THURSDAY, AUGUST 16, 1917.

AVIATION AND AIR-POWER.

(1) *Air-Power: Naval, Military, Commercial.* By C. Grahame-White and H. Harper. Pp. viii + 262. (London: Chapman and Hall, Ltd., 1917.) Price 7*s.* 6*d.* net.

(2) *The Aviation Pocket-book for* 1917: *A Compendium of Modern Practice and a Collection of Useful Notes, Formulae, Rules, Tables, and Data Relating to Aeronautics.* By R. B. Matthews. Fifth edition. Pp. xix + 300. (London: Crosby Lockwood and Son, 1917.) Price 4*s.* 6*d.* net.

(3) *The Properties of Aerofoils and Aerodynamic Bodies: A Text-book for Aeronautical Engineers, Draughtsmen, and Students.* By A. W. Judge. Pp. x + 298. (London: Whittaker and Co., 1917.) Price 15*s.* net.

(1) "AIR-POWER" is a non-technical survey of the position of aviation and its future, both in the military and civil senses. The book raises political as well as technical issues, and in the preface says that dominion of the air must mean ultimately the dominion of the world. Naturally enough, we find that Britain is to lead the world, but on the whole the book depends for its subject-matter on the ideas and propositions now well known in aeronautical technical circles, and the dominion looked for appears to be in the arts of peace rather than in those of war.

The book adds one more to the number of well-deserved tributes to the prowess of the British pilot during the war, and voices a fairly generally held opinion that natural aptitude for flying is a great and characteristic asset of the nation. It should not be forgotten that the war provides an outlet for sporting instincts which will be absent from the more humdrum work of the civil pilot, and the genius of the Germans for the organisation of humdrum labour should not be lost sight of in our efforts to avoid the suppression of individuality. The authors point out that in the present war the Germans reaped an initial advantage from the use of large numbers of mediocre aeroplanes, the organisation of the Allies for obtaining air supremacy being said to have been ineffective until the summer of 1916.

In future wars the authors foresee huge raiding expeditions by aeroplanes, the airship being heavily discounted by reason of its vulnerability to attack. On the other hand, aeroplanes are relatively safe from land-fire, although the proportion of machines brought down in this way is steadily increasing. During raids each bombing squadron is to be escorted by faster machines of a fighting class, whilst for long expeditions means will have to be discovered of keeping formation, the tendency being for units to separate and lose contact, thus rendering themselves more liable to attack from the opposing aircraft.

As a result of these bombing tactics we are to be driven underground. Arsenals, Government buildings, and factories of national importance are all to hide their diminished heads.

It is to be hoped that the aeroplane will not be such a terrible weapon of offence as is portrayed by the writers of "Air-Power." Fortunately, the discussion of the technical details of the future aeroplane gives hope for a reasonably lengthy period in which to adjust ourselves to the new world that is to be.

The future aeroplane is to travel at 200, 250, or even 300 miles an hour, and to accomplish this with safety the area of the wings is to be variable to a great extent between high speed and cruising speed. They are to have petrol turbines instead of the present reciprocating engines; many of them may be used in one aeroplane, which will probably be a multiplane. There is to be a Trans-atlantic service doing the journey in forty-eight hours, and air travel is to be the ideal form of touring, because there will be no dust and no petrol fumes, apparently not even from the turbines. With such a machine it is surprising to find that the authors are doubtful of their pilots, and say that careless pilots must not on any account be allowed to take charge of machines, or the public might get timid.

The programme outlined is scarcely ever outside the bounds of possibility, but views on aviation will have changed greatly long before the programme is completed. If the authors do not convey their full enthusiasm to their readers, it is hoped that they are helping to make known the growing conviction that aeronautics is going to take a not unimportant place in the future history of the nation.

(2) Engineering pocket-books, no matter what the branch dealt with, must contain a certain amount of common matter, and in the case of the aviation pocket-book the formulæ for the strength of struts and beams and the permissible loading of ball-bearings are instances of this common grounding. The specialised part of pocket-books comes from the standard text-books of the branch, and in aviation these books are still in the early stages of development. The formulæ and tables of the pocket-book are correspondingly meagre.

The aerodynamical information with which the book opens is correct enough, so far as it goes, but one may doubt its assistance to designers, who have much more recent and complete information at their disposal. On the subject of stability the book is very weak, and the brief note on lateral stability is valueless.

The author has given the method and formulæ used in the design offices when devising propellers, and as these are of a standard type the pocket-book will form a source of handy reference. It is probable that in the near future the theory will be extended, but not superseded. Engines are described mainly by the reproduction of the reports of trials, but some of the notes on tuning and engine faults are taken from the older subject of motoring, and should provide valuable assistance to those concerned in the use of aeronautical engines.

There are many other interesting features in the pocket-book, amongst which may be mentioned the tables of meteorological data, a description of compass errors and their elimination, scouting and signalling, a glossary of aeronautical terms, and a bibliography of aeronautics. The pocket-book makes a good beginning at collecting the skeleton tables and formulæ of the aeronautical industry, and may be expected to grow and keep pace with the text-books of the day.

(3) This book, one of a series of four contemplated by the author, consists of a collection of papers from various sources, of which the most prominent are the aerodynamical laboratories at the National Physical Laboratory and at Auteuil. The collection is uncritical, and in some cases the author is out of his depth. This is the case in the discussion of dynamical similarity, and more generally on all the theoretical topics dealt with in the book.

Aeronautics is still so new that work only three or four years old may need modification in the light of more recent experience before it can be used safely in a general scheme which includes this later work. It is the absence of these modifications which renders the book very little better than the original papers, and only so far as it leads to a wider distribution of knowledge has it any value.

The author limits the scope of his book to that part of aerodynamics which refers specifically to the performance of an aeroplane, and leaves to a separate volume the aerodynamical data which are concerned in the discussion of stability and control. It is clear that the author is handicapped by the restrictions which war places on publication, and considerable revision and addition may be expected at the end of hostilities.

THE GLASTONBURY LAKE VILLAGE.

The Glastonbury Lake Village: A Full Description of the Excavations and the Relics Discovered, 1892–1907. By A. Bulleid and H. St. George Gray. Vol. ii. Pp. xxxv–xl + 353–724 + plates lix–ci. (Glastonbury Antiquarian Society, 1917.) Price, 2 vols., 3*l*. 3*s*. net.

THIS volume completes the record of one of the most important excavations which have recently been carried out in this country. It falls into two parts: first, a descriptive catalogue of the objects discovered in the course of the excavation, prepared by a competent archæologist, Mr. St. George Gray, who was trained in the new school of archæological work under General Pitt Rivers, the pioneer in scientific processes of excavation; secondly, articles on plants, wild and cultivated, by Mr. Clement Reid; on the remains of birds, by Mr. C. W. Andrews; and an important series of papers by Prof. Boyd Dawkins on wild and domesticated animals, the inhabitants of the village, the range of the Iberic race in the prehistoric Iron age, and the place of that race in British ethnology.

The catalogue prepared by Mr. St. George Gray is a good piece of ethnographical work, each specimen being carefully described with a lavish display of illustrations. Indeed, it is more than a mere catalogue; it might be better described as a handbook for the archæologist, because he not only describes the specimens with which he is dealing, but compares each article with similar objects found elsewhere, and gives careful references to a large number of papers in scientific journals. It might be worth considering whether this part of the book might be reprinted in a cheaper form for the use of field workers.

In order to complete the survey of this interesting site it may be hoped that the chance of recovering the village burial-ground will not be overlooked. In its absence some important questions must remain unanswered. In Britain during the prehistoric Iron age inhumation and cremation were both recognised methods for the disposal of the dead. This was probably the case in Glastonbury, and though a good deal of pottery has been recovered, it is as yet impossible to say how much of it may have been used for funerary purposes.

The valuable series of papers contributed by Prof. Boyd Dawkins enables us to understand the physical types of the people, their connection with other races, and in some measure, with the help of the articles found on the site, to reconstruct their local culture. From the sporadic distribution of the human bones, as well as their general isolation, he believes that we must suppose that a general massacre of the inhabitants occurred, and this conclusion is amply supported by marks of violence found on some of the skulls. Like their neighbours, they seem to have been subject to Belgic tribes which at the time of the Roman conquest had become the dominant power in southern Britain. The Lake-village was probably stormed and sacked by some Belgic tribesmen when they took possession of Somerset some time between Cæsar's invasion and the Claudian conquest. As M. Salomon Reinach has shown in the case of some of the Celts of Gaul, these Belgæ were possibly head-hunters, and a weak settlement like this would be likely to provoke attack. In other places, like Wookey Hole and Worlebury, some survivors returned and reoccupied their houses. But at Glastonbury the whole population may have been wiped out or enslaved, and the site has remained uninhabited down to the present day. Possibly they were too weak to make effective resistance. The scarcity of weapons, even among people occupied in pastoral and industrial pursuits, is striking; out of 107 objects of iron, only seven could be classed in this category. At the same time, though sporadic fires used to occur, there seems to have been no general conflagration.

As regards the racial affinities of the inhabitants, they were members of the Iberic stock, the oldest element as yet traced in the existing European peoples. They were closely connected with their neighbours, the Silures, and probably they lost their Iberic tongue when they passed under the rule of the Goidels, and learned, in the Bronze age, to speak Gaelic. This Gaelic tongue was in its turn replaced by the Brythonic—Welsh,

Cornish, Breton—when the Brythons ruled the land in the prehistoric Iron age. Neither the Belgic nor the Roman conquest left any physical marks on this isolated community, hidden away in the marshes.

The best way of understanding their mode of life is by a comparison with that of the inhabitants of other similar settlements. The Worlebury folk, their neighbours, were in the same stage of culture as the Lake-villagers: practised the same arts—spinning, weaving, pottery-making; grew the same wheat, barley, and beans; had the same domestic animals, and lived in the same sort of huts, with this difference, that at Worlebury the huts were sunk in the ground, instead of being supported by artificial foundations in a marsh, and they were protected from attack by massive stone walls, instead of palisades.

We have said enough to indicate the value of this elaborate survey of an interesting, isolated prehistoric community, on which the Glastonbury Antiquarian Society and the editors, Dr. A. Bulleid and Mr. St. George Gray, are to be congratulated.

MECHANICS AND METALLURGY.

(1) *Guida Pratica del Meccanico Moderno.* By Arturo Massenz. (Manuali Hoepli.) Pp. xxiv+351. (Milano: Ulrico Hoepli, 1917.) Price 4.50 lire.

(2) *Tempera e Cementazione dell' Acciaio.* By Mario Levi-Malvano. (Manuali Hoepli.) Pp. xii+261. (Milano: Ulrico Hoepli, 1917.) Price 4 lire.

(1) THE present volume forms one of the excellent series of which Messrs. Hoepli have now published some 600, dealing with the arts and sciences. This work is intended chiefly for foremen and for students of technical and industrial schools who are about to start their works career. Brief descriptions are given of the various small tools and appliances met with in a modern shop, with particulars of the operations for which they are intended. The text and illustrations are suggestive rather than fully explanatory, though a series of exercises accompanies each chapter, thus permitting the student to follow what he reads. Simple mathematics are introduced where necessary to elucidate any particular point. The heat treatment which metals necessarily undergo in the course of working is explained. The book concludes with an exposition of the different systems of screw-threads and of the uses of the various machine-tools.

(2) This volume attempts to give in a small compass a comprehensive account of the hardening of steel for industrial purposes. It is a thoroughly up-to-date little manual, being entirely rewritten from an earlier work published by the same firm. The first part of the work is devoted to theoretical metallurgy—the constitution of iron, the iron-carbon system, effects of heat treatment and mechanical treatment on the structure of steels, etc.—and mentions the work that has been done on the subject by the leading European metallurgists during the last twelve years or so. In the practical part the various operations of hardening and cementation are described, together with the furnaces used, while the methods of temperature measurement—Seger cone, Féry thermocouple and pyrometer, etc.—are touched on. As an introduction to some larger work on the subject this handbook can be warmly recommended to readers who have attained to some fluency in Italian. The book is well illustrated and printed, and in a form convenient for the pocket. E. S. H.

OUR BOOKSHELF.

Experimental Building Science. By J. Leask Manson. Pp. vii+210. (Cambridge: At the University Press, 1917.) Price 6*s.* net.

THIS book is an indication of the more intimate relations which are growing up between pure science and industry, and provides a course of simple experimental work which should be within the reach of students destined to become responsible for the manifold operations comprised under the term "building construction." The author explains the fundamental laws of physics and chemistry, and draws upon building materials and the everyday devices employed in buildings for his illustrations of these laws. The underlying principles, as he points out, are necessarily devoid of any novelty, but the practical illustrations are numerous and well chosen. Starting with an explanation of density and of water and air pressure exemplified by reference to water supply and drainage problems, the structure of materials is next shortly dealt with, and then the application of force, which section includes some useful spring balance experiments. The physical section concludes with some account of heat, and the last third of the book is devoted to elementary chemistry. The diagrammatic figures are very fully "written up," which should help the student. Partly a text-book, partly a laboratory manual also supplied with test questions, the book is capable of a wide application, and should prove useful to the enlightened student of building who realises that if he is to maintain his position in later life he must at least know something of the fundamental laws of natural science as applied to his work.

