment, for *I. arrecta* may be sown in October and is ready for a first cutting in late May or early June following, whereas *I. sumatrana* cannot be profitably sown until February, and as a rule is not cut until mid-July. Another advantage in the case of *I. arrecta* is that this species suffers less from flooding and water-logging than *I. sumatrana* does. One of the most important considerations connected with the future prospects of natural indigo in India therefore is an increase in the cultivation of *I. arrecta* in preference to *I. sumatrana*, so as to cheapen the production of the dye. Unfortunately certain serious difficulties, chiefly of a botanical nature, are met with in the management of what is still a comparatively new and correspondingly unfamiliar plant in Bihar.

The most fundamental of these difficulties, which relates to the identity and the original home and habitat of the plant itself, was definitely settled on behalf of the indigo industry by the officers of the Indian Botanical Department in 1902. The remaining difficulties, which are of a physiological and pathological nature, have been the subject of study by the Indian Agricultural Department during the past ten years. The author of the papers now under notice has promised to deal with these difficulties and to indicate the means by which they may be overcome; also to consider how far existing methods of manufacture in Bihar are imperfect and to explain how these may be improved. His further contribution to the general subject will therefore be looked forward to with interest.

PROF. ALFRED SENIER

PROF. ALFRED SENIER, who died on June 29 at Galway, was born at Burnley on January 24, 1853. His parents, about two years after his birth, emigrated to Wisconsin, where he received his early education. In due course he attended the Universities of Wisconsin and Michigan, and graduated as doctor of medicine of the latter in 1873. But his interest lay principally in the subject of chemistry, and, returning to England, he filled, under Prof. Attfield's direction, the posts of assistant and demonstrator in chemistry to the Pharmaceutical Society in London from 1874 to 1882, and, afterwards, for about three years, that of lecturer in chemistry in St. John's College, Battersea, of which the Rev. Canon Daniel was at that time principal. He then became a research student with Prof. von Hofmann, and after a period of three years received the degree of Ph.D. from the University of Berlin. His inaugural dissertation, "Ueber Cyanursäure, ihre Isomeren und Derivate," on receiving this degree, was published. In 1890 he became *locum tenens* for Prof. Maxwell Simpson in Cork, and in 1891 he was appointed professor of chemistry and lecturer in medical jurisprudence in Queen's College, now University College, Galway.

Prof. Senier's researches in organic chemistry were devoted mainly to the cyanuric acids, to the acridines, and to phototropic and thermotropic phenomena. He proved the non-existence of α- and β-cyanuric acids, and his discovery of hexamethylacridine and α-naphthacridine led to the investigation of new acridine derivatives, to new methods of inquiry, and to the discovery of new types of acridine compounds. In his presidential address to Section B of the British Association in 1912, he dealt with the salient features of his work on phototropy and thermotropy.

He was always greatly interested in philosophical subjects, and was familiar with the topics and controversies of philosophy and logic. With Dr. W. R. Dunstan, he was instrumental in founding the Aristotelian Society in 1880. He was hon. secretary and treasurer of this society from its

foundation until 1884, and was made an hon. member in 1902.

Prof. Senier took an active part in all matters connected with the government of Galway College and of the National University of Ireland. He was a member of the governing body of the college and a member of senate of the university, and possessed in a high degree the qualities that are essential for securing efficiency in a position of responsibility in the administrative work of a university. He was a fellow of the Chemical Societies of London and Berlin, a fellow of the Institute of Chemistry, a member of the Royal Irish Academy, and an honorary doctor of science of the late Royal University of Ireland.

NOTES.

THE French National Fête Day is July 14, but as the date fell on a Sunday this year it was celebrated with much enthusiasm in London on Friday and Saturday. Last year the sum of 200,000*l.* was raised on "France's Day" for the French Red Cross, and this year it is expected that a total of a quarter of a million pounds will have been reached. The festival was made particularly noteworthy by messages which were dispatched to France by many leading societies and institutions in Great Britain, among them being the following:—*Royal Society:* The Royal Society of London sends greetings to the French nation, and more especially to its scientific men. It recalls the intimate friendship which since their foundation has bound together the Académie des Sciences with its own body. Always united in their endeavour to promote the advance of science, they are now joined in their efforts to defend the cause of civilisation and freedom. *British Association:* Nineteen years ago the Dover meeting of the British Association was "so arranged that two great nations which had been, a century earlier, grappling in a fierce struggle should in the persons of their men of science draw as near together as they could." Another joint meeting with France was on the point of taking place when our high hopes of lasting general peace were so cruelly destroyed. But out of the destruction has arisen a far closer union of our two peoples, and an even brighter prospect of our future co-operation for the good of humanity and of science. *Royal College of Surgeons of England:* Brothers-in-arms, we greet you. Bound by ancient ties of blood and by the memories of many a gallant contest in the past, to-day we stand as one nation united in a sacred cause. We have before us a happy presage from the past. As the united efforts of Pasteur and Lister have laid low the tyranny of disease, so shall France and Britain conquer a tyranny still more remorseless. Our future brightens, and shall endow Gaul and Briton with a common birthright to remain a splendid heritage for all time. *British Academy:* To France, who has so often inspired and led civilisation in Europe: to France, who upholds the banner of intellectual freedom and unfettered thought; to France, who for nearly four years has endured brutal outrage and the violation of all decencies of humanity and civilisation, the British Academy, in the name of British scholarship, sends on this great anniversary a renewed assurance of loyal fraternity and of unshaken determination to continue the conflict until liberty is secured and French soil delivered from the desecration of the invader.

THE prevailing epidemic of so-called influenza is widespread both in this country and on the Continent. The most striking symptoms are sudden onset with chills, headache, and pain in the neck, back, loins, and limbs, with general malaise. Fever is present, ranging from 102° to 104°, or even 105° F., but generally disappears almost suddenly on the third or fourth day of attack, and the individual rapidly convalesces. On the whole, the disease is quite mild and unattended with complications. It differs from the true influenza, which was so prevalent in 1889 and the early 'nineties, by being milder and of shorter duration, and by the rapid convalescence. The true influenza is caused by Pfeiffer's bacillus, a minute rod-shaped microbe abundant in the bronchial secretion. As regards the present disease, Capts. T. R. Little, C. J. Garofalo, and P. A. Williams state that they have investigated a number of cases and entirely failed to find the *Bacillus influenzae*, but a gram-positive diplococcus appears to be constantly present in the naso-pharynx, throat, and sputum, which they tentatively regard as being the causative organism (*Lancet*, July 13, 1918, p. 34). The *Lancet* suggests that the disease would be better named "catarrhal fever."

THE following grants of money for research committees were voted by the General Committee of the British Association at the meeting in London on July 5:—*Section A.—Mathematical and Physical Science:* Seismological investigations, 100*l.*; discussion of geophysical subjects, 10*l.* *B.—Chemistry:* Colloid chemistry and its industrial applications, 5*l.*; non-aromatic diazonium salts, 7*l.* 7*s.* 8*d.* *D.—Zoology:* Inheritance in silkworms, 17*l.* *F.—Economic Science and Statistics:* Women in industry, 10*l.*; effects of the war on credit, etc., 10*l.* *H.—Anthropology:* Palæolithic site in Jersey, 5*l.*; archæological investigations in Malta, 10*l.*; distribution of Bronze-age implements, 1*l.*; age of stone circles, 15*l.*; anthropological photographs, 1*l.* *I.—Physiology:* The ductless glands, 9*l.* *K.—Botany:* Heredity, 15*l.*; Australian Cycadaceæ, 7*l.* 17*s.*; Australian fossil plants, 15*l.* *L.—Educational Science:* The "free-place" system, 5*l.* *Corresponding Societies Committee:* For preparation of report, 25*l.* Total, 268*l.* 4*s.* 8*d.*

THE death of Mr. Isaac Beardmore is recorded in the *Engineer* for July 12. Mr. Beardmore, who was eighty-two years of age, was joint proprietor, and was associated with the management, of Parkhead Forge, Glasgow, for about twenty years. Under his control the Parkhead Forge was converted from an iron to a steel works in 1878–80.

