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

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THURSDAY, NOVEMBER 7, 1918.

RECONSTRUCTION.

National Reconstruction: A Study in Practical Politics and Statesmanship. By J. J. Robinson. Pp. x+155. (London: Hurst and Blackett, Ltd., 1918.) Price 2*s.* 6*d.* net.

"RECONSTRUCTION," like Mesopotamia, is a blessed word, and already there exists a considerable literature to expound its illimitable possibilities. The value of that literature is not equal to its bulk, for the writers too often have been misled by some passing phase of a rapidly shifting situation, or are the victims of doctrinaire theories or, worse, of "the Phrase," which Mr. Robinson notes "is very real and oppressive just now—the artificial and captivating jingles which are often made to do duty for facts and for reasoning from facts." If we had not enough already of "the monstrous regiments of people paid to get other people to do things," there would be justification for a censor who would refuse to pass for publication books on "reconstruction," unless they were written by those who combined some training in disciplined thinking with adequate experience of administrative problems—the perennial difficulty, in short, of achieving demonstrable progress by the machinery of institutions, working on, and worked by, men and women as they really are. The defects of the average administrator and the limitations of machinery are too commonly forgotten by those who assume in three hundred and fifty pages that a new British Empire can be created by a crop of committees and an encyclopædia of legislation in a few years "after the war."

Mr. Robinson would pass the suggested censor's test. His pages prove to a practised eye that he has thought deeply and read widely, while his administrative training has been varied and prolonged. He has, therefore, a right to summarise his experience. Moreover, he summarises it concisely, with freshness of expression and a stimulating conviction. Mr. Robinson certainly does not pretend that the monopoly of truth is on his writing-table, for he fully recognises that there are seventy-seven ways of constructing tribal lays, and that every single one of them is right. We certainly wish that Mr. Robinson could lure into "the school" where "he still is" as many politicians and voters, new and old, as possible and keep them there until peace was signed, sealed, and delivered. An old-fashioned parent once ascribed the success of his sons and daughters to the continuity and impartiality of his discipline. "I whipped my boys," he said, "to knock sense into them, and my girls to knock nonsense out of them." A course of Mr. Robinson would knock much sense into, and much nonsense out of, the young men and women who alone can be the "reconstructors" of the Empire. The future of "reconstruction" lies with the young, not with the middle-aged or the old, paralysed by the ignorance, apathy, and superstitions of the pre-war generation. One of Mr. Robinson's best lessons is that both the beginning and the end turn on the individual, "the mobile and mobilisable unit of power"—and if the unit fails we shall not even muddle through. Some of the instruction that the unit sorely needs can be found in Mr. Robinson's pages, and also much of the inspiration to discover more in life itself and in the inexhaustible potentialities of disciplined individual character.

It is not possible here to compress this valuable little book into a tabloid which a reader of reviews can swallow and imagine that he is thereby absolved from any further effort. We take it that the gist of Mr. Robinson's thesis is contained in his remark: "The history of civilisation up to 1917 is the history of power in unfit hands"; and the gist of his practical lesson is to show how "the unfit hands" can be made fit. We are supposed now to be on the eve of a General Election, the results of which presumably will be to determine by whom the work of "reconstruction" is to be achieved in the next five years. It would be salutary, indeed, if every candidate for Parliament and every voter had at every meeting in the election period to answer publicly in the presence of his fellow-voters, male and female, the catechism outlined in pp. 79–84—salutary and most humiliating. That catechism expands, but not unduly, the famous question: "If these things" (and we all know what "these things" are, the ills, mental, moral, physical, and social, from which we all individually and corporately suffer) "are preventable, why are they not prevented?"

We shall not misinterpret Mr. Robinson's "gospel" if we sum it up as a chain of proofs that what reconstruction demands is not so much a new theory of the State and citizenship as a new type of citizen, in whom knowledge is the teacher of duty, and duty the fruit of knowledge. Finally, Mr. Robinson concludes with a warning, so apposite and true and so often ignored that it must be quoted:—

"It may be difficult," he pronounces, "to get general readers, or popular audiences, to realise that Germany's intensive cultivation of war is neither the most dangerous nor perhaps the most considerable of her contributions to human experience and possibilities. . . . Surely it must be patent that the modern German Army is but the child of something more momentous. . . . Germans have attempted and achieved a Germanism which, after the war, will and must remain a perpetual challenge to other nations more loosely organised, less sternly schooled by the disciplinary education Germany subjected herself to for national ends . . . the German people will remain . . . it will not be met and mastered by anything less industrious and zealous than itself. By no machinery of voting, or credence given to empirical ignorance, can the slothful, the ignorant, and the disorganised close the highways of the world against the energetic, the educated, and the organised." "Is it necessary," asks Mr. Robinson, "for the moral to be the more stupid man? Is it possible

for him to win if he ordinarily is?" The affirmative answer does, indeed, "draw cheques on the universe which it has never yet honoured." The negative answer and how to secure it the reader will find in Mr. Robinson's pages.