Treatise on Hydraulics. By M. Merriman. Tenth edition, revised with the assistance of T. Merriman. Pp. x+565. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 18*s.* 6*d.* net.

SINCE the first publication of this book in 1889 there have been many notable advances in hydraulics. The eighth edition was entirely rewritten, the ninth (1911) reset, and the present edition contains supplementary sections which bring the volume up to date. General principles are treated in the first three chapters; the flow through orifices, over weirs, through tubes, pipes, and conduits, together with the flow of rivers,

are dealt with in chaps. v. to x. The work done on vanes, and water-wheels and turbines take up the following three chapters, and the book closes with chapters on naval hydromechanics, pumps and pumping. The space devoted to the flow of water is large by comparison, and includes, in addition to the usual subjects, the flow through fire-hose and in fountains. Biel's formula for the flow in pipes and channels is discussed, and results calculated from it are compared with those given by Kutter's formula. The treatment of this section is adequate and good.

The book contains many illustrations, mostly outline diagrams, and while these illustrate very well the principles discussed, the inclusion of a larger number of working drawings would have been better. This remark applies particularly to the sections dealing respectively with turbines and pumps; the latter has no working drawings whatever, and both sections could bear considerable expansion. Hydraulic machinery is dismissed in three and a half pages, with four inadequate sketches, regarded from the point of view of the student who desires to know how the appliances are actually constructed.

Throughout the entire volume there are copious references to articles in periodicals, other books, transactions of societies, etc.

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.*]

A Plea for the Fuller Utilisation of Coal.

THE suggestion in your article of July 26 on the Fuel Research Board of "the employment of coke-oven gas to supplement the output of suitably situated gas works, and the more extended use of water-gas," is timely, and it certainly does not err on the side of excess.

As pointed out in a paper which I read before Section G of the British Association in 1906, "if all the foundry coke which is used in this country were made in by-product recovery ovens, the resulting yield of gas would be more than 160,000,000,000 cub. ft. per annum, or *more than is used in one year in the whole of the United Kingdom*"; and, as regards the distance to which the gas might be conveyed, it is scarcely an exaggeration to say that the economic limit of supply is the coast-line of Great Britain.

The possibility of conveying gas over long distances is scarcely realised in this country, although in the United States gas has for many years past been piped at high pressures over hundreds of miles.

The need for a cheap supply of power is beginning to make itself felt. Not unnaturally we turn to electricity; but over long distances gas is a very formidable competitor.

The question of fertilisers is also attracting attention. For years past we have been spending something like 15,000,000*l.* per annum on importing nitrate of soda from Chile, and wasting an equivalent amount of nitrogen by our primitive methods of using coal.

We are beginning, too, to realise the importance of the great coal-tar industry which we have allowed to slip into German hands.

In every direction we are confronted by problems which depend for their solution on a fuller utilisation of our great national asset.

The burning of coal in its raw state was long ago denounced by the late Sir William Siemens as "a barbarous practice"; but habit is strong, and our business men have been too busy making money to give much thought to economy in power production.

Recent events have violently jolted us out of our ancient grooves, and there is now a disposition to consider novel proposals on their merits.

I showed in a paper read before the Society of Arts in March, 1906, that coal-gas made at the pit's mouth could be delivered in London at a price at which it would oust coal from the home and from many industrial processes. My proposals may be briefly summarised as follows:—

(1) The whole of the coke-oven gas now wasted would be utilised, and a part of the additional gas required generated from small coal at the pit's mouth by the ordinary method of carbonisation, but without regard to illuminating power.

(2) The waste heat from the retorts would be utilised to raise steam for compressing the gas.

(3) The exhaust steam would be used to generate water-gas.

(4) The gas would be piped to wherever required, and delivered under sufficient pressure to charge the storage cylinders of motor vehicles.

(5) Chemical works would be established near the collieries to deal with the ammonia, tar, etc.

In this way practically the whole of the available heat of the coal would be turned to account, instead of wasting some 90 per cent. of it, as is done in generating electricity by steam-power; and the residuals, the whole of which are wasted when coal is burnt under a boiler, would be turned to good account.

The question bristles with points of scientific interest, but I have already trespassed long enough on your space and on the patience of your readers.

ARTHUR J. MARTIN.

University Hall, Carlyle Square,
Chelsea, S.W.3.

Devitrification of Quartz Glass.

IN an article by Audley, published in the Transactions of the Ceramic Society, vol. xvi., part i., p. 124, it is stated that the addition of zirconia to fused quartz gives a product resembling quartz opaque glass, but in many respects superior to quartz glass, and less easily devitrified.

The statement is repeated in the article on the uses of zirconia in the issue of NATURE of July 5, and had previously found its way into much of the literature dealing with quartz glass. The alleged superiority of quartz glasses containing zirconium or titanium oxides is due to some experiments carried out by Thomas in the laboratory of Borchers at Aachen, and published in the *Chemiker Zeitung* in 1912. These experiments were shown by me (*Chem. Zeit.*, 1913, p. 589), and independently by others, to be untrustworthy, quartz glasses containing zirconium and titanium oxides being, in fact, more liable to devitrification than quartz glass prepared from pure silica. The purer the quartz glass is the less is its tendency to devitrify after prolonged exposure to heat. Quartz glass manufacturers in this country are well aware of this, and endeavour to produce a material as free as possible from all impurities.

A. C. MICHIE.

The Wallsend Laboratories,
Wallsend-on-Tyne, August 7.

THE REVISION OF THE CIVIL SERVICE EXAMINATIONS.

THE committee appointed by the Lords Commissioners of H.M. Treasury to consider and report upon the scheme of examination for Class I. of the Civil Service has reported under date June 20, 1917 [Cd. 8657]. It gives, in the first place, an historical summary showing the variations in the scheme first adopted when the principle of open competition came into effect in May, 1855. With its apologia for the predominance given to classics we need not concern ourselves in view of the amendments it proposes.

The revised scheme which it outlines provides for examination in two sets of the subjects. First, a compulsory set, including an essay, and papers on English, contemporary questions, general scientific principles and methods, and translation from one modern language (or from Latin, if desired by modern language students); to each of these 100 marks is assigned. There is also a compulsory *vivâ voce* examination to test alertness and intelligence; to this 300 marks are assigned. All this seems very reasonable.

The second set of subjects is optional; candidates may offer (*a*) languages; (*b*) history; (*c*) economics, law, etc.; (*d*) mathematics and science; and (*e*) an additional translation paper in a modern language.

For the first time the modern languages are placed on a par with Latin and Greek, 200 marks being assigned for translation, etc., and 200 for the history and literature of the country in each case.

Mathematics gets its proper place; 800 marks are assigned to the subject—400 for lower and higher mathematics respectively. Science also is similarly treated, the marks, *e.g.*, for physics being equal to those obtainable for Latin, viz. 400. Engineering is, for the first time, brought within the scope of the examination and may also earn 400 marks. Another important new subject is statistics, which is valued at 100 marks.

Candidates offering science subjects are very rightly required to produce evidence that they have received laboratory training in an institution of university rank; but there is, of course, to be no laboratory test in the examination itself.

On the whole the scheme may be regarded as quite satisfactory; it provides opportunities for men trained efficiently on varied lines to gain access to the important posts to which these examinations ultimately lead; and it will now be the fault of the provincial universities if their *alumni* are not found among those who serve the State in this way. And after the scheme has been in operation for some years there should be in the higher ranks a fair proportion of men who have had a good scientific training, while the remainder will not suffer from that complete ignorance of scientific principles and methods which characterises most of our existing mandarins.

Of course, the new scheme will not alter the deplorable system by which service in those departments of the public service not open to public competition are chosen so very largely from the ranks of classical scholars. It may still be possible, *e.g.*, for an authority on medieval English literature to be primarily responsible for technical education and for there to be no representative of scientific knowledge, training, and education among the highest officials of the Board of Education or among the chief administrators of the funds devoted to scientific and industrial research.

In an appendix to the report specimen papers are set forth. The one in general science (for *all* candidates) is interesting and on the right lines; it asks for just that amount of general scientific knowledge likely to benefit all public servants; and a wide choice is to be allowed. Quality in the answers is to be sufficient, and accuracy of statement and clearness of expression are to be essentials.

The compulsory paper on social, political, and economic subjects is also on the right lines; it requires a candidate to have some clear ideas as to the way we are governed and as to the questions underlying the proper conduct and development of our trade and commerce.

The age limits for candidates remain as at present—twenty-two to twenty-four. This will prejudice candidates from the provincial universities; but if it helps to lead to a later age of entry and to make the requirement of a four years' course for an honours degree more general, it will have done useful work. The provincial universities would do well to combine to fix their minimum age of entry at eighteen, with a standard of educational efficiency equal to that required from present candidates for the intermediate examination for the initial degrees.

The committee has done valuable work, and we may be sure that the experience and advice of the two fellows of the Royal Society who were members of it—Sir Alfred Ewing and Sir Henry Miers—have contributed in no small degree to the wise decisions which have been taken.

J. WERTHEIMER.

THE NEW EDUCATION BILL.

MR. FISHER introduced the long-expected Education Bill in the House of Commons on August 10, and it was read a first time. The reforms which the Bill outlines have long been overdue, but they have been delayed by the exigencies of our system of government, with the importance it has attached to the claims of the different political parties, which have year after year placed at the head of the Board of Education Ministers with no knowledge of the educational needs of the country, little appreciation of the intimate connection between educational efficiency and industrial and mercantile supremacy, and chiefly concerned with securing advantages for the party to which they owed their position. But in Mr. Fisher we have a Minister of Education who is an educationist conversant with every grade of our educational system and dominated by the idea that "education is one of

the good things of life, which should be more widely shared than has hitherto been the case amongst the children and young persons of the country"—to quote his own words. If his Bill eventually becomes an Act embodying the reforms he described in his introductory speech, it will mark a turning-point in English education and will place the nation firmly on the road leading eventually to real educational efficiency.

But the Bill is at its best only an instalment of what is wanted and what must be secured if our educational system is to be complete. As Mr. Fisher explained in his speech, the Bill does not affect the government of the universities, or of those institutions of secondary, technical, and other higher forms of education which are not maintained or aided by local education authorities. It does not deal with the scholarship system, the training colleges, or libraries, and the establishment of a satisfactory pensions scheme for teachers in secondary, technical, and other schools at present outside the State scheme of pensions. These pressing matters are, we are told, to be included in separate measures, but in view of the demands which the war must continue to make on the Government and the House of Commons, it is difficult to be optimistic as to the chances of early legislation in the direction of improving and extending our higher education.

Yet Mr. Fisher's Bill marks a great step forward, and it has received, we are glad to know, a general welcome. It assumes the administrative structure erected by the Act of 1902, and the educational work of the country will continue to be entrusted to the authorities on whom it was devolved by that Act.

The general framework of the Bill and the specific proposals of the Government were clearly explained in Mr. Fisher's speech, from which the following summary has been made:—

The Government desires:—First, to improve the administrative organisation of education.

Secondly, to secure for every boy and girl in this country an elementary school-life, up to the age of fourteen years, which shall be unimpeded by the competing claims of industry.

Thirdly, to establish part-time, day continuation schools, which every young person in the country shall be compelled to attend unless he or she is undergoing some suitable form of alternative instruction.

Fourthly, the development of the higher forms of elementary education and the improvement of the physical condition of the children and young persons under instruction.

Fifthly, to consolidate the elementary-school grants; and

Sixthly, to make an effective survey of the whole educational provision of the country and to bring private educational institutions into closer and more convenient relation to the national system.

A duty is imposed upon the councils of every county and county borough to provide for the progressive development and comprehensive organisation of education in their respective areas and to submit schemes to the Board, and in order that this function may adequately be discharged it is proposed to remove the twopenny limit of the amount to be raised for higher forms of education which was imposed by the Act of 1902. The council of a county or county borough will, in other words, plan out an educational policy. Before submitting its scheme to the Board the council will be required to consult the authorities having power in the county under Part 3 of the Act of 1902 with reference to the mode in which and the extent to which any such authority will co-operate with the county, and the Board will be informed as to the co-operation to be expected from any such authority.

There are some educational problems which can be most conveniently considered in relation to an area larger than a county or county borough, and by bodies representing a wider constituency. The supply of elementary teachers, for instance, could be best dealt with in relation to the large areas. So, probably, could a scheme for scholarships to be held at the secondary schools or the universities. Or, again, the provision and utilisation of secondary schools might be more scientifically planned and with less fear of overlapping in the large area than in the small area. It is, of course, possible under the existing law for authorities to combine for any one or all of such purposes.

The Bill provides distinct statutory authority for the formation of bodies which we may call provincial associations. The Board will be empowered by statute to provide for the establishment of provincial associations after consultation with the authorities concerned, the local education authorities being empowered to delegate administrative and educational functions to these associations, and conversely the associations being empowered to exercise any function so delegated. There will be county and county borough authorities obliged to submit comprehensive schemes of education for their respective areas, and these will be gradually supplemented by provincial associations for those educational purposes which are most conveniently dealt with in relation to areas larger than those of the county and county borough.

The education given in public elementary schools is not to be considered an end in itself, but a stage in the child's education destined to lead to other stages. Local education authorities, under Part 3 of the Local Education Act of 1902, will be required to make adequate provision, either by special classes or by means of central schools, for what may be termed higher elementary education. The Bill provides not only for the introduction of practical instruction at appropriate stages, but also for the preparation of children for further education in schools other than elementary, and for transference at suitable ages to such schools.