THE death is announced, on July 14, at seventy-seven years of age, of Dr. R. O. Cunningham, emeritus professor of natural history and geology, Queen's College, Belfast. Dr. Cunningham was naturalist to the survey of the Straits of Magellan and author of "Notes on the Natural History of the Straits of Magellan" and "On Reptiles, Amphibia, Fishes, Mollusca, and Crustacea obtained during the Voyage of H.M.S. *Nassau*."

Two Chadwick public lectures were delivered by Prof. D'Arcy Thompson last month at the Mansion House, London, and the Surveyors' Institution, Westminster, respectively. Abstracts of these lectures have been published in the *Fish Trades Gazette* of June 29 and July 6. The first dealt, in general, with the fishing industry of Europe, and in particular with the line and trawl fisheries of Great Britain. The second had for subjects the great herring fishery of the Scottish and English east coasts, the growth of the industry and its administration, and the origin of the fishing population.

A SEPTUAGENARIAN engineer of distinction, with a long record of useful public and private service, has passed away in the person of Mr. George Waller Willcocks, C.B., whose death occurred on July 7. His most prominent work in this country was in connection with the Local Government Board, which appointed him its chief engineering inspector in 1902. Some time previously he had been, first chief assistant, and then chief, hydraulic engineer for Ireland, until the office was abolished in 1890, when he received the thanks of the Irish Executive for his services. Mr. Willcocks had also considerable foreign and colonial experience. After several years with the East London Railway, he went out, in 1869, to Hungary, to engage in railway development in that country, and, in 1880, he was in South Africa, constructing waterworks in Natal and Cape Colony. His private practice included much Parliamentary work on railway Bills, and he also reported to the Thames Conservancy on the condition of the river from Purfleet to the sea. He was a member of the Institution of Civil Engineers, having been elected in 1873.

THE Electrical Research Committee, which was appointed last autumn, under the auspices of the Department of Scientific and Industrial Research, is at present engaged in superintending a research on insulating materials (fibrous materials, porcelain, ebonite, mica, composite materials) and the waterproofing treatment of insulating windings of electrical machines, in respect of which grants have been made to the Committee by the Research Department, the British Electrical and Allied Manufacturers' Association, and the Institution of Electrical Engineers. The Committee consists of three members nominated by the institution, and three members nominated by the B.E.A.M.A., the nominees of the former being Mr. C. H. Wordingham (chairman of the Committee), Mr. C. C. Paterson, and Mr. C. P. Sparks, and those of the latter Mr. F. R. Davenport, Mr. D. N. Dunlop, and Mr. A. R. Everest. The temporary address of the Committee is 1 Albemarle Street, London, W.1, and the secretary is Mr. P. F. Rowell.

JUNE this year was generally cold and dry over the United Kingdom, and for the first month of summer was far from seasonable. At Greenwich the mean temperature for the four weeks ending June 29, as shown by the weekly weather reports of the Meteorological Office, was 57·3° F., which is 2° below the normal. The greatest deficiency of temperature occurred in the closing week, when the mean was 56·7° and 4° below the normal. The maximum shade temperature in each of the last two weeks, ending June 22 and 29, was 73°, and for the week ending June 15 was only 74°. For one-half of the days in June the London temperatures failed to touch 70°. It is, however, not necessary to go further back than two years for an equally unsatisfactory record, the weather being decidedly colder in June, 1916, when the mean temperature for the month at Greenwich was 2° lower, and there was a greater absence of warm days. The month this year was drier. The total rainfall for the four weeks ending June 29 at Greenwich was 0·75 in., which is 1·06 in. below the normal, and 41 per cent. of the average. There was no rain in the week ending June 8, and only 0·06 in. for the week ending June 29. In the Midland counties the total rainfall for the four weeks ending June 29 was 0·91 in., and in the south-east of England 1·01 in. The report for the week ending June 29 states that the deficiency of rainfall in the South of England has been almost continuous since the week ending May 11, the deficiency for that period being 38 mm. or 1·50 in., and the total measurement in seven weeks is only 51 per cent. of the average.

WE have received from Miss M. M. Brinkworth, 3 Mount Beacon, Bath, an example of a peloriate Viola flower. Pelorisation with or without spurs has been observed in various species of this genus, but the case illustrated by Miss Brinkworth's specimen differs in showing a concomitant increase in the number of sepals and petals.

SOME interesting explorations were made in Spitsbergen last year by M. Adolf Hoel and Capt. S. Rövig, of the Norwegian Navy. A short paper in *La Géographie* (vol. xxxii., No. 2, 1918) gives the chief results. The territory examined was in the south, chiefly between Bell Sound and Horn Sound. M. Hoel denies the distinction generally made between the Archean and Hecla Hook formations on the west coast. He claims to have discovered in the Hecla Hook beds north of Horn Sound rocks characteristic of the so-called Archean formation of Spitsbergen. All these rocks, at least in the south of Spitsbergen, he attributes to pre-Devonian, probably Silurian, times. M. Hoel further claims to have discovered Tertiary rocks on the west coast between Horn Sound and South Cape. The paper also contains some information about the Horn Sound glaciers. Finally, there is news of increased mining activity, including new claims and the encroachment of certain Scandinavian claims on British estates.

A REPORT (vol. ii., A.5) on the Danish Oceanographical Expeditions of 1908–10 to the Mediterranean and adjacent seas deals with the distribution and life-histories of the fishes belonging to the families Argentinidæ, Microstomidæ, Opisthoproctidæ, and Mediterranean Odontostomidæ. The report, written by Dr. Joh. Schmidt, refers almost entirely to the collections made by the author himself on board the Danish Fishery Research steamer *Thor* during the years 1903–10 in the north-eastern Atlantic, and later on in the Mediterranean. It is entirely systematic. There are very clear charts showing the distribution of the fishes collected, and special attention is devoted to larval and post-larval forms, a large number of these being described and figured.

BULLETIN No. 11 of the Department of Fisheries for the Province of Bengal and Bihar and Orissa (Calcutta: Bengal Secretariat, 1918) consists of an account of investigations on the Hilsa undertaken during 1917, and also of a summary of previous work. The Hilsa is a very highly esteemed Indian food-fish. It is a Clupeoid (*Clupea* or *Hilsa ilisha*), and, like the salmon, it is an anadromous fish ascending rivers from the sea in order to spawn. From the time of Francis Day (1873) it has been the subject of more or less unsuccessful investigation. Day, recognising that the existence of weirs or anicuts presented great difficulties to the upward passage of the fish, advised a kind of under-water fish-pass, which does not seem to have been successful. The Madras Fisheries Department instituted research into methods of artificial culture in 1909, but this was apparently dropped. The present (Bengal) Department began again about the same time, and, after sending a superintendent to America to study methods of shad-culture, tried to propagate Hilsa on the same lines, but without success. In this paper Messrs. T. Southwell and B. Prashav examine the methods, discuss the reasons for failure, and suggest further investigation.

THE May issue of the *Veterinary Review* (vol. ii., No. 2) contains, in addition to the reviews and abstracts of veterinary literature, a useful article by

Prof. Railliet on oxyurosis in the horse. After giving an account of the history and characters of the genus Oxyuris, the author describes the cosmopolitan species, *O. equi* (*curvula*). He holds that there is no warrant for referring to different species, as Jerke has done, the short-tailed and long-tailed females, for these gradually merge, and they agree in all other essential characters, and the males are identical. In Prof. Railliet's opinion the correct view is that *O. equi* has polymorphic females. A summary of the pathogenic effects of these worms is given, and observations on the life-history cited, which indicate that the species has a direct development.

DR. J. SCHWETZ contributes to the *Annals of Tropical Medicine and Parasitology* (vol. xi., No. 4) observations on the habits of three species of tsetse-flies—*Glossina brevipalpis, fusca*, and *pallidipes*—in the Belgian Congo. These three and two other important species—*palpalis* and *morsitans*—select as resting-places the trunks and larger branches of trees. In regions where they exist *brevipalpis* and *pallidipes* are not restricted to limited belts, but, like *morsitans*, are found uninterruptedly over large stretches of country. *Brevipalpis* accommodates itself to forest, park land, and wooded savannah, but *pallidipes* (like *morsitans*) does not inhabit the forest, whereas *fusca* occurs only in the forest, and, in fact, only in moderately dense forest belts. Where it does occur *fusca* is not uncommon and is sometimes even abundant; Dr. Schwetz states that his two trained native boys collected more than 500 specimens in a few weeks. This species does not fly during the day, like *morsitans* and *palpalis*, but remains motionless on tree trunks, being only occasionally stimulated into flight by the passing of men and animals. Its definite period of activity is an hour or two after sunset, and anyone passing then through a haunt of this fly is sure to be attacked by numerous specimens. The haunts of *brevipalpis*, *pallidipes*, and *fusca* are almost exclusively along roads and paths.