The Bill includes a series of proposals designed to improve and to strengthen the existing fabric of elementary education so as to secure to every child in the kingdom a sound physique and a solid groundwork of knowledge before the period when the part-time system begins. The establishment of nursery schools for children under five years is encouraged, and the local education authorities are empowered to raise the age at which normal instruction in the elementary schools begins to six, as soon as there is an adequate supply of nursery schools for the younger children in the area.

The law of school attendance is to be amended so as to abolish all exemptions between the ages of five and fourteen, and further restriction is to be placed upon the employment of children during the elementary-school period. The first of these proposals rests upon the belief that children are introduced to the normal instruction of public elementary schools at too tender an age. At four or five years sleep and play are far more important than letters, and, wherever the home is good, the child should be encouraged to stay with its mother. It is not proposed to compel the provision of nursery schools, but to enable such schools, attendance at which must be voluntary, to be aided from the rates, and in the development of these schools, which will often be open-air schools, a

real improvement in the health of young children may reasonably be looked for.

The second proposal involves as its consequence the abolition of what is known as the half-time system. The system has been condemned by every educationist and every social reformer. It is bad for the physique of the children, it is injurious to the intellectual prospects of the half-timer, and it has been shown not only that the work upon which the children are engaged is not such as to develop the higher forms of industrial activity, but also that when the half-time system is once admitted in the textile industry it spreads to other forms of employment as well.

The third measure for improving elementary-school education is the further regulation of the employment of children during the period of daily elementary-school life. The Government desires a full period of school life, unimpaired by the competing claims of employment, for all children of the working population. At the present moment the effect of our elementary-school education is greatly harmed by the work which is imposed on children out of school hours. They are liable to be employed for three hours before the school opens and for some hours after the school closes, and the general opinion of inspectors is that of all reforms affecting elementary education there is none more vital than the enforcement of strict limitation of the employment of children in their school-going days. The Bill proposes that no child under twelve shall be employed for profit, and here the Bill has been anticipated by by-laws passed in some large municipalities. No child under fourteen shall be employed on any day on which he is required to attend school before the close of school hours or after 8 p.m. on that day, or on other days before 8 a.m. or after 8 p.m. The Bill provides that the local education authorities, if satisfied on the report of the school medical officer or otherwise that the child is being employed in such a way as to be prejudicial to health or education, may forbid or regulate that employment. If the local education authority should decide that it would be wise to continue the elementary education in the elementary schools either of the boys or the girls in their area or of boys or girls following particular occupations in that area up to the age of fifteen they shall be empowered to do so.

The most novel provision in the Bill is that, with certain exceptions, every young person no longer under any obligation to attend a public elementary school shall attend such continuation school as the local education authority of the area in which he resides may require for a period of 320 hours in the year, or the equivalent of eight hours a week for forty weeks. The main exceptions are the following:—Attendance at schools will not be required in the case of a young person who has received to the satisfaction of the Board suitable full-time instruction up to the age of sixteen, or has passed the matriculation examination of a university of the United Kingdom or an examination recognised as an equivalent to that, or is shown to be unsuitable or deficient for part-time instruction. In other words, every young person who has not received a full-time education up to the age of sixteen shall receive a part-time education up to the age of eighteen, either in schools provided by the local education authority or in schools under their direction, such as the schools established by manufacturers in their works. The Bill provides that part-time instruction shall be given by day; it must be taken out of the employers' time, and provision is made to ensure that the young person who is required to attend continuation classes shall not be worked unduly long hours during the days on which the classes are held, and that he or she shall be given a reasonable interval for food, rest, and washing between work and school. The classes are not to be held on Sunday or any holiday or half-holiday which a young person is accustomed to enjoy. The proposal comes to this, that any young person who has to undergo full time for instruction will be liberated from industrial toil for three half-days a week during forty weeks—two half-days to be spent in school, while one will be a half-holiday.

The Bill rightly attaches great importance to physical education. Physical training is already an element, perhaps not a sufficient element, in our elementary-school curriculum, and grants have recently been sanctioned for organisers of physical training in public elementary schools. The present Bill gives physical training a place in continuation schools. Every boy and girl in those schools will receive physical training. It goes even further. It empowers the local education authority to establish nursery schools for young children, to maintain playing-fields, school baths, or school game centres, and equipment for physical training, and it extends the powers and duties with regard to medical inspection now possessed by the local education authorities in the case of elementary schools and secondary schools provided by them, and continuation schools under their control.

In commending the Bill to the consideration of the House, Mr. Fisher said:—"We have reached a point in our history when we must take long views. We are a comparatively small country, and we have incurred the hostility of a nation with a larger population, with a greater extent of concentrated territory, and with a more powerful organisation of its resources. We cannot flatter ourselves with the comfortable opinion—I wish we could—that after this war the fierce rivalry of Germany will disappear and hostile feeling altogether die down, and this in itself constitutes one reason for giving the youth of our country the best preparation which ingenuity can suggest. There is another reason. We are extending the franchise. We are making a greater demand than ever before on the civic spirit of the ordinary man and woman at a time when the problems of national life and of world policy, as to which this House will be called on to decide, have become exceedingly complex and difficult. How can we expect an intelligent response to the demands which the community proposes to make on the constructive judgment of its men and women unless we are prepared to make some further sacrifices in order to form and fashion the mind of the young?

"We assume that education is one of the good things of life, which should be more widely shared than has hitherto been the case amongst the children and young persons of the country. We assume that education should be the education of the whole man, spiritually, intellectually, and physically; and it is not beyond the resources of civilisation to devise a scheme of education, possessing certain common qualities, but admitting at the same time large variation, from which the whole population of the country, male and female, may derive benefit. We assume that the principles upon which well-to-do parents proceed in the education of their families are valid *mutatis mutandis* for the families of the poor, and that the State has need to secure for its juvenile population conditions under which mind, body, and character may be harmoniously developed. We feel also that, in existing circumstances, the life of the rising generation can only be protected against the injurious effects of industrial pressure by a further measure of State compulsion. But we argue that the compulsion proposed in this Bill will be no sterilising restriction of wholesome liberty, but the essential condition of a large and more enlightened freedom. It will tend to stimulate the civic spirit, promote general culture and technical knowledge, and diffuse a steadier judgment and a better-informed opinion through the whole body of the community."

THE REGENERATION OF THE BRITISH SCIENTIFIC INSTRUMENT TRADE AFTER THE WAR.

MUCH attention is being paid at present to the capture of Germany's foreign trade after the war, and the same arguments that apply in other spheres hold good for the scientific instrument trade as well. The Germans, thanks to their efficient organisation and methods of education, had been able, at the time the war broke out, to attain a supreme position in this branch of their export trade. To quote one instance from statistics: Germany exported to Russia alone, in 1913, mathematical, physical, and chemical instruments to the value of nearly two millions sterling, and chemical and pharmaceutical products to almost the same amount. While corresponding figures are not available in a complete form for similar British products, there is every reason to believe that they represent only a small fraction of these amounts.

The following notes, based on conversations the writer had with the directors of two of the leading German manufacturers of physical and chemical apparatus, will explain the reason for Germany's success and point out the direction in which British manufacturers should proceed after the war.

In nearly every case the German youth desiring to adopt scientific instrument making as a trade has to serve a long apprenticeship in the particular branch to which he intends to devote his energies. This training is supplemented by courses in elementary science (including in many cases mathematics) held in the continuation schools (*Gewerbeschulen*), of which there are one or more in any town of importance. Thus, in addition to knowing how to construct an instrument, the German craftsman generally knows exactly what function that instrument is intended to perform—he crystallises his scientific notions into his daily work. He also realises the value of precision. It is highly important, therefore, that English instrument makers should be afforded more ample facilities for obtaining this scientific training at the same time as their workshop experience, in order to avoid the mere mechanical repetition which their practical experience calls for.

In Germany there is closer *rapprochement* between instrument-making firms and college and university teachers, with the result that new forms of apparatus are being continually evolved for proving a given law or explaining a scientific phenomenon. A perusal of the catalogues of Kohl, Enencke, and other firms will show the diversity of apparatus that were current articles with these houses.

It is to be hoped that after the war some publishing house will consider the advisability of establishing a periodical devoted to the theoretical and practical side of instrument making. Germany possesses more than one such organ, viz. the *Zeitschrift für Instrumentenkunde* (with its supplement, *Deutsche Mechaniker-Zeitung*, devoted to the practical side of instrument making) and *Der Mechaniker*. The former journal is at the same time one of the many organs of the Physikalisch-Technische Reichsanstalt (the German National Physical Laboratory). Whenever a purely physical instrument is designed in that institution, the experimental data leading up to its design, as well as the mechanical details, are published in the *Zeitschrift für Instrumentenkunde*, the editorial staff of which includes one or more members of the Reichsanstalt staff. The value of such a journal to instrument makers, especially when their own staff includes men with a thorough scientific training, is incalculable.

Again, in order to make scientific products known abroad, the Germans resorted to an extensive system of propaganda, by means of elaborate descriptive catalogues printed in the language of the country with which they wished to deal. Many of these catalogues embrace almost every known instrument for teaching and other purposes.

British manufacturers, my German informants told me, are quite as capable as the Germans of constructing instruments of precision equal in every respect to the German products. There is no reason, therefore, why they should not secure a large share of the business that was done by Germany in pre-war days, provided they (1) take steps to construct a more comprehensive range of apparatus; (2) keep pace with modern scientific requirements; (3) keep in closer touch with British men of science; (4) give more attention to the publication of catalogues in foreign languages; and (5) establish a journal embodying the peculiar features of the *Zeitschrift für Instrumentenkunde*. E. S. HODGSON.

DR. FÉLIX LE DANTEC.

IT is with regret that we have to record the death of a well-known French biologist, Dr. Félix Le Dantec, at the age of forty-eight years. For many years a sufferer, he hastened his end by generous work in the war hospitals, though indeed the flame of his life always burned too quickly to last long.

Of Breton extraction and precocious talents, Dr. Le Dantec studied in Paris under Pasteur, Metchnikoff, and other great masters. His doctorate thesis dealt with intra-cellular digestion in the Protozoa. Although he returned at times to similar investigations, *e.g.* on Sporozoa and Bacteria, he was led by temperament and by circumstances to a kind of life which the pure investigator often fails to understand. On the one hand, Le Dantec was, as he said himself, an intellectual adventurer; he could not desist from the pursuit of the elusive—What is life? What is individuality? What is personality? What is sex? What is evolution? What is knowledge? His last book, which was published this year, is entitled "Savoir." On the other, he had the vocation of a teacher, and fulfilled it with an extraordinary industry and enthusiasm, unsparing of his own vital resources. We refer not so much to his work as lecturer in Lyons and *préparateur*

in Paris, but to his extraordinary writing of books, in which we see an heroic effort to win a way to clearness for himself and others. Thus we have "La matière vivante," "La Théorie nouvelle de la vie," "Evolution individuelle et Hérédité," "Traité de Biologie," "Le Déterminisme biologique," "Les Influences ancestrales," "La Lutte universelle," and at least ten more!

Dr. Le Dantec was a biologist of the mechanistic school; he held to a hard-and-fast determinism; he was a devoted disciple of Lamarck; he made passionate endeavours after scientific clarity as opposed to what he regarded as superstitious sentimentalism, metaphysical verbiage, and intellectual hypocrisy. While many of his radical ideas have been criticised as too abstract and simplicist, not gripping the actual facts of life, many others were certainly luminous and useful, such as that of the organism continually trafficking with its environment, sustaining itself by functioning, "l'édification de la vie par la vie." Of the man himself there is no doubt: his whole life spoke of courage, sincerity, a passion for veracity, a willingness to follow what he thought was truth wheresoever it led him.

NOTES.

ON August 9–10 a large magnetic storm was recorded at Kew Observatory. It began with a "sudden commencement" at about 4.14 a.m. on August 9. The "sudden commencement" was unusually large, especially in D (declination). In H (horizontal force) it was not visibly oscillatory, consisting of a rise of about 110 γ ($1\gamma = 1 \times 10^{-5}$ C.G.S. unit). In D it was distinctly oscillatory, an easterly movement of about 4′ being followed by a westerly movement of about 17′. The extreme westerly position of the needle was reached about 4.50 a.m. on August 9, when the needle pointed 34′ more to the west than it did when the storm began. The D trace was highly oscillatory at times, especially between 9.30 and 10.30 a.m. on August 9. Conditions became much quieter after 11 a.m., and continued so until 9.20 p.m. on August 9, when there was a recrudescence of the storm. The extreme easterly position was reached about 0.24 a.m. on August 10. The storm had pretty well subsided by 4 a.m. The total range of D during it was approximately 55′. The disturbance in H, generally speaking, waxed and waned in intensity with that in D, but did not show so much abatement between 11 a.m. and 9.20 p.m. on August 9. The recrudescence after 9.20 p.m. on August 9 was, however, conspicuous. The lowest and highest values of H were both recorded on August 9, the former about 9.30 a.m., the latter about 9.30 p.m.; the total range was about 370 γ. During the greater part of the time the vertical force trace was not much disturbed. The value of the element was slightly depressed during the morning hours of August 9, and there was a considerably larger depression between 9.30 p.m. on August 9 and 2 a.m. on August 10. The range of the element during the course of the disturbance was about 250 γ. The disturbance was of the kind usually accompanied by aurora.

IT was announced in NATURE of August 2 that the Museums Association proposed to hold a conference in October next. The announcement was based upon a circular, dated July 24, asking persons who intended to be present to communicate with Mr. E. E. Lowe (Museum and Art Gallery, Leicester), who is hon. secretary of the association. A circular dated August 2, signed by the members of the Executive Committee, has now reached us, and we learn from it that the proposed conference will not be held, as a sufficient number of promises to attend has not been received.

THE High Commissioner for New Zealand has been informed by cable that reports of the damage done by the recent earthquake in the southern part of North Island were much exaggerated, and that the earthquake was in no way destructive.

MR. CHARLES T. DRUERY, who died on August 8, was a naturalist as well as a horticulturist of eminence. At a time when not many horticulturists were inclined to see beyond the horizon of their gardens, Mr. Druery did much to encourage the wider outlook which has now become more general. His passion for the study of ferns, and in particular for the abnormal and monstrous forms, led him to see that the science of genetics must be called in to help to explain the ways of cultivated as well as of wild plants. Of alert mind, he recognised at an early date the importance of Mendel's work, and it was his pen that wrote the first English translation of Mendel's famous memoir. In recognition of his services to horticulture his name was enrolled among those of the sixty original recipients of the Victoria Medal of Horticulture. A gifted linguist, Mr. Druery wrote on subjects other than horticulture. Quite recently he published a volume of verse—of a humour akin in type to that practised by early Victorians—and his many friends were compelled to admire, not only the versatility, but also the youthfulness of mind of a man who, though of advanced age, proved himself younger than most of those of a later generation.

DR. A. CALMETTE, director of the Institut Pasteur, Lille, and Dr. L. Martin, director of the Hôpital Pasteur, have been appointed to subdirectorships at the Institut Pasteur, Paris.

THE G. C. Greenwell silver medal of the North of England Institute of Mining and Mechanical Engineers has been awarded to Prof. W. G. Fearnsides for his paper on "Some Effects of Earth-movement on the Coal-Measures of the Sheffield District (South Yorkshire), and the neighbouring parts of West Yorkshire, Derbyshire, and Nottinghamshire."

ACCORDING to the *Journal of Industrial and Engineering Chemistry*, the Seaman gold medal, which is each year awarded by the American Museum of Safety for the promotion of hygiene and the mitigation of occupational disease, has been conferred upon the Julius King Optical Company of New York, for their appliances against the dangers of ultra-violet and infra-red light.

MAJOR J. C. WOODS has been awarded the Gaskell prize of the Medico-Psychological Association of Great Britain and Ireland, consisting of fifty guineas and a gold medal, and Dr. M. Krohn a replica of the medal in silver and the sum of fifteen guineas.

THE National Academy of Sciences of the United States has received from Miss M. H. Elliot the sum of 8000 dollars to establish a fund in memory of her late father, Daniel Giraud Elliot, and has accepted the trust. A medal, to be known as the Daniel Giraud Elliot gold medal, and an honorarium will be awarded annually for a paper, essay, or other work in some branch of zoology or palæontology published during the year. The award is not restricted to naturalists resident in the United States. Drs. H. F. Osborn,

C. D. Walcott, and F. A. Lucas have been appointed judges for the bestowal of the medal and honorarium. It is expected that it will be possible for the first award to be made in April, 1918.

THE mycological collection of the late Dr. J. W. Ellis has been acquired by purchase by the herbarium at Kew. It comprises nearly 1600 dried specimens, is especially rich in micro-fungi, and includes a series of mounted specimens of those of economic importance. There are also 330 microscopic slides.

AN Aerial Postal Service between Italy, Sicily, and Sardinia has already been established, as we read in the *Journal of the Society of Arts*, August 3. The first post was inaugurated on June 24 between Naples and Palermo, and three days later the next service, from Civita Vecchia on the mainland to Terranuova-Pausania (Sardinia). In the first trip from Naples to Palermo, a seaplane was used, carrying a heavy mail, flying at a height of 1500 to 2000 metres at 140 kilometres (say ninety miles) an hour, reaching Palermo in less than two hours and a half. The service from Civita Vecchia to Sardinia was opened on June 27 by two seaplanes, each carrying 100 kilogrammes of mail in watertight bags. The passage was made in an hour and forty minutes, leaving Civita Vecchia at 6.20 a.m. and reaching Terranuova about 8 a.m., and the return journey was made in about the same time.

AN appeal for the loan of prismatic compasses for use in the Army has been issued by the Countess Roberts. Any good prismatic compass, such as is used for map-making and surveying, would be acceptable. The instruments would be engraved and registered under the lenders' names to facilitate their return, when possible, after the war. They should be sent to the Manager of Lady Roberts's Field Glass Fund, 64 Victoria Street, S.W.1.

THE Cavendish lecture of the West London Medico-Chirurgical Society was delivered on June 22. The lecturer, Capt. Andrew Macphail, Canadian Army Medical Corps, who is professor of the history of medicine at McGill University, Montreal, took as his subject "A Day's Work." In a word-picture of considerable power he described the medical organisation of that part of the Army concerned with the attack on, and capture of, the Vimy Ridge. "The Medical Service, above all other services, has done its perfect work. It has yielded an army without sickness. I have never seen a case of typhoid, and the few infectious cases are of the nature of children's diseases. Except for a few days on the Somme, I have not seen more flies than one would see on a well-kept farm. Purified water is put into the men's bottles. To drink from an unauthorised source is a crime. Wells are examined even whilst they are yet under fire, and food is scrutinised before every meal. Men are bathed as methodically as they are fed, and by fire and steam the advances of the humble, but friendly, louse are discouraged. One acquires a certain pity for this most dependent and helpless of all creatures—his means of livelihood are so restricted and he is so unbeloved." He finally concluded with some inspiring sentences on the outlook, the lessons of the past, and the messages of war.

THE *Eugenics Review* for July (vol. ix., No. 2) contains an abstract of an address by Judge Henry Neil on the Mothers' Pension System, of which he is the founder. The State legislature of Illinois eleven years ago inaugurated the system, and at the present time thirty other States have adopted it. Mothers' pensions are maintenance grants made in respect of children under fourteen to a parent who is a "proper guardian"—that is to say, of established good character, but too poor to feed, clothe, and "home" her children adequately. The money is provided by general taxation, and the pensioned mother is put on the county pay-roll and receives her cheque every month. If she prove herself unable to handle the money properly her pension may be revoked, but very few cases of any abuse of this kind occur, and practically about three-fourths of the destitute children in the thirty States in which this pension system has been adopted are now looked after at home. Supervisors, appointed by each State, see that the children are properly cared for, and an immense saving in public money has been effected, the cost per child being about one-third that incurred by institutional care.

DRS. BROWNING, Gulbrausen, and Thornton give a further contribution on the antiseptic properties of flavine and brilliant green, with special reference to their suitability for wound treatment, in the *British Medical Journal* for July 21, p. 70. Flavine compounds and brilliant green are antiseptics which exert a slowly progressive bactericidal action. Concentrations of these substances, which at first inhibit, and finally kill, bacteria, are without harmful effect on the tissues locally or generally. Flavine compounds are enhanced in their bactericidal potency by the presence of serum, while brilliant green, in common with most other antiseptics, is reduced in its activity by serum. Brilliant green satisfies requirements for application by repeated irrigation in aqueous solution (1 : 2000), while with flavine, since it is most potent in the presence of serum, the indication is to arrange the wound dressing so that it may act in a serum medium. Operative measures are an essential preliminary to the effective use of therapeutic antiseptics in wounds, since the antiseptic can act only when brought into intimate contact with the infected tissues.

WHEN Mr. and Mrs. Routledge finished their investigations on Easter Island in 1915, they touched at Pitcairn Island, and there engaged two brothers, direct descendants of the *Bounty* mutineers, Charles Young, aged twenty-eight, and Edwin Young, aged twenty-five, to serve as hands on their yacht *Mana*. On their arrival in England these young men were sent to the Royal College of Surgeons to undergo examination by Prof. A. Keith and Dr. W. Colin Mackenzie. This is the first opportunity enjoyed by European anthropologists of examining members of this interesting community. From their report, published in the August issue of *Man*, it appears from examination of their genealogy that their ancestral composition should be 13/32 parts British and 19/32 parts Tahitian. Prof. Keith sums up the result of the examination as follows:—"I regard the two Pitcairn Islanders as decidedly more Tahitian than European in their physical characteristics. In facial features Charles is European, Edwin is not, yet in actual shape of the head the case is reversed—Charles has the typical Tahitian head, Edwin rather the European; in texture of hair they are Tahitian rather than European. In size of brain they are typical of neither British nor Tahitian, but incline rather to the second than to the first. But there can be no question of physical degeneration; they are both splendidly developed men." They belong to the sixth generation of the descendants of the mutineers—six generations in 127 years.

THE *Museum Journal* published by the University of Pennsylvania (vol. vii., No. 4, December, 1916) contains an account of the University expedition to the Amazon in 1913, under the superintendence of Dr. F. H. Church and Mr. W. C. Farabee. An interesting account is

given of the Macusi and Wapisiana tribes, representatives of the Carib and Arawak linguistic families. The Macusis practise the custom of the couvade, the father, after a child is born, taking to his bed for a month, and eating none but the most delicate foods, the mother meanwhile taking care of him and of the baby. The Wapisiana also practise the couvade, but the period of careful eating for the father extends among them to a year after he leaves his bed. Their marriage system is interesting, because they are required to marry blood relations. A man must marry his cousin from another village and take her home to his own village. He may, and often does, marry two sisters, and he can take a wife outside his family only in case there are no cousins available. They will not eat game shot by a gun or arrow, and their diet is confined to fish and fruit. The rubber traffic and the cruelty of foreigners have been fatal to the natives of this region. There are but two survivors, two sisters, of the once-important Zapara tribe. It is well that a scientific examination of them has been made before they become extinct.

MR. H. U. HALL publishes in the *Museum Journal* of the University of Pennsylvania (vol. viii., No. 1, March, 1917) a well-illustrated paper on a collection of gods of the Yoruba tribe of the hinterland of Lagos, West Southern Nigeria. Before a burial a masked dancer wearing the shroud of the dead man dances before his relations, condoles with them, and discusses matters in which they and the dead man were interested. Offerings made to his mask are supposed to be passed on to the deceased in deathland. To prove that the dead man has gone to heaven, a person representing him is hidden in a room close by, and answers questions regarding the fate of the deceased. This person, known as Egun, seems to have been originally regarded merely as an incarnation of the dead man, but he has now developed into a kind of bogy, whose function it is to carry away persons who have become a nuisance to their neighbours—scolds, busybodies, scandalmongers. In his public character his very touch is fatal, and to threaten an Egun with personal violence, or for a woman to speak disrespectfully of him, is an offence punishable with death.

IN the August number of the *Fortnightly Review* Sir Thomas Holdich discusses the suggestion of a federation of the southern Slavs into one great Jugo-Slav nationality. The federation would include Slovenes, Croats, and Serbians, and extend from the Save basin to the southern borders of Serbia, covering an area of at least 75,000 square miles, and containing a population of more than twelve millions. It would include Serbia, Bosnia and Herzegovina, Croatia, southern Styria, southern Carinthia, possibly part of Carniola, and Slavonia and Syrmia. One of the great difficulties would be the question of Dalmatia and Istria. Despite the nationality of their inhabitants, these two Adriatic lands are geographically more related to Italy than to the Balkan lands. Dalmatia is separated from Bosnia by the natural barrier of the Dinaric Alps, and would scarcely serve as the chief sea outlet for the Jugo-Slav State. That outlet, Sir Thomas Holdich thinks, should be at Salonika. It is interesting to note that the author suggests the river Drave from near its source to the Danube as part of the northern boundary, but he proposes that a new capital should be chosen for Serbia at Nish, less exposed to aggression than Belgrade.

THE first part of a "Bibliography of Fishes," the work of Dr. Bashford Dean and Dr. C. R. Eastman, has just been published by the American Museum of Natural History. It consists of the first instalment (A to K) of a list of titles of papers, arranged under authors' names, and is a large octavo volume of 718 pages. When completed it will include some 40,000 titles. The authors regard the time as opportune for the preparation of a compendious list of papers dealing with fishes, since the group is fairly well known, and there is now increasing difficulty in dealing with the literature in the absence of any special bibliography. Further parts will complete the list of titles by the inclusion of anonymous publications and pre-Linnæan works. Then will follow a summary of general bibliographies in which papers dealing with fishes are listed; an account of works describing voyages and expeditions in which fishes are observed and described; and a list of periodicals relating to fish culture. A subject-index is in course of preparation, and in this part reference will be made to the index of authors' titles. These titles will not be repeated, the papers being identified by the author's name, the year of publication, and a number indicating order of publication should more than one paper have been published by the author during the same year. Fossil as well as recent forms are included. In general the bibliography deals with the morphology, development, physiology, pathology, distribution, and habits of fishes, but works on angling are not as yet considered.