WE have received a pamphlet on the Rockefeller Foundation compiled by its president, Mr. George E. Vincent, being a review of its war-work, public health activities, and projects for medical education in 1917. The war-work includes a military base hospital of seventy beds erected in the grounds of the Rockefeller Institute in New York City, which embodies features which French and British practice has proved essential in a base hospital; here military and naval medical officers are sent for study and experience. A tuberculosis campaign has been instituted in France. The training of sanitary medical officers is being promoted by the foundation and maintenance of a school of hygiene at the Johns Hopkins University. Public health work is being carried out in many lands. The control of hookworm disease (anchylostomiasis) is being studied in several States of the Union, in Brazil, Siam, Fiji, and China. Malaria is being dealt with in some of the southern States, yellow fever in South America, medical education is being aided in China, and contributions of funds and material have been given to the American Red Cross. Truly a fine record, which has been rendered possible mainly by the princely donations of the founder, Mr. John D. Rockefeller.

THE phenomena of concretionary growth receive discussion in two recent memoirs of the Canadian Geological Survey. In Memoir 101 Mr. W. A. Johnston refers to the importance of elevation above the local water-table in promoting the formation of concretions in certain marine Pleistocene clays. In Memoir 102 Mr. T. T. Quirke discusses clay-balls in fluvioglacial clays in the Espanola district of Ontario, giving useful references to the analogous "marlekor" or Imatra stones of Fennoscandia.

WHEN Dr. L. L. Fermor showed, in 1906, that a crystalline form of psilomelane existed in Central India, he was without evidence of the system to which it should be referred. He now (Records Geol. Survey of India, vol. xlviii., p. 103, 1917) shows from a careful investigation that hollandite crystallises in the scheelite class of the tetragonal system, a bipyramidal class without vertical planes of symmetry, here styled "pyramidal" without further qualification. Dr. Fermor regards romanèchite, which was named but not described by Lacroix in 1900, as a hollandite with more water and less ferric oxide. Since the accents vary in the paper, it may be remarked that the grave accent is correct, as in the village name of Romanèche.

MR. P. W. BRIDGMAN (*Amer. Journ. Science*, vol. xlv., p. 243, 1918) has prepared a number of cylinders of rocks and crystals with central cavities drilled in them. These have been subjected in a jacketing cylinder of chrome-nickel steel to pressures up to 12,000 kg./cm.^{2}. Disintegration takes place from the walls of the cavity, and it gradually becomes filled with flakes and sand. In the case of crystals, the splinters have no obvious connection with the crystalline symmetry. Even the flaws in the original specimens appear to play no part in this secondary fracturing; they are probably already closed tightly by natural pressure. The author concludes that "minute crevices, at least large enough for the percolation of liquids, exist in the stronger rocks at depths corresponding to 6000 or 7000 kg./cm.^{2}, and possibly more."

A CONTRIBUTION to the question of the origin of kaolin in deeply seated rock-masses is made by Messrs. S. Paige and George Steiger of the U.S. Geological Survey (Journ. Washington Acad. Sci., vol. viii., p. 234, 1918). In connection with the chalcosine deposits of Tyrone, New Mexico, even quartz has become replaced by kaolin. It is suggested that sericite, which occurs abundantly as an alteration-product of felspar in the local porphyries, has become decomposed by solutions containing sulphuric acid from the copper ores. Fluorine, which is shown to exist in the sericite, is thus set free, and this has enabled the quartz to disappear in solution. Kaolin, resulting from the attack made upon the sericite, takes the place of the quartz in the final mass. The effect of descending solutions from sulphide ores in promoting the kaolinisation of sericite is also referred to by Mr. J. Coggin Brown in his recent description of the mines of galena and zinc-blende at Bawdwin in the North Shan States (Records Geol. Survey of India, vol. xlviii., p. 171).

THE French are turning their attention just now to the Pyrenean region, where considerable water-power is available for industrial purposes. A number of chemical factories have been, or will be, installed in the region. Of special importance (according to an article in *La Nature* for June 29) is the manufacture of calcium carbide, artificial fertilisers, and cyanates, while it is also hoped to develop the mineral deposits and treat them cheaply in the large factories, which will give ample power for the purpose. The bauxite deposits will be exploited for the production of aluminium, and the artificial fertiliser industry is sure to receive an impetus when the water-power still available is harnessed. At present only about one-fifth of that which can be produced is utilised. The article

gives brief particulars of a number of installations which are already working, and of others which it is hoped to erect when capital and labour are available for the purpose.

THE amplitude of the oscillations produced in a singing arc depends on the curvature of the current-voltage characteristic curve. If i_0 is the constant current upon which the variable current of effective value i_1 is superposed, it is shown (*Revue générale de l'Electricité*, April 20) that $i_1 = k\rho i_0/r$, in which k is a coefficient, ρ the curvature of the characteristic curve at the region over which the oscillations are taking place, and r the resistance of the oscillatory circuit. In this equation i_0 depends on i_1, and also on ρ and r, but if i_1 is not very large, i_0 may be considered as nearly equal to the current that would be obtained with $i_1 = 0$, and the equation would give to a first approximation the effective value of the oscillating current in the singing arc.

IN a lecture at the Technical College, Munich, Dr. A. Traube read a paper on the production of coloured photographs by a process which he calls "Uvachromie." Three photographs are taken through suitable colour-filters, the negatives being copied on ordinary kinematograph films. After fixing, these films are treated in a bath so as to form a chemical compound that readily absorbs colour material. The three component pictures can be coloured and dried in about twenty minutes, and they are then placed in register upon one another, and the coloured photograph is complete. The new process has the advantage that as many copies may be made as are required, the process being rapid and simple. The photograph retains its sharpness of definition, and corrections in colour can easily be made by replacing one or other of the component films in the colour solution for the appropriate length of time.

THE May (1918) issue of *Navigazione interna* (Propaganda dell' Associazione Nazionale del Congressi di Navigazione) gives particulars of the work of the Hydrographic Office of the Po during the period 1914–17. In spite of the war, much useful work has been done by the institution with regard to rainfall observation (the number of observation stations both in the mountains and plains has been increased and new methods of observation have been initiated), hydrography, levelling surveys, measurement of flow of streams, forecasting of floods and dry periods, the measurement of the turbidity of streams, temperature measurements on the waters of the Po, investigation of subterranean streams, etc. Rainfall observation and investigation, in particular, have received a great deal of attention. It is proposed to study Swiss methods of rainfall and snowfall observation, using various modern types of recording instrument, and to correlate and co-ordinate results. Glacier study has also had the attention of the authorities, and results of considerable importance as to the formation of glaciers and their influence on rainfall and temperature in valley regions should be anticipated when this work has been placed on its final basis.

ATTENTION may be directed to a Bulletin just issued by the Engineering Experiment Station of the University of Illinois, entitled "Percentage of Extraction of Bituminous Coal, with Special Reference to Illinois Conditions." It is well known that in coal-mining it is never possible practically to extract the whole of the coal from any given seam, and that a certain percentage is always left behind and lost; furthermore, such loss is admittedly greater on the average in the United States than it is in Great Britain, one of the main reasons being the low price of coal in the United States; "the coal-mining engineer of America accordingly has not had as his problem the development of methods of extraction which would result in the largest percentage of ultimate recovery, but rather the development of methods which would result in the lowest cost of production." From a table given in the present Bulletin it appears that the percentage of recovery of the entire seam ranges from as much as 97 per cent. in the George's Creek Field of Maryland to as low as 50 per cent. in Central Illinois. The subject necessarily requires discussion in detail, since the amount of coal left behind depends in each case upon a large number of conditions, the nature of the seam, its thickness, depth from surface, inclination, character of roof and floor all having to be taken into account, whilst the amount of damage done to the surface and the monetary value of such damage have also to be considered. Although American conditions of coal-mining are very different from those prevailing in this country, the Bulletin will well repay perusal by British coal-miners, especially if it arouses sufficient interest to cause a similar investigation to be undertaken in this country.