THE fourth part of the Annals of the Durban Museum (vol. i., pp. 291–431) is a list of the sea-fishes recorded from Natal, and is the work of Dr. J. D. F. Gilchrist and Mr. W. W. Thompson. It is purely a systematic list, containing no reference to the local occurrence, or habits, or uses of the species recorded, and its size is due to the inclusion, under each specific name, of the authors who have already described the species and of the publications in which these descriptions have appeared.

MR. HENRY J. HOWARD records the first-known British gathering of the Mycetozoon, *Physarum carneum* (Journ. Roy. Microscop. Soc., 1917, part iii., June, p. 265). It was first found on dead wood on Cheyenne Mountain, Colorado Springs, by Dr. Sturgis in 1908. Previous to Mr. Howard's gathering, only one other European specimen was known, from the grounds of Collegia de Campolide, Lisbon.

MR. H. M. STEVEN, Carnegie research scholar in the University of Edinburgh, has published, in the Transactions of the Royal Scottish Arboricultural Society (vol. xxxi., July, 1917, pp. 131–55), an important paper on the relation of the Chermes group of insects to British forestry. These insects, which were not clearly described until recently, are remarkable for their obscure and complicated life-history. They attack conifers, and do much damage to ordinary plantations of various pines and of common larch, spruce, and silver fir. Mr. Steven gives an elaborate account, with seven figures, of the species known to exist in Britain, which are now assigned to four genera, Chermes (in a restricted sense), Cnaphalodes, Pineus, and Dreyfusia, each with two species. He admits that once a plantation is formed there is no practical method of dealing with these pests; but, as healthy, vigorous trees are scarcely attacked, much may be done in the way of prevention by choice of species clearly suitable to the conditions of the area. Certain exotic species, which are at present relatively immune, may be often chosen, and amongst these are valuable trees, like Japanese larch, Sitka spruce, and Corsican pine. Steven's distinct contribution to preventive measures is based on observations that Chermes insects were often widespread in tree nurseries, and did most serious damage immediately after a plantation had been formed. Fumigation with hydrocyanic acid gas generated from potassium cyanide effectually kills insects on nursery

stock, and young trees thus treated when planted out have a good chance of establishing themselves in their new environment. Subsequent infection, though possible, does little harm.

THE current number of the Science Reports of the Tôhoku Imperial University (second series, Geology, vol. iv., No. 2) contains a useful contribution to our knowledge of the distribution of the genus Gigantopteris by Prof. Yabe, with descriptions of three Asiatic species by K. Koiwai. The genus Gigantopteris was founded by Schenk for some fernlike fronds from the Lui coalfield in south-central China, for which he originally proposed the name Megalopteris in ignorance of its previous use by Dawson. Dr. D. White in 1912 (Proc. U.S. Nat. Mus., vol. xl., p. 493, 1912) recorded the occurrence of a new species of Gigantopteris in Permian beds in Texas and Oklahoma, and brought forward evidence in favour of including Schenk's genus in the Pteridosperms. Prof. Yabe now records the occurrence of Gigantopteris in some new Asiatic localities, and discusses the geological and geographical range of the genus; he recognises four species, White's *G. americana* of Permian age and three from Permian and Triassic strata in Manchuria, Corea, and southern China. The chief interest of the paper lies in the additional data with regard to the distribution of Gigantopteris in space and time. Prof. Yabe also contributes a paper on "Problems concerning the Geotectonics of the Japanese Islands," with critical reviews of various opinions expressed by previous authors. The same publication includes a paper by I. Hayasaka on "A New Hydrozoan Fossil from the Torinosu Limestone (Lower Cretaceous) of Japan," for which he founds the genus Circoporella, thus directing attention to its close alliance with Circopora, a genus instituted by Waagen and Wentzel for a type from the Productus Limestone in the Salt range in India. The figures given by Hayasaka resemble sections of certain calcareous Algæ, but the resemblance may be superficial.

IN the Transactions of the Geological Society of South Africa, vol. xix. (1917), p. 33, Prof. Schwarz records the discovery of diamonds in the Molteno Beds of Molteno, Cape Province, associated with other detrital minerals, such as might arise from the decay of a crystalline schist. He quotes Mr. E. J. Dunn as agreeing with him that important evidence is thus furnished that the South African diamonds are older than the igneous pipes which have brought them in many places to the surface. In the same volume (p. 54) Mr. P. A. Wagner describes from Jagersfontein nodules of ultrabasic character, peridotite and garnet-diopside-eclogite, which contain graphite, and regards them as fragments of deep-seated equivalents of the diamond-bearing kimberlite in which they occur. Mr. Wagner, in the discussion on Prof. Schwarz's paper (Proc. Geol. Soc. South Africa, 1916, p. xli), evidently recognises the divergence of view, and asks for fuller evidence that the detrital splinters are true diamonds. The much-desired section reaching down to an eclogite mass, either traversed by, or merging into, a pipe of kimberlite, is unfortunately not yet revealed in South Africa.

THE cider-apple crop would appear to offer possibilities of a substantial and wholesome addition to our food supplies in these days of stringency. According to recent estimates the average English crop is not less than 200,000 to 250,000 tons, whilst that of France approaches 2½ million tons. Much of the surplus not absorbed by the cider industry has in the past been wasted owing to the difficulty of providing any satisfactory alternative outlet. In some seasons the jam manufacturer has taken considerable quantities of the sharp or acid varieties, but the sweet and bitter-sweet varieties which form the bulk of the crop have hitherto proved quite intractable, the tissues remaining tough and leathery even after prolonged boiling. This defect has been commonly ascribed to the relatively high tannin content of the cider apple, in which case it is difficult to understand the satisfactory results obtained at the jam factory with some of the sharp varieties. From experiments carried out by Prof. B. T. P. Barker at the University of Bristol Horticultural Research Station it seems more probable that the difficulty is associated with the pectins of the fruit. The Bristol experiments, of which a brief account is given in the July issue of the *Journal of the Board of Agriculture*, have shown that the yield of soluble pectins from apples is substantially increased by digestion with weak acid, and that by suitable application of this treatment, using a dilute solution of tartaric acid, the most resistant apples can be reduced to pulp and converted into a palatable jam. Citric acid serves equally well, or, if available, acid fruit or fruit juices can be used with advantage.

IN the current Bulletin (vol. vii., No. 2, for June, 1917) of the Seismological Society of America, there are two studies of recent Californian earthquakes. The Tejon Pass earthquake of October 22, 1916, is described by Prof. J. C. Branner, and the Santa Barbara Channel earthquakes of April 12 and 20, 1917, by Mr. A. C. Mattei. The epicentre of the earlier and more important earthquake (of intensity 7) seems to have been near the summit of the Tejon Pass, which is about sixty miles north-west of Los Angeles; and Prof. Branner supposes that the earthquake was due to a movement along the fault which traverses the pass in the E.S.E. direction. It has been suggested, though on insufficient evidence, that this fault is a continuation of the San Andreas fault along which the San Francisco earthquake of 1906 originated. All three earthquakes here described visited thinly populated districts, and the maps of isoseismal lines which accompany the papers can only be regarded as approximate. In the same number Mr. Otto Klotz gives a brief notice of the late Prince Galitzin, and also a revised determination of the velocity of the L or surface waves. In adopting the value of 230 km. per minute, he considers that more extended data will confine any amendment of this value within one per cent.

THE report on the work of the Imperial Institute just presented to the Executive Council states that, apart from confidential reports to the Admiralty, the Ministry of Munitions, the War Trade Department, and other Government departments, reports were completed on the composition, value, and commercial prospects of raw materials from eighteen countries in the Empire overseas, while the inquiries received and answered related to as many as thirty British countries. A possible new raw material for paper manufacture is indicated by the increasing use of wattle bark by British tanners. Large quantities of the spent bark are likely to be available in the United Kingdom, and investigations conducted at the Imperial Institute show that, though the yield of pulp from the bark is somewhat low, the material is promising for the production of brown paper and the cheaper grades of white or cream papers, such as newspapers. Arrangements are being made at a British paper mill for a large-scale trial of the spent bark. A special monograph dealing with the occurrence and utilisation of zinc ores through the world, with special reference to the British Empire, is in preparation. An inquiry has been received from Zanzibar regarding the disposal of clove stems, which before the war were shipped principally to Germany.

The possibility of distilling oil from them has been discussed with a number of essential oil distillers, and as a result it appears probable that a market may be found for the stems for that purpose.

DR. P. P. PODJAPOLSKY has for some years been investigating the occurrence of chlorophyll in various animals ("On Chlorophyll in Animals and on the Fate of Chlorophyll in the Animal Organism," Moscow, 1916). He finds that a green pigment, giving an absorption band between the lines B and C of the spectrum, can be extracted from the wings and elytra of a number of Orthoptera, and from the skin of some frogs (*Rana esculenta, Hyla arborea*). As the band described coincides exactly with that shown by an extract of a green leaf, such as that of Robinia, he concludes that chlorophyll itself is present in these animals. He suggests that chlorophyll in animals may be produced *de novo* by the animal, or it may be derived from ingested plant material escaping digestion wholly or in part, or it may be the result of symbiosis. He states also that the chlorophyll band between B and C may be observed in spring in the bile of grass-fed herbivorous animals, such as cows and sheep. Dr. Podjapolsky has been able to recognise not only chlorophyll but also bile pigment in a pyridine extract of the contents of the stomach of the mammoth discovered in a glacier at Beriosov, and now preserved at Petrograd. From the position of the animal it would seem to have slipped backwards on the ice, and its violent efforts to recover itself probably caused a regurgitation of bile into the stomach. It is surprising that the author makes no attempt to explain his use of the term chlorophyll, and gives no reference to the work of Willstätter, who has, of course, clearly shown that crude chlorophyll contains four distinct pigments, two green and two yellow.

THE well-known "Index of Spectra" compiled by Dr. Marshall Watts (London: W. Wesley and Son) has been further extended by the recent publication of Appendix X. The principal tables refer to the arc and spark spectra of gadolinium, gallium, germanium, gold, holmium, indium, and copper, and to the spectra of hydrogen and helium. Most of these have been brought well up to date, but the extension of the band spectrum of helium by Fowler, and the important observations of the "proto-helium" lines by Paschen, appear to have been overlooked. In the case of elements having very complex spectra, the tables have been shortened by the exclusion of the fainter lines, and it will still be necessary to refer to original sources when full information is required. Formulæ are given for certain spectral series, and in this connection it may be noted that Dr. Watts continues to use the term "oscillation-frequency" when "wave-number" is meant. References to recent literature are very numerous, and the new appendix will be a valuable aid to those who are engaged in spectroscopic investigations.

MESSRS. MASSON ET CIE (Paris) have in preparation for appearance in their series "Collection Horizon, Précis de Médecine et de Chirurgie de Guerre":—"Plaies de la Plèvre et du Poumon," Prof. R. Grégoire; "Troubles mentaux de guerre," Prof. J. Lépine; "Blessures de la Moelle et de la Queue de cheval," Drs. G. Roussy and J. Lhermitte; "Electrodiagnostic de guerre: Clinique. Conseil de réforme. Technique et interprétation," Prof. A. Zimmern; and new editions of "Hystérie-Pithiatisme et Troubles nerveux d'ordre réflexe en Neurologie de guerre," J. Babinski and J. Froment; "Formes cliniques des Lésions des Nerfs," Mme. Athanassio-Benisty; "Les Blessures de l'abdomen," J. Abadie.

OUR ASTRONOMICAL COLUMN.

THE AUGUST METEORS OF 1917.—Mr. W. F. Denning writes that at Bristol the weather conditions were very favourable for observation on Saturday, August 11. The number of meteors visible to one observer in 4h. 40m. watching, 9h. 10m. and 14h. 10m. Greenwich Mean Time, was 219, of which 195 were Perseids. Mr. Denning was assisted in recording the shower by a friend, Mr. P. O. Wright, who, alternately with the former, counted the meteors as they appeared. A few rather brilliant objects were seen, four being estimated to equal Venus and nine to equal Jupiter, while there were many first magnitudes. The radiant was situated in the usual position at 45°+58°, and the point was well defined. The maximum of the shower occurred between 13h. and 14h. G.M.T., when more than one meteor per minute appeared, though the moon, a little past the last quarter, was shining in the heavens. On the whole the shower was decidedly brighter than the average, both in point of numbers and in the brilliancy of the meteors. It was probably the best Perseid display witnessed at Bristol since 1898. Of the minor showers of the epoch there was comparatively little evidence, but there was a prominent shower of Cygnids from about 292°+50°. The meteors were bright, and at the ends of their flights burst with flashes of bluish-white light. This shower was also well observed contemporary with the Perseids in August, 1893.

NEW ELEMENTS OF MARS.—An investigation of the discordance between the positions of Mars deduced from observations and those computed from Newcomb's tables has been made by Dr. F. E. Ross, and published by the Nautical Almanac Office, U.S. Naval Observatory (Astron. Papers, vol. ix., part ii.). The following new elements of the orbit of the planet are given:—

Fundamental epoch, 1900 Jan. 0, Greenwich Mean Noon. T, time from this epoch in Julian centuries.

Mean Longitude:—

$$l = 293^\circ\ 44'\ 51{\cdot}46'' + (53 \text{ rev.} + 222117{\cdot}33'')T + 1{\cdot}1184''T^2.$$

Longitude of Perihelion:—

$$\pi = 334^\circ\ 13'\ 5{\cdot}53'' + 6626{\cdot}73''T + 0{\cdot}4675''T^2 - 0{\cdot}0043''T^3.$$

Eccentricity:—

$$e = 19247{\cdot}168'' + 18{\cdot}9895''T - 0{\cdot}0158''T^2.$$
$$= 0{\cdot}09331290 + 0{\cdot}000092064T - 0{\cdot}000000077T^2.$$

Longitude of Node:—

$$\theta = 48^\circ\ 47'\ 11{\cdot}19'' + 2775{\cdot}57''T - 0{\cdot}005''T^2 - 0{\cdot}0192''T^3.$$

Inclination to Ecliptic:—

$$i = 1^\circ\ 51'\ 1{\cdot}20'' - 2{\cdot}430''T + 0{\cdot}0454''T^2.$$

Logarithm of Mean Distance:—

$$\log a = 0{\cdot}182897034.$$

Theory and observation, which were discordant to the amount of six seconds of arc in R.A. in 1905 and 1907, are brought into more satisfactory agreement by these elements. Tables for correcting the heliocentric positions are given.

ELEMENTS OF SUN'S ROTATION.—A new determination of the direction of the sun's axis has been made by Th. Epstein (*Astronomische Nachrichten*, 4892). It is based upon observations of fifty-eight spots in various latitudes, made in the years 1903 to 1910. The value obtained for the longitude of the ascending node of the equator is 73° 59·2′, and for the inclination of the axis to the ecliptic 82° 43·7′. These are in very close agreement with Carrington's values, and there is evidently no sufficient reason to modify the existing tables for physical observations of the sun.

THE BRITISH SYNTHETIC COLOUR INDUSTRY IN WAR TIME.

THE lecture delivered to the Society of Arts by Mr. C. M. Whitaker in December last merits a more than passing notice as illustrating the difficulties in the way of British dye producers during the war period and the manner in which a commendable degree of success has been obtained in coping with the dye shortage. It deserves to be more generally known that even before the war British firms were already opposing a resolute front to German competition. These firms not only issued pattern-cards and circulars comparable in style with those sent out by their foreign rivals, but they also dealt with the difficulty of language by printing these manuals of instruction in the principal European tongues. Even in 1906 these instructions had been furnished by the pioneer firm of Read Holliday and Sons, Ltd., in all these languages, and also in Japanese. Very early in the development of the colour industry this firm had acquired the Schutzenberger and Lalande patent for dyeing indigo by the modern scientific process with hydrosulphite, and even to-day the older dyers sometimes refer to this method of indigo dyeing as the "Holliday" vat.

The lecturer pointed out from his own personal knowledge that the practice of sending out practical dyers to assist the firm's *clientèle* of dye-users in their application of the colouring matters is not exclusively a German procedure. The above-mentioned firm and its successors, British Dyes, Ltd., have afforded their customers this expert assistance for more than thirty years.

At the outbreak of war the British dye industry was in the hands of four or five firms, who together controlled a capital not greatly exceeding half a million sterling, and the problem confronting this group of industrialists was how to replace the former German import of dyes having an annual value of about 1,800,000*l*. Even in peace times such a problem would be incapable of immediate solution, but taking into account the distractions of war, the results obtained in the last two years are distinctly encouraging. The vulnerable point in the British position was not, however, that of lack of capital, but rather the bad habit which had arisen of buying from abroad intermediate products which could with comparatively little expert knowledge be converted into finished dyes. An additional handicap arising from this cause was the shortage of chemists having the necessary works experience. Attention is being concentrated on these two vital points. The two leading firms, British Dyes, Ltd., and Messrs. Levinstein, Ltd., have taken into their employment a large number of college-trained chemists, some of whom are exercising their talent for research on the essential intermediates, while others are acquiring works experience in the supervision of industrial processes and in the handling of men.

It is impossible for those untrained in organic chemistry to have any correct perception of the amount of preliminary work which precedes the production of a coal-tar dye. The complete manufacture of an ordinary synthetic black may involve twenty-one distinct chemical operations. Other modern products require even more processes. The British dye firms certainly deserve full credit for their success in coping with the vitally urgent requirements of the Allied Governments in equipment colours. One British firm alone furnished the military authorities with 145,000 lb. of wool khaki dyes in the fateful month of December, 1915, when Army requirements were increasing to an enormous extent. This supply of wool khaki dyes has been maintained, together with prodigious amounts of cotton and linen khaki colours. The armies of our Italian and Russian Allies have also been largely supplied from British sources. The appearance of the uniforms of soldiers returning on leave is the best testimonial to the fastness of British-made khaki dyes, showing that these colours can withstand the severest war conditions.

In the valuable discussion which followed the lecture the points of interest raised were the question of the multiplicity of names for the same dye and the possibility of simplification in this respect, the German monopoly of bromine, and the relations of the dye-producing industry and teaching institutions.

G. T. MORGAN.

THE ROTATION OF THE MOON.[1]

AN interesting *résumé* of the progress of our knowledge of the moon's rotation, together with a considerable amount of original work, is given in the memoir before us. The author recalls the remarkable control which the earth exerts on the rotation; the line joining the poles of the moon's equator and orbit always passes through the pole of the ecliptic, which lies between them, $1\frac{1}{2}^\circ$ from the first, $5\frac{1}{4}^\circ$ from the second; both poles revolve round the pole of the ecliptic in 18·6 years. The earth's action has also forced the period of rotation to coincide with that of revolution; the existence of this action is still in evidence from the fact that all secular and long-period terms in the moon's revolution have their counterpart in the rotation; for example, the secular acceleration in longitude has not the effect of making us gradually see a different hemisphere.

Much attention has been given of late years to the "physical libration," especially the annual term, which is considerably the largest. Different determinations of its coefficient show a surprisingly large range; the largest value is that of M. Puiseux, 19·1″, derived from forty Paris photographs covering a period of fifteen years; the other values range from 5·7″ to 1·0″. We have to divide these figures by 220 to obtain the apparent shift seen from the earth. This gives 5·2″ for the Puiseux value; it does not appear that the numerous meridian observations of the crater Mösting A will permit of so large a value.

In studying the problem mathematically, the author makes use of some methods introduced by MM. Zinner and Charlier, which have appeared in earlier *Meddelanden*. He denotes the three principal moments of inertia of the moon by A, B, C. A is about the diameter pointing towards the earth, and C about the axis of rotation. The three ratios $(C-A)/A$, $(C-B)/B$, $(B-A)/A$, are denoted by k_1, k_2, k_3. It is shown that stability demands that B be greater than A, *i.e.* the moon's equator is elongated towards the earth; if k_1, k_2 have different signs, C lies between A and B, and the rotation is unstable. It is shown that k_1, k_2 may be either both positive or both negative; in the first case C, B, A are in descending order of magnitude, in the second case B, A, C; the latter would involve rotation about the longest axis, which is interesting as a theoretical possibility, but it is shown later not to be the actual case. Hence k_1, k_2 are both positive. k_1 is stated to be about 0·000627; the values of k_3 corresponding with the physical libration coefficients of Franz, Hayn, and Puiseux are 0·000314, 0·000157, and 0·001178 respectively. The last value makes k_2 negative, and therefore indicates unstable motion, another reason for concluding that the Puiseux coefficient is too high. However, it is shown that controlled rotation may exist, even when the conditions of stability are not satisfied.

[1] "Uber die Rotation des Mondes." Von Axel Jönsson. *Meddelanden* of Lund Observatory, ser. ii., No. 15. (Lund: C. W. K. Gleerup, 1917.)

The suggestion has been made that the moon may not be a perfectly rigid body, but may have sensible change of shape under the varying strains; also that the interior may be partly fluid; the final chapter of the memoir discusses the changes in the equations of motion to which these hypotheses give rise, but does not express any opinion as to their tenability. The preceding chapter gives the numerical calculation of a large number of coefficients, using Brown's expressions for the moon's co-ordinates, and different assumptions for the values of k_1, k_2, k_3.

A. C. D. C.

ADAPTATION AND DISEASE.[1]

THE time has come to bring before biologists in general the contributions of medical research of the last quarter of a century to the study of evolution. The fact of evolution all thinking minds accept, but as to how evolution has been, and is being, brought about is a very different matter. The fight truly centres upon the cause or causes of variation—whether the tendency to vary is something inherent in living matter, numerous variations presenting themselves through this inherent tendency, of which those that are best fitted for their environment alone survive, or whether it is primarily and essentially brought about by forces acting from without upon a relatively labile living matter: whether, that is, variation is inherent, proceeding from within, or acquired, proceeding from without.

But this basal problem has been largely neglected by the biologists, the fight all these years waging round the secondary problem of the transmission of acquired properties to the offspring. Herbert Spencer made this transmission of acquirements one of his "principles." Weismann violently[2] opposed the doctrine, carrying with him latter-day biologists, until Mr. Bateson, replete with his studies upon Mendelism, reaches the antipodal suggestion that when a new property manifests itself in any individual of any species, it is impossible to regard it as an acquirement: it is not new, but its manifestation is due to loss of properties already possessed. Evolution, like a squid, progresses backwards, what appears to be a new property is on the contrary primeval. Prof. Bateson's address on Heredity at the International Medical Congress in London in 1913, and his Presidential address at Melbourne in 1914, were quoted *in extenso*. That which to outward seeming is the simplest form of life is verily in constitution the most marvellously complex: the higher forms of life are the lower.

The truth seemed to be that valuable and fascinating as are the studies for the establishment and amplification of Mendel's law, that law deals only with the interplay of allelomorphs, with the combinations and permutations of positive and negative unit properties possessed by the species. It only establishes the extent of variation possible *within the boundaries of the species*. But no amount of interplay of properties already possessed by the species will result in the production of individuals which are outside the species.

Sir Ray Lankester recently laid down that the one fallacy in all Lamarckian doctrine was that adopted by Herbert Spencer, namely, what he termed "direct adaptation." There is really no such thing. The supposed mysterious property of direct adaptation is always due to survival by selection of organisms which varied in many directions.

[1] Abstracts of four Croonian Lectures delivered at the Royal College of Physicians on June 14, 19, 21, and 26, by Prof. J. G. Adami, F.R.S., Temporary Lieut.-Colonel C A.M.C.

[2] Sir E. Ray Lankester has in the *British Medical Journal* taken exception to the use of this word; the author agrees that "vigorously" better expresses his meaning.

Now if there be one fact that is constantly being impressed upon the student of immunity and the workers in pathogenic bacteriology, it is that direct adaptation, *i.e.*, specific modification in response to specific alteration in environment (within limits which he would lay down) is one of the basal phenomena of living matter. It seems useful, therefore, to marshal in order the data bearing upon these matters as they present themselves to those engaged in medical research.

Problems of this nature are *a priori* most likely to be solved by experiments upon the very simplest, and again upon the most complex forms of life. For problems of adaptation and heredity the bacteria possess the supreme advantages of rapid reproduction coupled (according to our present knowledge, or want of knowledge) with a complete absence of the disturbing influence of sex and conjugation. Certain biologists are unwilling to regard the products of asexual binary division as true generations. One very distinguished biologist had said that a long cultivation of a bacterial growth is "one continuous individual." This is an impossible position. The very idea of individual connotes independent, or potentially independent, existence. We might with equal logic, basing ourselves on the continuity of the germplasm, declare that all living beings constitute one continuous individual.

Adaptation in the Bacteria and the Evolution of the Infectious Diseases.

It is absurd to expand the Batesonian hypothesis and imagine that whenever man became man he acquired the germs of all bodily ills, and that the purely human ailments were already there. Some diseases, like tuberculosis, have been with us from the remotest historical times, and even from prehistorical, as witness the late Sir Armaud Ruffer's studies in palæopathology upon mummies of early dynasties, and the recognition of caries and pyorrhœa in permian fishes and tertiary three-toed horses. This is only to be expected. The bacteria are among the earliest of all forms of life. Drew, from his studies of the calcareous ooze of the Florida lagoons, showed that a dentrifying bacillus caused the deposition of chalk out of sea-water. Walcott has discovered Cyanophyceæ and possible micrococci in the oldest of all sedimentary rocks, the Algonkian.

But this does not mean that all orders of pathogenic bacteria and microbes have always been with us. Zymotic phenomena must run parallel with geological. The vast majority of fossils are remains of species and genera which have passed away, but certain species, and, indeed, certain genera, have existed unchanged through countless ages to the present day. The brachiopod Lingula of the Cambrian rocks is to be found to-day living buried in the sand between the tide-marks in the Tropics. The pearly Nautilus, Limulus, Ceratodus, and Anaspides have remained apparently unaltered for extraordinarily long periods of geological time.

The same would seem to be true with respect to zymotic diseases and their causative agents. Many of the plagues and epidemics mentioned by early writers are unrecognisable to-day. The tritest example of a disease which has come and gone is the malignant "sweating sickness," which, first noted in 1485, was last heard of in 1551. As regards diseases still with us, whatever view be taken regarding the origin of syphilis, it is certain that this was unknown in Egypt and in Rome at the time of Galen. Diphtheria and cholera, both with absolutely characteristic symptoms, were unknown in Europe until the beginning of the nineteenth century. Even if these

two diseases had been locally endemic for long periods in some districts, we may come to the same conclusion as is reached in many cases of the geographical distribution of animals and plants. When a form introduced into a continental area rapidly spreads over that area, its previous absence is to be explained as due to the fact that the form in question originated at some period after the separation of the different continental areas. In this very war two new diseases, hitherto unknown, have made their appearance—trench fever and trench shin.