ACCORDING to a note in the *Chemical Trade Journal* for June 29, a new radio-active element of considerable emissive power has been detected in the residue from pitchblende, which forms the raw material employed as a source of radium. This residue was subjected to treatment which finally left undissolved only the members of the tantalum group; and this insoluble remainder showed a radiation, at first slight, but gradually increasing largely, which proceeded mainly from the evolution of actinium, and indicated the presence of the new element "protactinium." Experiments for the separation of the element are to be undertaken. The period of semi-disintegration probably fluctuates between 1200 and 18,000 years. The information is based on statements published in the *Münchner Neueste Nachrichten*.

OUR ASTRONOMICAL COLUMN.

DISCOVERY OF WOLF'S PERIODIC COMET.—M. Jonckheere, who has been searching for the return of Wolf's periodic comet since May 4, discovered it on July 9 at 10h. 45m. G.M.T. with the 28-in. equatorial at Greenwich. The comet was at the time of discovery between the 15th and 16th magnitude, and about 9″ in diameter. It is about +50s. in R.A. and 15′ north of the place given by M. Kamensky's orbit (A.J. 729). On July 10 the magnitude was estimated as 15th, and on July 12 as 14th. The comet was discovered in 1884, when it was of 8th magnitude, and was observed in the returns of 1891, 1898, and 1911, but not in 1905.

THE NEW STAR IN AQUILA.—The new star has varied but little in brightness during the past week, and was of approximately the 4th magnitude on July 14. The spectrum, however, has shown a further approach to the nebular stage. On July 13 Prof. Fowler observed that in the visible spectrum the enhanced lines of iron were represented only by very feeble lines at 517 and 532, while the line about 501, which would appear to be the chief nebular line, was scarcely inferior in brightness to H_β. The line about H_γ also appeared to have gained in relative brightness, as if the nebular line 4363 had made its appearance. The band at 464 was bright and broad, and a faint band on its less refrangible side was probably 4686. There was also a faint band about the position of the helium line 4471. The group of three bright lines in the region of D was reduced in intensity. It would seem that the loss in magnitude due to the fading out of the enhanced lines and the reduced

intensity of the hydrogen lines has been partially compensated by increased intensity of the nebular lines.

An account of photographs taken at Meudon on June 12 and 15 has been given by Mr. J. Bosler (*Comptes rendus*, June 24). In addition to the whole series of hydrogen lines, there were bright lines at 592, 588, 569, 532, 518, 502, 493, and 465, and fainter lines at 648, 638, 555, and 454. The bright lines varied in breadth from 30 to 60 Å., and were accompanied by the usual dark lines on their more refrangible sides; if interpreted in terms of motion, the displacements would indicate a relative velocity of 2300 km. per second, or about 2½ times that observed in any previous nova. Dark lines, apparently without bright companions, occurred at 461, 421, 389, and 3934 (K).

The new line noted by Mr. Phillips on July 4 was about 407, as in Nova Persei on March 21 and 27, 1901; the position previously given was erroneous.

Photographs obtained by Mr. Phillips on July 12 and 13 show a well-defined line on the red side of H_γ, which is doubtless the above-mentioned nebular line 4363. The band at 468 has also been noted in recent plates.

Father Cortie sends the following notes on recent photographs:—"On July 13 a photograph of the spectrum showed that each of the hydrogen bands H_β to H_ζ contained a central brighter region in which were two bright lines. Each band was about 50 Ångström units in breadth. The bright region at wave-length 4640 extended altogether over 160 angstroms, and consisted of two broad bright bands, in continuous spectrum. On June 30 this bright region had a breadth of 90 Ångström units, and on July 8 of 110 units. There was a second bright band beginning at λ4523, and extending over more than 50 units. The visual spectrum showed H_α very bright, and probably just doubled, D bright, and a continuous patch of colour in the green.

"In the photographs of June 29 and 30 the 4640 band was doubled, the more refrangible component being the brighter. The same is true of H_γ. On July 13, in the 4-in. finder, for a few moments the star itself seemed to be double, the companion just preceding the brighter star in right ascension. This may be an illusion, but is noted in case any other observer has seen the star double."

A NEW VARIABLE STAR IN AURIGA.—By comparison of photographs taken with a 4·4-in. portrait lens towards the end of 1905, Mr. A. Stanley Williams detected a star of varying magnitude situated in Auriga, and he has since then accumulated sufficient visual observations to establish the character of the light-curve (Monthly Notices, R.A.S., vol. lxxviii., p. 483). The position of the star for 1900 is R.A. 5h. 8m. 27s., decl. +39° 57·5′. The discussion of the observations shows that the variation is of the Cepheid type, and the period 18·3563 days. The magnitude ranges from 10·04 at maximum to 10·79 at minimum, and the interval from minimum to maximum is 7·0 days.

FUNDAMENTAL PROBLEMS OF PHILOSOPHY AND SCIENCE.

A JOINT session of the Aristotelian Society, the British Psychological Society, and the Mind Association was held in London on July 5–8. The aim of this session, which has now been held for several years, is to endeavour to bring together the actual workers in mental and neurological science and those engaged in purely philosophical research for the discussion of fundamental problems. The subjects discussed included problems of mathematics and physics, of physiology and biology, of practical psychology, and of pure metaphysics.

Lord Haldane presided at the opening meeting, when Prof. Alexander expounded a new philosophical theory of space and time. His theory is that there is one primitive entity, the matrix or stuff of existence, space-time, and that all forms of mind and matter are complications of it. In the discussion Prof. Whitehead criticised it from the point of view of mathematical physics, and Prof. Pringle-Pattison from that of philosophy.

Prof. Wildon Carr presided at the discussion of the symposium "Are Physical, Biological, and Psychological Categories Irreducible?" The contributors were Dr. J. S. Haldane, Prof. D'Arcy Thompson, Dr. Chalmers Mitchell, and Prof. L. T. Hobhouse. The discussion proved of exceptional interest in the number of illustrations from applied science which were brought to bear on the question. The main problem was the adequacy of mechanistic interpretation as used in physics when applied to the higher spheres of life and mind. The opposing views were represented by Dr. Haldane and Prof. D'Arcy Thompson. Prof. Whitehead, Prof. Nicholson, and Mr. Brierley contributed valuable accounts of experiments in their respective sciences, and Dr. Schiller, Lord Haldane, and others discussed the relation of the problem to philosophy.

Dr. C. S. Myers presided at the symposium "Why is 'the Unconscious' Unconscious?" by Dr. Maurice Nicoll, Dr. W. H. R. Rivers, and Dr. Ernest Jones. The discussion was notable as emphasising a distinct change which seems to be manifesting itself in the theory and practice of psychoanalysis. Many of the distinctive features of Freud's original statement, *e.g.* the endo-psychic censor, seem to be vanishing into the background. There was remarkable unanimity in most of the speakers in regarding "the unconscious" as not simply a force resisting inhibition and baneful in its effect, but as essentially and primarily a force to be identified with the spring of life itself. Besides the three contributors to the symposium, the chairman and Dr. McDougall, Dr. Mitchell, Dr. Crighton Miller, Dr. Constance Long, Dr. Goldsbrough, Mr. Flugel, and Prof. Wildon Carr took part.

The largest attendance was at the meeting on Sunday afternoon, when Mr. A. J. Balfour presided at the discussion of the symposium "Do Finite Individuals Possess a Substantive or an Adjectival Mode of Being?" The contributors were Prof. Bernard Bosanquet, Prof. Pringle-Pattison, Prof. G. F. Stout, and Lord Haldane. In the discussion Prof. Bosanquet defended with noticeable earnestness the view which is identified with the philosophy of Mr. Bradley and himself, the view that the ultimate subject of predication is one and universal, that reality is the absolute. He was opposed by Prof. Pringle-Pattison, who acknowledged, however, a wide ground of common agreement. A more decided opposition came from Prof. Alexander. Lord Haldane, in a very clear summary of the two views, held that the real crux of the problem lay in the antithesis between the concepts of substance and subject, and suggested that the solution is the doctrine of degrees of truth and reality. Prof. Whitehead expressed the point in dispute with mathematical precision in his question addressed to all the disputants, "Is there any substantive existence of a *relatum* which is independent of all or any relation?"