How, then, can we picture to ourselves the evolution of an infectious disease? In the first place, it is to be noted that pathogenic microbes are singularly diverse in their affiliations—there is scarcely a genus of micro-organism but has its representative or representatives among the pathogenic organisms—moulds, yeasts, fission-fungi, spirochætes, filterable viruses and chlamydozoa, amœbæ, flagellate and ciliate protozoa. *Every pathogenic microbe has closely related species differing from it in little beyond that the one is virulent, the other not.*

Next, the allied species are found suggestively growing in the cavities or on the surfaces of the body in the same habitat as the virulent forms, or, again, in the water and foodstuffs taken by the animal. This leads to the conclusion that pathogenic microbes at some period or periods have originated from forms saprophytic on the body surfaces, or in the foodstuffs, that they have originated by adaptation of these forms to growth, not on, but within, the tissues.

We possess abundant examples of experimental adaptation of bacteria to new foodstuffs, to foreign sugars, glucosides, fats, etc., from Pasteur onwards. The observations of Penfold, Twort, Massini, and others upon the accustomance of bacteria to new sugars and their acquirement of the power of fermenting the same may be mentioned. The bacilli taking on these new powers were not mutants, the outcome of chance variation, but the acquired new property was definitely the result of a particular environment. Major F. B. Bowman has prepared a simple experiment which demonstrates that not some, but all, the members of a culture of bacilli, subjected to the same environment in a fluid medium of growth containing a foreign glucoside—isodulcite—acquire the new property.

Here, then, contrary to Bateson, we have evidence of positive acquirements from without, and, contrary to the Lankesterian dogma, we can so arrange our experiment as to obtain, not evidence of variation in many directions, but evidence that organisms placed in a given environment all vary in one identical direction with clockwork regularity.

If this be true regarding other properties, it must be true regarding the acquirement of virulence. As a matter of fact, Thiele and Embleton, at University College, had experimentally taken a harmless saprophytic form, the *B. mycoides*, accustomed it gradually to grow at the temperature of the body, and then, employing the dead bacilli to induce anaphylaxis and increased susceptibility, had, upon making a second injection, succeeded in obtaining the active growth of the bacilli in the tissues of the guinea-pig—and with this found that the bacillus was now virulent, killing other animals when injected into them. With these examples for consideration, is it possible for medical men not to believe in direct adaptation?

The Adaptation to Disease-producing Agencies in the Higher Animals.

It is in respect to these new acquirements in the higher animals that we obtain the deepest insight into the processes involved, and that through the abundant, not to say overwhelming, studies of the last thirty years upon immunity. Yet although every man and woman of the day discusses familiarly matters such as typhoid inoculation, diphtheria antitoxin, and tuberculin, not a single general biologist has dwelt seriously upon the significance of these studies. *Immunisation is direct adaptation.* Take the familiar examples (to medical men) of immunisation to the phytotoxins, abrin, the active principle of the jequirity bean, and ricin, of the castor oil plant. The rabbit and guinea-pig have never come across these in nature. They are, in fact, intensely poisonous. One gram of ricin is adequate to kill 1,500,000 guinea-pigs. Feed these small animals with minute and progressively increasing doses, and eventually they can be given 100 times the fatal dose. And now I c.c. of the blood serum of the immunised animal will destroy ten, one hundred, or one thousand times the fatal dose, according to the grade of immunity induced. Clearly, the blood serum now contains antitoxic substances, bodies which combine with the toxin, rendering it inert and harmless. The antitoxin has been elaborated and excreted into the blood by certain cells of the animal, and once these cells have acquired the property of elaborating an antiricin, they continue to produce it for weeks and months. Here is the acquirement of a new property—the acquirement is something positive, something added; there can be no alternative hypothesis of loss of inhibitory factors. Nor is it a chance variation: the power can be produced in any mouse or rabbit or guinea-pig with absolute certainty. Nor is it a matter of the survival of the fittest. The case of diphtheria and tetanus toxins, and the production of antitoxins against these toxins is absolutely parallel. The tissues can be educated to elaborate, and elaborate in excess, a body substance which neutralises the toxin, and, once started, they continue for weeks and months to elaborate the antitoxin. It has been shown that it is the cells that take up and fix the toxins which elaborate the antitoxins. It is, however, only a minority of the pathogenic bacteria that form and excrete ectotoxins, poisons which are discharged into the fluid of growth; the majority do not excrete toxic substance. Nevertheless the body can be immunised against these also, though here the immunity is of a different order. It is bacteriolytic—a process of digestion. The fluids of the body gain the power of dissolving and digesting these bacteria That power has been acquired by the millions of soldiers subjected to anti-typhoid inoculations.

This fact of the acquirement of a power on the part of the body fluids to digest the bacteria can easily be demonstrated. Every student of medicine has heard of Pfeiffer's reaction, in which the peritoneal fluid of a guinea-pig given progressive injections of the typhoid bacillus or the cholera spirillum, instead of forming a favourable culture medium for these bacteria now causes a rapid swelling up and dissolution, so that they melt away like sugar in water. Clearly, in the process of immunisation certain tissues of the body have gained the property of elaborating ferments which digest and dissolve the bacterial bodies, so that now, with little or no general reaction, the animal withstands many times the fatal dose of these pathogenic organisms. And this reaction is in general narrowly specific, so that it is employed to distinguish, for example, between closely related species of spirilla.

Nor is this necessarily merely a temporary acquirement on the part of the individual. For months after a man has been given one or two doses of dead typhoid bacilli his blood serum has a different physical constitution, or, as we are accustomed to term it, contains specific "anti-bodies"—agglutinins. The whole British Army now agglutinates the specific

bacilli of typhoid, paratyphoid A and paratyphoid B, and that for a year or more after inoculation of the soldiers. Smallpox, naturally acquired, usually confers a lifelong immunity. We here observe the working of a law which, if recognised, has not been dealt with adequately by biologists. In 1896 Wiegert, the Frankfort pathologist, laid down the law of inertia—the law that once a cell is stimulated to perform a certain act, it continues to perform that act for some time after the stimulus has ceased to be in operation. Here is something beyond mere inertia; the functional activity once started, at least in the order of events under consideration, continues too long to be comparable with physical momentum; rather there appears to be the setting in motion of a cyclic process of intercellular reactions and counter-reactions, the one starting the other. It is preferable, therefore, to employ a non-committal term, and to speak of the "law of habit." Of this law numerous examples may be given, both from among the bacteria and morbid states in man.

Next, to advance further, evidence obtained from medical research shows that acquirements, whether of defect or excess, are capable of being passed on to the next generation. There is abundant evidence of this in the case of the bacteria, and here the longer the environment has acted on a given species of microbe, the longer the microbe retains the impressed property, but as he could not state dogmatically that there is any biochemical property that is specifically fixed in these lower forms, still less could he regard any acquirement as being permanently fixed.

With regard to higher animals, difficulties are introduced by intra-uterine existence, so that the only clear cases to be considered are those in which the male parent alone has been subjected to the noxious or other influence. If the lymph contains soluble toxic substances, it is evident that the germ cells are not precluded from absorbing them, and, like the other tissue cells, from being influenced by them. There are many examples, clinical and experimental, of the effects upon the male germ cells of lead, nitrate of mercury, tuberculin, abrin, etc. The most conclusive observations are those of Prof. Stockard, of Cornell Medical College, New York, in which, by subjecting male guinea-pigs for some little period to the fumes of alcohol, he found not merely that the offspring were stunted and enfeebled, but that by crossing unrelated offspring of alcoholised fathers, which themselves had not been subjected to alcohol, the progeny of the third generation showed more extreme conditions of defect than did their parents. The importance of these observations upon the understanding of human family histories and inherited neuroses, etc., was very great.

The preceding are cases of what has been termed parallel induction. So long ago as 1901 the lecturer pointed out how what we now term the endocrine organs—the organs, that is, of internal secretion—are closely associated with the generative organs, and that influences from without acting upon these organs by causing an excess or defect of their internal secretions, are capable of affecting the germ cells, so that there is a definite possibility that the same order of disturbance which affects one or other endocrine organ of the parent may present itself in the offspring. Prof. E. W. MacBride has recently expressed the same opinion, and there is to be seen in this possibility or probability the solution of a long-standing difficulty, namely, the admission that there is one possible group of cases for which the Lamarckian theory holds true, and this, oddly enough, along the lines of Darwin's discarded hypothesis of pangenesis; only it is not by specific corpuscular pangens, but by diffused secretions that the germ cells are influenced.

The Physico-Chemical Basis of Immunity and Evolution.

It had been shown that the studies upon pathogenic bacteria and upon immunity prove conclusively the existence of direct adaptation of a definite order, both in the lowest and in the highest forms of life. It is along these lines that medical research is surely leading us.

Believing that workers in medicine are in the right, where is it that the other biologists have gone wrong? The latter, from the morphological trend of their studies, have perforce conjured up separate individual particles or structures, each the bearer of an individual property or group of properties. Their conceptions have perforce been in the terms of specific atomies. In his pangenesis hypothesis Charles Darwin evolved such a conception, and in his great sanity cast it aside. Weismann rioted in such, with his ids, idants, and determinants, all figments of the imagination. The same tendency is shown and carried forward in full vigour by the modern Mendelians.

Suppose we start, instead, from known facts and known phenomena, and upon these endeavour to build up our idea of the nature of the germ cell and of the organic basis of heredity. First, as to the constitution of living matter. We know that whatever form of life we investigate, animal or plant, mammoth or microbe, whatever form we analyse, or whatever tissue—leaving out of account water and certain vehicular salts to which no specific vital functions can be attributed—just one order of highly complex compounds is common to and to be isolated from all, and these are the proteins. This universal presence in itself indicates that they are intimately associated with vital functions. When isolated chemically they are inert; in other words, living matter contains proteidogenous, rather than proteid substances. Much attention has to be given to the study of the chemistry of the proteins in relationship to metabolism: the huge size of the protein molecule, close to the limits of visibility under the highest power of the microscope; its great molecular weight; the impossibility of gaining identical analyses of two samples of the same protein, even if, like hæmoglobin, crystallisable; the structure of these molecules; their dissociation into smaller complexes, the peptones; their further dissociation into amino-acids; the synthesis of the polypeptids. The protein molecules may, therefore, be represented as a ring or chain of linked peptone molecules, each having its ring of glycocoll nuclei with swinging side-chains. In the much simpler bodies with which the organic chemist is in the main concerned, bodies like the carbohydrates or the benzol derivatives, we know how the transfer of a given radicle from the *alpha* to the *delta* position, for example, upon a ring may bring about a profound change in the chemical and physical properties of the compound. When two carbon atoms are united together there are, or may be, six free affinities, and when these are satisfied by six different monovalent groups, twelve different isomeric arrangements are possible. What must be the possibilities in a protein like hæmoglobin, with 700 and more carbon atoms in the complex, and hæmoglobin is simple compared with the nucleoproteins.

If the biophores, or molecules of living matter, be at least proteidogenous, obviously it is not necessary to demand a separate determinant, a separate molecule for each specific property; it is simpler to regard properties inherent in the biophores as an expression of the constitution of the same, of the mode of linkage of the various nuclei, their number, and the nature of their side-chains. This conception is within the bounds of physical possibility; Weismann's ids and idants certainly are not.

Accepting this conception of the chemical constitution of the essential living matter as a working hypothesis, we know that in conjugation the one constituent of the germ cells contributed in an approximately equal portion by both parents to the zygote, or fertilised ovum, is the nuclear chromatin, and as heritage of properties may come equally from either parent, in the nuclear chromatin must reside the main heritable and character determining material. The conclusion is inevitable that the essential biophoric molecules are conveyed in the nuclear chromatin. The cell-wall, the cytoplasm, and the nuclear membrane are all conservative agents, tending to preserve the biophores from sudden change from without, but, while conservative, this system is exposed to constant change, particularly in the more active tissue cells. The system is not inert, but is constantly reacting with the external medium in which the cell finds itself. The semi-permeable cell membrane, while preventing the entrance of some substance, freely permits the entrance of others, whether directly or after a preliminary dissociation into smaller molecules by the action of extracellular enzymes. Once foodstuffs are taken into the cytoplasm they are, if necessary, broken down into yet simpler molecules by intracellular enzyme action. Foodstuffs are not utilised by the cell as such, but only after dissociation and disintegration, and then either by oxidation to supply energy or, on the other hand, to be built up in growth.