The final meeting was presided over by Prof. Wildon Carr. Two short communications, the first on "The Philosophical Importance of the Verb 'To Be,'" by Miss L. S. Stebbing, the second on "The Summation of Pleasures," by Miss Dorothy Wrinch, both called forth an animated and interesting discussion.

THE MUSEUMS ASSOCIATION.

SOME evidence of the desirability of our educational institutions "carrying on" in war-time is afforded by the excellent results achieved at the annual conference of the Museums Association, held at the Town Hall, Manchester, on July 9–11. In view of the difficulty of entertainment, etc., the conference was curtailed to three days, but as a result of the lengthy sessions each morning and afternoon, and on one evening, probably more actual work was crowded in the three days than during any previous conference. It was remarkably well attended, there being about eighty delegates from England, Scotland, Wales, and Ireland. To the great regret of the members, the president, Mr. E. Rimbault Dibdin, was prevented through illness from attending and giving his address. This was particularly unfortunate in view of the recent efforts of the association to give more prominence to matters connected with the art side of museum work, an aspect which was possibly partly neglected by the association in years gone by. However, by the efforts of the local secretary, Mr. Haward, and the general secretary, Mr. J. Grant Murray, this aspect of the association's work was well to the fore.

The members had the usual experience of hearing a few papers on elementary museum matters, mostly by local authors, but one result of the association's propaganda during the last quarter of a century was amusing. For years the association has endeavoured to make the education committees interested in the museums, and has advocated the appointment of special teachers to devote their time entirely to giving lectures to pupils in museums and art galleries. This has at last been accomplished at Manchester, and, possibly through being unaware of the association's efforts, the various teachers concerned gave details of the nature of their work. The value of museums in war-time was brought prominently forward, and no doubt impressed the various chairmen and members of committees who were present. Bearing more particularly upon the war were:—"The Aims and Objects of the Imperial War Museum," by Lieut. Charles ffoulkes, and "Local War Museums," by Mr. Charles Madeley. Dealing with educational aspects of museums were:—"The Art Museum and the School," by Mr. J. Ernest Phythian; "The Museum in Relation to the School," by (*a*) Mr. R. Saunsbury, (*b*) Mrs. B. Bell, and (*c*) Miss B. Hindshaw; the art side of museum work being represented by "The Preservation, Cataloguing, and Educational Value of Print Collections," by Mr. Isaac J. Williams; "The Museum in Relation to Art and Industry," by (*a*) Mr. Henry Cadness, (*b*) Mr. H. Barrett Carpenter; "The Application of Art to Industry and its Relation to Museum Work," by Mr. S. E. Harrison; "Art Museums," by Mr. Fitzgerald Falkner; and "Material and Design in Relation to Craftsmanship," by Mr. Joseph Burton.

The more general subjects dealt with were:—"The Museum and Trade," by Mr. Thos. Midgley; "A Plea for the District Federation of Museums and Art Galleries," by Mr. Robert Bateman; "Arrangement of an Ethnographical Collection," by Mr. Ben H. Mullen; "Local Museums and their *Rôle* in National Life," by Mr. Louis P. W. Renouf; and "Museum and Art Gallery Finances," by Mr. E. E. Lowe; a little relief being given to the somewhat serious proceedings by a humorous paper on "Packing and Removing a Museum of Geology and Antiquities in War-time," by Mr. Thos. Sheppard.

Before and after the meetings many members visited the museums and art galleries for which the Manchester district is so famous. There was an informal dinner at the conference headquarters, the Grand Hotel, on July 10, under the chairmanship of Dr. W. E. Hoyle, and the Lord Mayor of Manchester provided tea for the members at the Town Hall each day. The president for next year is Sir Henry H. Howarth, and the hon. secretary Mr. W. Grant Murray, of Swansea. At the council meeting, held at the close of the conference, it was agreed that the association should meet again next year.

ECONOMIC RESOURCES OF NEW SOUTH WALES.

THE report of the curator, Mr. R. T. Baker, of the New South Wales Technological Museums for the year 1916 shows that these museums are accomplishing much useful work in adding to our knowledge of the economic resources of New South Wales and in securing the better utilisation of these resources. Increased attention is being given to the native timbers of the Colony, especially for the manufacture of furniture, and the museums staff has been able to assist in this direction by supplying technical information regarding the timbers and by adding to the exhibits numerous examples of Australian workmanship in home-grown timber. An elaborate illustrated monograph on the fishes of Australia and their technology was published during the year by Mr. T. C. Roughley. This is designed to meet the large demand that has arisen with the development of Australian fisheries for accurate information regarding the edible fishes of the country. The book also describes the methods in use in the New South Wales fishing industry. A good deal of research work has been accomplished in spite of the difficulties caused by the war, and the staff has taken part, either in an advisory or executive capacity, in several investigations arranged by the various committees that have been formed in Australia for the promotion of munition manufacture or the development of industrial and scientific research. These include an investigation of the use of grass-tree resins as a source of picric acid (New South Wales Munitions Committee) and an inquiry into the economic possibilities of posidonia fibre (Executive Committee of Science and Industry), two subjects which have long attracted attention both in this country and Australia. Perhaps the best known work of the museums is that on the eucalypts, and it is interesting to note that among the papers published during the year two more on this subject were included, the first on the eucalypts of South Australia and their essential oils, and the other on the essential oil of *E. Macarthuri*.

THE TORNADOES OF THE UNITED STATES.[1]

NATURE of a Tornado.—The relation of a tornado to human life and property depends upon its nature. What it *does* is determined by what it *is*. Briefly stated, a tornado is a very intense, progressive whirl, of small diameter, with inflowing winds which increase tremendously in velocity as they near the centre, developing there a counter-clockwise, vorticular, ascensional movement the violence of which exceeds that of any other known storm. From the violently agitated main-cloud mass above there usually hangs a writhing, funnel-shaped cloud, swinging to and fro, rising and descending. With a frightful roar comes the whirl, advancing almost always towards the north-

[1] By Prof. Robert DeC. Ward, Harvard University, Cambridge, Mass., U.S.A. Abridged by the author from the Quarterly Journal of the Royal Meteorological Society, vol. xliii., No. 183, July, 1917.

east with the speed of a fast train (twenty to forty miles an hour or more), its wind velocities exceeding 100, 200, and probably sometimes 300 or more miles an hour; its path of destruction usually less than a quarter of a mile wide; its total life a matter of perhaps an hour or so. It is as ephemeral as it is intense.

Fortunately for man, tornadoes are short-lived, have a very narrow path of destruction, and are by no means equally intense throughout their course. Their funnel cloud, which indicates the region of maximum velocity of the whirling winds, ascends and descends irregularly. Where it descends, the destruction is greatest; where it rises, there are zones of greater safety. The whirl may be so far above the ground that it does no injury whatever. It may descend low enough to tear roofs and chimneys to pieces. It may come down to the ground and leave nothing standing.

FIG. 1.—St. Louis, Mo., tornado, May 27, 1896. Wreck of Car Barn. From the Quarterly Journal of the Royal Meteorological Society.

Damage and Loss of Life in Tornadoes.—The central low-pressure core of the tornado is surrounded by radially inflowing winds of moderate strength, and then, closer to the centre, by spiralling and ascending winds of terrific violence; strong enough to crush and wreck the strongest buildings; ascending with sufficient velocity to carry aloft objects so heavy that for wind to lift them seems almost impossible. The surface winds which take part in the vorticular inflow and ascent seem to be chiefly responsible for the damage and loss of life. There is, however, an additional factor. The central "core," surrounded by its whirling winds, has its pressure greatly reduced by the centrifugal force of the whirl. It therefore exerts a powerful explosive effect upon near-by air at ordinary pressures, within buildings or in other more or less well-enclosed spaces. This curious but very widely attested explosive effect accounts for many tornado "freaks" which cannot be explained by any controls, either of radially or spirally inflowing winds, whatever their velocity.

The damage done by tornadoes may be roughly classified as follows:—(1) That resulting from the violence of the surface winds, blowing over buildings and other exposed objects, crushing them, dashing them against each other, etc.; (2) that caused by the explosive action; and (3) that resulting from the uprushing air movement close around the central vortex. Carts, barn-doors, cattle, iron chains, human beings are carried through the air, whirled aloft, and dashed to the ground, or they may be dropped gently at considerable distances from the places where they were picked up. Iron bridges have been removed from their foundations; beams are driven into the ground; nails are forced head-first into boards; cornstalks are driven partly through doors; harness is stripped from horses; clothing is torn from human beings and stripped into rags. The damage is greater and extends farther from the centre on the right of the track than on the left, for the wind velocities are greater on the right, as in the "dangerous semicircle" on the right of the track of tropical cyclones.

The explosive effects are many and curious. The walls of buildings fall out, sometimes letting the roof collapse on to the foundations; or the roof may be blown off, leaving the walls standing. The accompanying photograph (Fig. 1) illustrates some of the damage which was done by the St. Louis, Mo., tornado of May 27, 1896. The surface of the ground may be swept clean, as if with a broom. Articles may be blown out of houses and carried to great distances. Empty bottles are uncorked; feathers plucked from

barnyard poultry; doors and windows blown out; soot rises from chimneys; mud penetrates clothing.

Property damage in the United States due to tornadoes varies greatly from year to year, depending, as it does, upon the "accidental" passage of tornadoes through well-populated or through sparsely settled districts. In half an hour the St. Louis tornado (May 27, 1896) destroyed property to the amount of 10,000,000 dollars in St. Louis alone. In some years the damage for the whole United States falls to but a few hundred thousand dollars.

Fig. 2 illustrates the tragic fate of one family in a tornado (May 30, 1879).[2] A house was moved entirely from its foundation to the south-east, then broken to pieces and scattered along the tornado track to the north-east for more than a mile. The members of the household, consisting of father, mother, and four children, ran outdoors as the storm came. They first turned north-west, but, thinking that the tornado was coming towards them, they turned towards the east. One by one they were caught up and carried by the wind. The father and baby were carried 150 yards into a field to the north-east, and found in the agonies of death. The mother was carried eastward seventy-five yards, and dashed against a tree, around which she

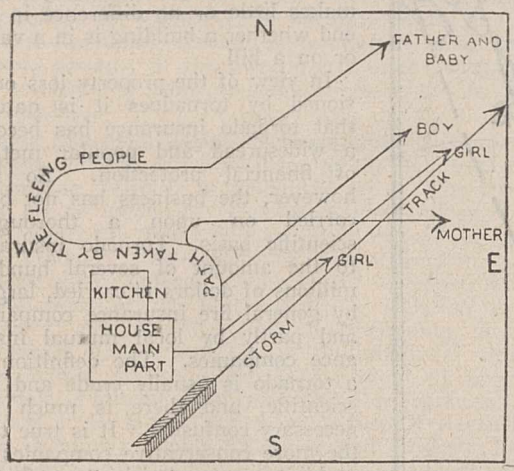

FIG. 2.—Tornado, May 30, 1879. From the Quarterly Journal of the Royal Meteorological Society.

was partially twisted; her skull was crushed, and her clothing was stripped from her body. A girl was found dead, fifty yards north-east of the house, in the direct path of the storm. A boy was blown into a haystack forty-five yards to the north-east, and a girl was found eighty yards to the north-east lying in the tornado track. Neither of these two children was seriously injured. Disasters similar to this one come all too frequently in the American tornado belt.

Finley listed some 600 tornadoes, of which forty were fatal to human life, causing a loss of 466 lives and injuring 687 persons.[3] In the case of the St. Louis tornado (May 27, 1896) the loss of life was 306. In fact, in this one storm the fatalities and the damage to property were greater than in any other single tornado on record. Prof. Mark W. Harrington, formerly Chief of the U.S. Weather Bureau, estimated that the chance that a tornado may, in any year, cross the particular locality where any individual may happen to be is 1 in 625,000, and "not worth worrying about."[4] The late Prof. Cleveland Abbe concluded that even in the so-called "tornado States" the probability of tornado destruction is less than that of lightning or fire.[5]

Distribution of Tornadoes in Place and Time.—The real home of the tornado is over the great lowlands east and west of the Central and Upper Mississippi and of the Lower Missouri valleys, and, to a less marked degree, over some of the southern States. Tornadoes are rare west of the 100th meridian, and very rare or unknown in the mountain areas. They have been reported from all States east of the plains, but decrease markedly in frequency towards the north. They are rare in the Appalachian Mountains, and also infrequent along the Atlantic and Gulf coasts. The widespread impression that tornadoes are increasing in number in the United States is without foundation of fact. Tornadoes are reported with greater accuracy than formerly, and they are likely to do more damage than they used to do because the country is more densely populated.

Tornadoes may appear in any month, and at almost any hour of the day or night. Like thunderstorms, however, they distinctly prefer the warmer months, and the hours closely following the warmest part of the day. Thus spring and early summer (April–July) and 3–5 p.m. are their favourite times.

Tornado Weather Types.—Tornadoes have much in common with thunderstorms. In fact, they are, in reality, special local developments, of greater violence, in connection with severe thunderstorms. The general conditions which produce these two phenomena are, to a large extent, identical. The essential difference comes in the formation of the vorticular whirl in the tornado. Thus, like the largest and most severe American thunderstorms, tornadoes occur as attendants of the parent cyclones of which they are the offspring. They are born, in the large majority of cases, in the area of warm, damp southerly winds flowing northward from the Gulf of Mexico in front of a general cyclonic storm. This storm is usually more or less elliptical or **V**-shaped, its major axis extending north to south or north-east to south-west from the Great Lakes, across the central lowlands well into the southern States. The "wind-shift line" or "critical axis" is usually well marked. North and west of the wind-shift line northerly to westerly winds are blowing, with relatively low temperatures, and not infrequently with rain or snow. South and east of the critical axis there is a great flow of southerly or south-westerly winds with higher temperatures, usually sultry and oppressive weather, and often with rain squalls. When conditions are favourable, tornadoes are likely to occur in a district some 300, 400, 500, or more miles to the south-east, south, or south-west of the cyclonic centre, near, but usually to the east of, the wind-shift line. Here the contrast between the warm, damp southerly and the cool, dry northerly and westerly winds is sharp. Here is inevitably a zone of great disturbance; of over-running, under-running, and mixing; of turbulence; of instability; of local whirls. Here, aided by the local warming due to sunshine, are favourable conditions for breeding thunderstorms and, fortunately much less often, for developing tornadoes. The parent cyclone may travel many thousands of miles, a good part of the way round the world, yet in only one portion of its long course, in the Mississippi valley region of the United States, and usually only at one time of the year, in spring and summer, is just the right combination of conditions attained for developing the dreaded tornado. The

[2] J. P. Finley, "Report of the Tornadoes of May 29 and 30 in the States of Kansas, Missouri, Nebraska, and Iowa," Professional Papers, U.S. Signal Service, No. iv. (Washington, D.C., 1881.)

[3] J. P. Finley, "Report on the Character of Six Hundred Tornadoes," Professional Papers, U.S. Signal Service, No. vii. (Washington, D.C., 1884.)

[4] M. W. Harrington, "About the Weather," p. 164. (New York, 1899.)

[5] Cleveland Abbe, "Tornado Frequency per Unit Area," *Monthly Weather Review*, vol. xxv., p. 250. (Washington, D.C., June, 1897.)

accompanying figure (Fig. 3) is a freehand composite illustration, showing in a broadly generalised way a weather map characteristic of tornado occurrence in the Central Mississippi valley region of the United States. Tornadoes also spring up under conditions which differ considerably from those here illustrated. It is, therefore, impossible to select or to draw any fixed "tornado-type" map.