This matter of growth is wholly neglected by the other biologists. They speak of inorganic bodies (crystals) growing by agglutination, organic bodies by intussusception. "Intussusception," "imbibition," "intercalation," and "interpenetration," are all inane terms; they cannot possibly explain how two molecules of living matter appear where there was but one before, two grains of wheat where but one was put into the ground. Growth is one of the great underlying phenomena of living matter, and zoologists and botanists have in a simple Topsy-like manner been satisfied that the phenomena occurs—and have left it at that. Increase in the amount of living matter means multiplication of the molecules of living matter, and this multiplication can only take place after the manner of the growth of a crystal, by ions arranging themselves into radicles, and radicles arranging themselves in a particular order, until in orderly sequence the necessary radicles become built up, identical in arrangement with the pre-existing molecule, in association with which the group has become developed. This conception is materially aided by the recognition that crystallisation does not of necessity demand the production of rigid rectilinear figures. Lehmann in 1904 first directed attention to the existence of "fluid crystals"; in 1906 Adami and Aschoff pointed out that these fluid crystals are frequent in the animal organism. As D'Arcy Thompson remarks, "the phenomenon of liquid crystallisation does not destroy the distinction between crystalline and colloid forms, but gives added unity and continuity to the whole series of phenomena."

Weismann's doctrine of the continuity of the germplasm is erroneous; it is not the germplasm which is eternal; merely there is a potential continuity of molecular arrangement and constitution. The functional and vegetative activities of the organism and the cell, along with the essential nature of metabolism and enzyme action, emphasise that these matters of adaptation and evolution have to be approached from the aspect of function and the dynamics of living matter, rather than from the point of view of cell statics. "Function precedes structure," and the study of cell function must afford the key.

As regards the acquirement of the new power of digesting and utilising a foreign protein, it is seen from what has been said that these proteins are complexes of amino-acids; and the number of the individual amino-acids is limited. Proteolytic enzymes, already in existence, whether intra- or extra-cellular, do not attack the foreign protein as a whole, but must be regarded as dissociating certain everyday amino-acids from the complex. But doing this, to take the simplest case, the relative number of molecules of the different amino-acids presented to the cell may come to differ from the normal, or, again, the simpler complexes due to the breaking down of the foreign proteins may not be identical in constitution with those which the cell and its biophores had been accustomed to utilise in growth. In either case the constitution of the biophores may become altered as they are built up. Where enzyme-like bodies, such as the toxins and phytotoxins, become introduced into the cytoplasm, their toxic function must be regarded as due to their power of dissociating the living molecules, by detaching certain radicles. If the toxic molecules be not present in too great a number, time is given for the living molecules to attract and build up again the lost radicles, and by the law of habit, if this process be constantly repeated, particular radicles are now to be built up in excess of the needs of the cell, and, undergoing discharge, become the antitoxin bodies of the blood and body fluids.

That this conception of the mechanism of immunity and progressive adaptation is substantially correct was strongly supported by the long-continued and admirable studies of Prof. V. C. Vaughan, of the University of Michigan, and the later work of Abderhalden, of Berlin, and his pupils.

The prevalent conception of the Mendelians that the parental properties remain segregated in the germ cells is open to attack. In the zygote, the fertilised germ cell, and in all the tissue cells derived therefrom, it is inconceivable that two orders of biophores, or active living molecules, can exist floating in a common nuclear sap, undergoing growth, building up side-chains and radicles, discharging certain of these, or undergoing dissociation from time to time, without the two reacting upon each other, and without a certain amount of interchange, without the one having a greater affinity for side-chains elaborated by the other and building these into its system. There must be this interaction, and at a slower rate, due to their more latent state, this same interchange must take place in the germ cells. Along these lines it is still possible to interpret the facts of Mendelism, and, indeed, interpret not a few phenomena which by the hypothesis of determinants fail to obtain explanation.

Briefly, each species must be regarded as having for its essential living matter a distinct organic compound, a compound as distinct as any inorganic salt, but differing from that simpler salt in that whereas the central ring, or chain, is to be regarded as having a relatively fixed constitution, the radicles composing that ring or chain are to be regarded as capable of attracting and then reproducing a series of side-chains which may vary in constitution, so that within the species there may be various strains, just as we may speak of various strains of crystalline hæmoglobin obtained from different samples of human blood.

It is possible to replace an impossible hypothesis based upon supposititious independent and transposable determinants by one based upon our present knowledge of the composition and properties of the main and outstanding constituent of living matter—the proteins. To one who regards life, not from the morphological point of view, in terms of form, but from the physiological, in terms of function, who regards life as a moving equilibrium, who regards it as in essence

"a state of persistent and incomplete recurrent satisfaction and dissatisfaction of certain proteidogenous molecules," and metabolism as the primary and basal characteristic of living matter, for such a one Prof. Bateson's stumbling-block does not exist.

The hypothesis of a backward evolution by the progressive removal of inhibitory factors, like the baseless fabric of a vision, fades into nothingness once it is confronted by the proof that direct positive acquirements can be brought about experimentally. It enters into the limbo of the past as an example of the Spencerian tragedy—that of a deduction destroyed by a fact.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—M. L. de la Vallée Poussin, professor in the University of Ghent, is to act temporarily as lecturer in Sanskrit and Tibetan at the School of Oriental Studies.

THE Gladstone memorial prize of the London School of Economics and Political Science has been awarded to Miss Olive Wright.

SIR W. WATSON CHEYNE, Bart., has been elected Parliamentary representative of the Universities of Edinburgh and St. Andrews.

MR. ARTHUR T. BOLTON has been appointed curator of Sir John Soane's Museum, Lincoln's Inn Fields, in succession to the late Mr. W. L. Spiers.

MAJOR F. C. PURSER has been elected to the chair of the Theory and Practice of Physic in the Schools of Surgery of the Royal College of Surgeons in Ireland.

DR. A. W. ASHTON has been appointed principal of the mechanical and electrical engineering department of the Stoke-on-Trent Central School of Science and Technology.

DR. W. H. WELCH has resigned his position as head of the department of pathology at Johns Hopkins University to take up the directorship of the School of Hygiene and Public Health. Dr. W. G. McCallum, of Columbia University, succeeds him at Johns Hopkins University.

APPLICATIONS are invited for a limited number of places in the Pilcher Research Laboratory attached to Bedford College for Women, Regent's Park, N.W.1. Places are available for post-graduate work in science or in arts, preference being given to research in science, and, at the present time, to any investigation connected with the war. Applicants must state their qualifications, the nature of the research, and the period for which application is made. Further information may be obtained from the principal of the college.

MANY letters have been received by the chairman of the British Prisoners of War Book Scheme (Educational) testifying to the usefulness of the scheme. Further contributions are urgently needed. In the technical and scientific sections the prisoners' demand for books is very large, but the works asked for are rarely obtainable as gifts, as the owners generally need them for their own use, while second-hand copies, sufficiently up to date, are proving increasingly difficult to procure. In these circumstances the committee is compelled to make large purchases of new copies of up-to-date books of the above character, and, for this, ample funds are essential. Donors to the scheme will recognise that their gifts do not merely help to save the prisoners from mental starvation, but also increase their value as a commercial and professional asset after the war. Offers of books (which should always be accompanied by a detailed list) are also invited and should be addressed to Mr. A. T. Davies, C.B., "Prisoners of War," Board of Education, Victoria and Albert Museum, South Kensington, S.W.7.

SPEAKING last week at the Oxford summer meeting of university extension and other students, Prof. W. H. Perkin said that certain industries, which at one time appeared to be firmly established in this country, had left them to flourish abroad, and inquiry into the reason for this resulted in the conclusion that the cause of our failure had been our neglect of scientific methods and lack of appreciation of the value of research. At the commencement of the war Germany had, roughly, ten times as many advanced students engaged in research work as there were in this country. It must be clear to everyone that we could not hope to compete with Germany while such a state of things existed, and it was entirely due to our lack of appreciation of the importance of research that so many of our industries had already gone to Germany and so many were in process of being transferred when the war broke out. But in tackling and solving difficult manufacturing operations it was not too much to claim that the scientific men in our universities had shown how valuable they could be to the manufacturers, whether it be in connection with munitions of war or in the development of purely industrial operations. There could be no doubt that the war had already brought about this welcome change—that a much closer association between the manufacturer and the scientific worker was growing up, such, indeed, as had not previously existed in this country. There were, of course, not a few who were afraid that the introduction of work of industrial importance into our universities, and especially into such universities as those of Oxford and Cambridge, would have a bad effect on these institutions. They feared that the lofty academic spirit which had always pervaded our older universities would suffer from contact with the realities of commercial life, and while he could understand the suspicion which was always associated with any radical change in old-established traditions, he failed entirely to see why the introduction into the students' career of some of the conditions of the life which so many must ultimately adopt should be in any way prejudicial. He was certain that purely academic work and industrial research could go along side by side to their great mutual advantage.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 23.—M. Paul Appell in the chair.—Ch. **Lallemand**: Remarks on the extension to the sea of hourly time zones. The extension to the sea of the system of hourly zones in use on land, suggested in January last by J. Renaud, has been adopted by France for warships and mobilised vessels, and the Service Hydrographique de la Marine has published a planisphere of the hour zones. In Great Britain a committee appointed by the Admiralty has unanimously recommended the adoption of the same rules for British ships.—E. **Haug**: The extension towards the west of the strata of Basse-Provence.—M. **Leau**: The measurement of linear ensembles.—M. **Tournier**: The experimental determination of the efficiency of marine engines and boilers.—V. **Valcovici**: The position of the point of arrest in movement of uniform rotation.—J. C. **Solá**: A new stream of stars in Sagittarius.—A. **Guébhard**: A new manner of regarding volcanic action and the pseudo-eruptive ap-

pearances of granite.—M. **Dalloni**: The facies of the Lower Miocene to the south of Tell and the fauna of the Cartennian of Uzès-le-Duc, Algeria.—(The late) A. **Cochain**: Considerations on volcanic action.—C. **Sauvageau**: The proper motion of the chromatophores.—M. **Molliard**: The artificial production of a gall.—V. **Galippe**: Normal parasitism and microbiosis.—W. T. **Porter**: Observations on traumatic shock. It is shown that the increase of respiration produced by the administration of carbon dioxide is of great service in cases of shock; three examples of this treatment following severe operations are cited in which good results were obtained.

WASHINGTON, D.C.

National Academy of Sciences, Proceedings, vol. iii., No. 6 (June 15).—H. **Nyquist**: The Stark effect in helium and neon. An improvement of Lo Surdo's method is applied.—F. W. **Clarke** and R. M. **Kamm**: New analyses of Echinoderms. A progressive enrichment in magnesia, following increase of temperature, is unmistakable.—C. B. **Davenport**: Utilising the facts of juvenile promise and family history in awarding naval commissions to untried men. A study, with family charts, of a number of naval officers.—Gladys A. **Anslow** and Janet T. **Howell**: The triplet series of radium.—C. **Barus**: The measurement of small angles by displacement interferometry.—S. **Flexner**: Mechanisms that defend the body from poliomyelitic infection, (*a*) external or extra-nervous, (*b*) internal or nervous. A report upon the results of recent experiments.—J. B. **Brinsmade** and E. C. **Kemble**: The occurrence of harmonics in the infra-red absorption spectra of diatomic gases. The discontinuities in the structure of these bands force the conclusion that the angular velocities are distributed among the molecules in the discontinuous manner predicted by the older form of the quantum theory, and the proved existence of harmonics is almost equally good evidence that the vibrational energy of the molecules is distributed in the same manner.—W. **Wilson**: The loss in energy of Wehnelt cathodes by electron emission. The emission of the electrons from Wehnelt cathodes is due to a similar mechanism to that causing the emission from heated pure metals.—E. C. **Miller**: Daily variation of water and dry matter in the leaves of corn and the sorghums. Under the conditions of these experiments the sorghums, particularly milo, absorb water from the soil and transport it to the leaves more rapidly in proportion to the loss of water from the plant than does corn, and thus the sorghums can produce more dry matter for each unit of leaf area under severe climatic conditions than can the corn plant.—C. **Barus**: Note on complementary Fresnellian fringes.—C. **Barus**: The displacement interferometry of long distances. In preceding notes two methods for measuring small angles have been suggested. Application is here made to the determination of distances, and it is shown that an object at about a mile should be located to about 30 ft.

BOOKS RECEIVED.

Morphology of Gymnosperms. By Prof. J. M. Coulter and Prof. C. J. Chamberlain. Revised edition. Pp. xi+466. (Chicago: University of Chicago Press.)

The Nutrition of Farm Animals. By Dr. H. P. Armsby. Pp. xvii+743. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 11*s*. net.

A First Course in Higher Algebra. By Prof. H. A. Merrill and Dr. C. E. Smith. Pp. xiv+247. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 6*s*. 6*d*. net.

Dutch N.W. New Guinea: A Contribution to the Phytogeography and Flora of the Arfak Mountains, etc. By L. S. Gibbs. Pp. iv+226. (London: Taylor and Francis.) 12*s*. 6*d*.

Le Paludisme Macédonien (Collection Horizon). By P. Armand-Delille, P. Abrami, G. Paisseau, and H. Lemaire. Pp. viii+109. (Paris: Masson et Cie.) 4 francs.

Problems in Dynamics (with Full Solutions). By Atma Ram. Pp. 245+diagrams 16. (Lahore: Atma Ram and Sons.) 3 rupees.

The National Food Supply in Peace and War. By Prof. T. B. Wood. Pp. 44. (Cambridge: At the University Press.) 6*d*. net.

A Defence of Idealism; Some Questions and Conclusions. By M. Sinclair. Pp. xxi+396. (London: Macmillan and Co., Ltd.) 12*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.