Protection of Life.—The possible protection and preservation of human life in tornadoes are very real and vital questions over large areas of the United States. From a long and intimate study of tornadoes Finley deduced certain rules for the protection of life which have over and over again proved their accuracy and value. If a tornado is approaching, from west or south-west, and the observer is on or very near its probable path, the best thing to do, if there is time, is to run *north*. "Dug-outs" or tornado-cellars should

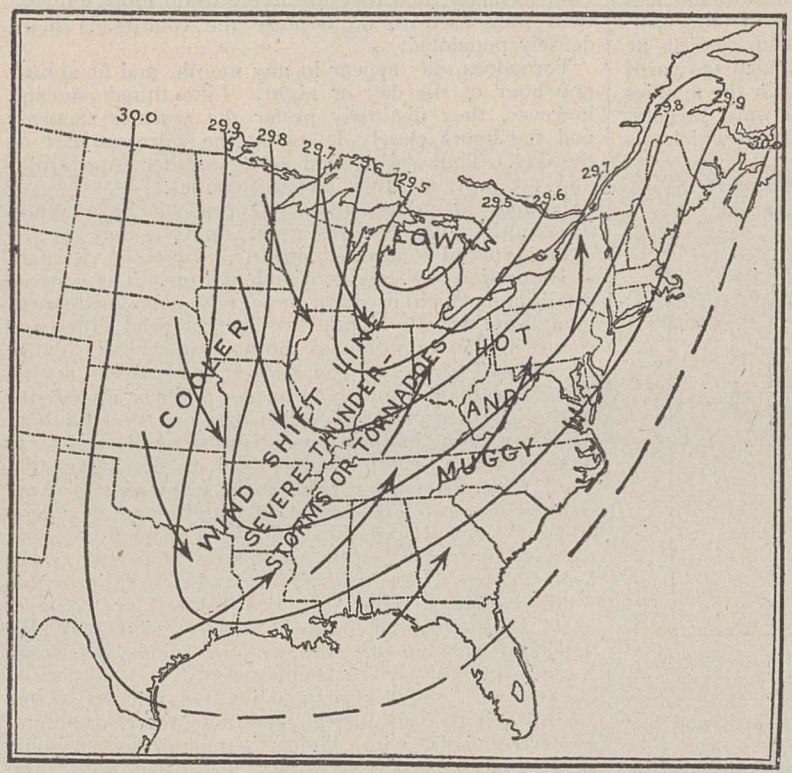

FIG. 3.—Composite weather map, showing conditions favourable for tornadoes R. DeC. Ward). From the Quarterly Journal of the Royal Meteorological Society.

be provided near the house. The safety secured by means of "dug-outs" is that they remove persons who seek refuge in them from risk of injury from flying *débris*, also from the danger of being picked up by the winds.

If there is no time to escape, or if escape is impossible, the safest place is to stand, face forward, against the west or south wall of the cellar, as near the south-west corner as possible. The reason for these precautions is this: that the *débris* of the house will, if the building is destroyed, be most likely to be carried towards the north-east. Hence north-east or east rooms and walls are least safe. If caught outdoors, and otherwise unable to escape, the best thing to do, as a last resort, is to lie flat on the ground in an open space, face downwards, the head to the east, and the arms placed over the head for protection.

Protection of Property: Tornado Insurance.—In regard to the protection of property certain things are fairly clear. Tornadoes cannot possibly be prevented; and no building, certainly none of any practical use, can be built to withstand the violence of the wind in the vortex of a well-developed tornado. Hence the only resource left is to protect life and property to the best of our ability and with a knowledge of the facts which have been brought to light by a sane, unprejudiced, scientific study of the phenomena. Owing to the varying intensity of tornado violence and of the velocity of the surface winds, the damage done to different sorts of buildings varies greatly. If the intensity of the storm is not sufficiently great to destroy everything in its path, the damage done by the less violent winds will obviously depend largely upon the strength of construction and upon the building materials. It was Finley's advice to build "as you would without the knowledge of a tornado." He found, however, that, other things being equal, a frame building seems to resist destruction better than one of brick or stone. The modern steel-construction buildings have some of the "elastic" quality which renders frame structures safer than the more stable and solid ones of stone or brick of the older style. It makes little or no difference in the end whether a building is in a valley or on a hill.

In view of the property loss occasioned by tornadoes it is natural that tornado insurance has become a widespread and popular method of financial protection. So far, however, the business has not been carried on upon a thoroughly scientific basis. Tornado insurance to the amount of several hundred millions of dollars is carried, largely by general fire insurance companies and partly by local mutual insurance companies. The definition of a tornado is usually crude and unscientific, and there is much unnecessary confusion. It is true that the more conservative companies do prohibit some "risks," such as windmills, old and frail buildings, large plate-glass windows, and the like. It is interesting to note the marked rise and fall of the amount of tornado insurance with the occurrence in any year of severe or destructive tornadoes. Closely following the St. Louis tornado of May, 1896, there was an increase of tornado insurance of nearly 10,000,000 dollars, and after the Omaha (Nebraska) tornado of Easter Sunday, 1913, several million dollars' worth of tornado insurance was written in Omaha and the surrounding districts, which were at once thoroughly canvassed by insurance agents. Many new "dug-outs" and cellar caves were built at the same time. As Prof. H. E. Simpson [6] has pointed out, tornado insurance risks differ from others in several ways, notably in the fact that there is no criminal hazard present. For people cannot remove, or explode, or destroy their buildings for the sake of the insurance on the plea that the damage was done by a tornado. It is obviously wise to scatter tornado risks across, not along, the usual path followed by tornadoes.

[6] H. E. Simpson, "Tornado Insurance." *Monthly Weather Review*, vol. xxxiii., pp. 534–39. (Washington, D.C., December, 1905.) (A short bibliography is appended.)

The complete destruction often caused by a single tornado makes it extremely unsafe for any local mutual insurance company to insure over a small area only, where the loss occasioned by one tornado may ruin the company. On the whole, general tornado insurance in the "tornado belt," and buildings erected without regard to the possibility of tornado occurrence, seems to be the best policy. The present status of tornado insurance in the United States is an excellent illustration of the mistakes which are made when thoroughly well established scientific facts, which are easily accessible to the public, are disregarded.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Education Bill was read for a third time in the House of Commons on July 16, and will be considered at once in the House of Lords. It is expected that the Bill will be passed into law before the Parliamentary recess.

BY the will of the late Lord Rhondda the governing body of Gonville and Caius College, Cambridge, will receive out of the residue of his estate the sum of 20,000*l*., to be applied at its discretion for the benefit of the college, but preferably in the establishment and maintenance of six to ten scholarships tenable at the college for mathematics, natural science, or moral science (including economics), preference being given, *ceteris paribus*, in the awarding of such scholarships to residents or sons of residents in Wales or Monmouthshire.

THE Industrial Reconstruction Council has arranged a series of lectures to be given at the Saddlers' Hall, Cheapside, October to December next. The lectures will be as follows:—"Commerce and Industry after the War," Sir Albert Stanley (President of the Board of Trade); "Principles of Reconstruction," Dr. Christopher Addison (Minister of Reconstruction); "Functions of the Government in Relation to Industry," Mr. W. L. Hichens (managing director, Cammell, Laird, and Co.); "International Trade," Sir Arthur Steel-Maitland (Department of Overseas Trade); "Labour and Industrial Development," Mr. Ernest J. P. Benn (chairman, Industrial Reconstruction Council); and "Science and Industry," Sir William S. McCormick (Department of Industrial and Scientific Research).

THE report of the librarian of the Congress of the United States for 1917 gives a full account of the progress of this great library. A grant of no less than 676,714 dollars was provided for the institution by Congress. The library now contains more than 2½ million volumes, besides manuscripts, maps and charts, music, and prints. Among other valuable acquisitions it contains the largest, most readily accessible, best catalogued, and most used collection in America of Chinese books. Large additions have been made to the valuable library of music. Great stores of materials for the study of social history have been brought together, including both ancient and modern political documents, such as those of Mr. Bancroft Davis, Israel Washburn, and others. The collections are splendidly housed, and the work of arrangement and cataloguing is in active progress.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, June 19.—Mr. G. W. Lamplugh, president, in the chair.—Sir Douglas **Mawson**: Some features of the Antarctic ice-cap. The ice-mantle of the south formerly involved the sub-Antarctic Islands, Patagonia, southern New Zealand, and the higher mountains of Tasmania and of the neighbouring portions of Australia, but it retreated to its present confines—a circumpolar continent—at a time apparently concurrent with the disappearance of the extensive Pleistocene ice-sheets of the northern hemisphere. The existence of a great land mass situated on the face of the globe just where the sun's rays fall most obliquely has the effect of intensifying the polar conditions. This result is achieved by reason of the elimination of the ameliorating influence of the ocean and as a result of the acceleration of the circulation of the moist atmosphere from the surrounding sea to the land, owing to the wide difference in temperature pertaining over the one and the other. Thus the presence of extensive land at the Pole, in contradistinction to ocean, results, under present cosmical conditions, in increased refrigeration, and consequently in greater extension of the polar ice-cap. This, in turn, reflects on the average temperature of other regions of the globe, for an ice surface absorbs but a relatively small proportion of the sun's radiant heat. The existence of the Antarctic continent must therefore have some bearing on the climate of the northern hemisphere, and be reckoned with as a factor contributing to the refrigeration thereof. The shelf-ice formations, including the Ross Barrier and the Shackleton Shelf, were specially referred to; mention was made of their growth and decline, of a method of determining their depth below water, and of the probability of specialised life existing beneath such formations.

Physical Society, June 28.—Prof. C. H. Lees, president, in the chair.—I. **Williams**: A new method of measuring alternating currents and electric oscillations. The method consists of the application of the Crookes and Osborne Reynolds radiometers to the measurement of the R.M.S. values of electric currents. Two types of apparatus are described. In the first of these the heat generated by the passage of the current through a microhm resistance causes the deflection of a light mica vane attached to the extremity of a suspended beam. In the second type the deflection of a fine fibre is employed. Tables and curves are given connecting the indications of the instruments with the current and with the degree of evacuation.—Prof. E. H. **Barton** and Miss H. M. **Browning**: Demonstration of coupled vibrations. The apparatus shown consisted of a pair of pendulums, each of which was suspended from the mid-point of a sagging string, the direction of which was transverse to the direction of oscillation of the pendulums. The two sagging strings were connected by a light wooden rod at the points from which the bobs were suspended. Each bob consisted of a metal funnel, from the apex of which a fine stream of sand fell during an experiment. A horizontal board could be moved slowly on rails just below the oscillating bobs, and the fine sand falling on this gave curves showing their motion. When one bob is set in oscillation, the other being initially at rest, the latter, as is well known, starts to vibrate with gradually increasing amplitude until the first bob has been brought to a standstill, when the process is reversed. From an examination of the equations of motion it is found that the amount of sag in the transverse strings governs the degree of "coupling" of the oscillators, and by varying this, and also the relative mass and periods of the pendulums, curves can be obtained illustrating all the phenomena of coupled electrical oscillations. By stopping one of the bobs when it has just been reduced to rest, thereby preventing the energy from being re-absorbed by it, the conditions of the quenched spark can be imitated.

PARIS.

Academy of Sciences, July 1.—M. Léon Guignard in the chair.—G. **Bigourdan**: The observatory of Godin, Fouchy, and de Bouguer: its co-ordinates.—M. **Hamy**: The determination of radial velocities with the objective prism.—G. **Charpy**: The influence of forging and rolling (*corroyage*) on the mechanical properties of steel. It is generally accepted that cast-steel ingots must be forged or rolled hot until the final section is reduced to between one-third and one-fourth the original section. This involves a considerable expenditure of fuel and labour, and experiments are given by the author which suggest that this hot working does not really improve the metal; the strength is increased in one direction, but reduced in another.—M. Trabut was elected a correspondant for the section of rural economy in succession to the late M. Yermoloff.—J. **Andrade**: A family of displacements and a generalisation of the dihedron.—P. **Humbert**: Two polynomes associated with the polynomes of Legendre.—C. **Raveau**: Thermodynamics based entirely on Carnot's principle. A second absolute temperature.—Ed. **Chauvenet** and Mlle. H. **Gueylard**: The combinations of neutral zirconyl sulphate with some alkaline sulphates. From thermochemical measurements the existence is indicated of the double salts $[(ZrO)SO_4]_3.2Na_2SO_4$ and $[(ZrO)SO_4]_3.2(NH_4)_2SO_4$, together with the two corresponding containing $7H_2O$.—A. **Valeur**: The presence of a non-volatile alkaloid in the broom (*Sarothamnus scoparius*). This new alkaloid was isolated from the last mother liquors obtained in the successive crystallisations of commercial sparteine sulphate, and the name sarothamnine is suggested. Its formula is given provisionally as $C_{15}H_{24}N_2$, isomeric with the base spartyrine resulting from the gentle oxidation of sparteine.—Mlle. Yvonne **Dehorne** and L. **Lutaud**: Tectonic observations on the neighbourhood of Martigues (Bouches-du-Rhône).—F. X. **Skupienski**: Sexuality in the Myxomycetes.—R. **Souèges**: The embryogeny of the Liliaceæ. Development of the embryo in *Anthericum ramosum*.—M. **Folley**: Technique of blood transfusion.—P. L. du **Noüy**: A general equation for the law of normal cicatrisation in surface wounds.

CAPE TOWN.

Royal Society of South Africa, May 15.—Dr. J. D. F. Gilchrist, president, in the chair.—Ethel M. **Doidge**: South African Perisporiaceæ. III. Notes on four species of Meliola hitherto unrecorded from South Africa. The fungi considered in the paper are all from Natal and the eastern part of the Cape Province, and have been identified from recent collections.—J. D. F. **Gilchrist**: Reproduction of fishes in Table Bay. The eggs and young of twenty-one species of fishes were procured in about sixty tow-nettings made at more or less regular intervals throughout the year. Fourteen of these were referred to known species. The eggs procured and larvæ hatched from them are described and figured. The eggs of the sardine (*Sardina sagax*) and of the anchovy (*Engraulis capensis*) indicate that these fish are present in abundance, though as yet not utilised for economic purposes.—W. A. **Jolly**: Note on the electrogram of the medulla oblongata.

BOOKS RECEIVED.

Chemical Combination among Metals. By Prof. M. Giua and Dr. C. Giua-Lollini. Translated by G. Wooding Robinson. Pp. xiv+341. (London: J. and A. Churchill.) 21*s.* net.

Papers for the Present. Second series, No. 4. The Re-education of the Adult. The Neurasthenic in War and Peace. The Convalescent as Artist-Craftsman. Pp. iv+19. (London: Headley Bros., Ltd.) 6*d.*

Telegraphy, Aeronautics, and War. By C. Bright. Pp. xvii+407. (London: Constable and Co., Ltd.) 16*s.* net.

Life and Letters of Sir Joseph Dalton Hooker, O.M., G.C.S.I. Based on materials collected and arranged by Lady Hooker. By L. Huxley. 2 vols. Vol. i., pp. x+546. Vol. ii., pp. vi+569. (London: J. Murray.) 36*s.* net.

The Recovery and Re-manufacture of Waste Paper. A Practical Treatise. Printed on paper made entirely from regenerated waste paper. By J. Strachan. Pp. vi+158. (Aberdeen: The Albany Press.) 12*s.* 6*d.* net.

Report on the Danish Oceanographical Expeditions, 1908–10, to the Mediterranean and Adjacent Seas. Published under the superintendence of Dr. J. Schmidt. Vol. ii. Biology. No. 4. Pp. 1–154+1–28+1–40+1–15. No. 5. Pp. 1–154+1–70+1–18+1–20. (Copenhagen: A. F. Høst and Søn.)

The Zinc Industry. By E. A. Smith. (Monographs on Industrial Chemistry.) Pp. viii+223. (London: Longmans, Green, and Co.) 10*s.* 6*d.* net.

The Commonwealth Book of Cookery. By M. V. Palmer. Pp. 124. (London: Longmans, Green, and Co.) 2*s.* 6*d.* net.

The Modern Treatment of Mental and Nervous Disorders. A lecture delivered at the University of Manchester on March 25, 1918. By Dr. B. Hart. Pp. 28. (Manchester: At the University Press.) 1*s.* net.

CONTENTS.

Editorial and Publishing Offices:
MACMILLAN AND CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.