APPLICATIONS OF COAL-TAR DYES.

Modern Dyeing Methods: The Application of the Coal-tar Dyestuffs: The Principles Involved and the Methods Employed. By C. M. Whittaker. Pp. xi+214. (London: Baillière, Tindall, and Cox, 1918.) Price 7*s.* 6*d.* net.

THIS is one of a series of eighteen volumes (published or in course of preparation) edited by Dr. Samuel Rideal, and intended to give a comprehensive survey of the chemical industries, as set forth in the general preface which precedes that of the author. It cannot be said that the author has followed this well-conceived plan so conscientiously as he might have done; in fact, the only point to which he has rigidly adhered has been the subdivision of his subject into sections. We are promised in the general preface that "there will be a general bibliography, and also a select bibliography to follow each section." Such bibliographies (coupled with references to current literature) would have represented a most valuable adjunct to a small work such as this, in which the treatment of so vast a subject is attempted, but all that is given (except a few references in the text) is a very incomplete list of works and current publications on pp. 10 and 11, while no select bibliographies follow the sections. The scope of the work is, however, ill-defined, for it bears no fewer than three titles, namely, Modern Dyeing Methods, The Application of the Coal-tar Dyestuffs (both on the title-page), and Dyeing with Coal-tar Dyestuffs (on the cover); strictly speaking, each of these subjects would require different bibliographies. The second heading is, however, the one under which the book is advertised in the general list, and one would certainly have expected the textile printing, lake-manufacturing, and paper-making industries to receive due consideration, but the two former are ruled out for lack of space, while the third is only cursorily mentioned in one or two places.

The dyestuffs are correctly subdivided under the various sections according to their mode of application in dyeing, and not according to their chemical constitution. Their application in the dyeing of the various classes of textile fabrics is generally adequately described, and many practical hints are given which may prove useful to the dyer. But, apart from inaccuracies, there is a certain looseness in the style which may in some cases lead to confusion. In some sections the author gives (*e.g.* on p. 12) a list of the principal classes of compounds from a chemical point of view, with a typical example of each. Thus the triphenylmethane dyestuffs are represented by magenta (the formula given is actually that of *p*-rosaniline hydrochloride, but this is of minor consequence); while on p. 13 the azo-dyes of basic character are typified by Bismarck brown (with an incorrect formula), but there is nothing to indicate that these are only typical examples. The grouping of the acid dyestuffs on p. 28 is a little clearer, but still requires some further explanation, and the same applies to the artificial mordant dyestuffs on p. 40. In the three later sections dealing with the direct cotton dyestuffs, the insoluble azo-colours, and the eosines respectively, no examples at all are given. Not only do we find such inconsistencies, but there is also displayed in many cases a lack of the sense of proportion. Thus, while on p. 19 particulars are given of two methods (*a* and *b*) of applying basic colours in cotton-dyeing, which are seldom, if ever, used to-day, the direct method, which is very useful for light shades, and ensures good penetration and level dyeing, is not even mentioned.

The last section is devoted to the valuation and detection of dyestuffs, but it is very inadequately handled. No mention is made of any of the exact quantitative methods of estimating dyestuffs which are in use at the present time, while with regard to the identification of dyestuffs on dyed fabrics the author, after referring the reader to Prof. A. G. Green's excellent work on the subject, contents himself with giving a few practical hints or tips, including two for the detection of "faked" indigo.

Altogether, the work is disappointing, and adds little, if anything, to our present knowledge of the subject.

THE MEASUREMENT OF TEMPERATURE.

Methods of Measuring Temperature. By Dr. Ezer Griffiths. With an Introduction by Principal E. H. Griffiths. Pp. xi+176. (London: Charles Griffin and Co., Ltd., 1918.) Price 8*s.* 6*d.* net.

IT is a pleasant task to welcome this work by Dr. Ezer Griffiths, of the Heat Department of the National Physical Laboratory. During the last few years it has been necessary to refer to text-books written by our Allies rather than to works written by British men of science when general information on temperature measurement is required. This has been particularly unfortunate, as so much of the fundamental work in thermometry is due to Englishmen.

Principal E. H. Griffiths, in an interesting introductory reminiscence, points out the great advances that have been made in the subject during the last thirty years. He states that "our knowledge of the temperature scale about 1600° C. is comparable both in facility and accuracy with our measurements some thirty years ago in the neighbourhood of 600° C." That this is no exaggeration a glance at the chapters on "The Fundamental Scale of Temperature" and "High-temperature Melting-points" will show. In the former chapter Dr. Ezer Griffiths summarises the work done in gas thermometry, the most difficult of all thermometry. He points out that the dis-

covery of the monatomic gases with no chemical affinity has made available elements which approach the "ideal gas" nearer than hydrogen or nitrogen. Argon will probably be employed in all the higher temperature gas thermometry because it does not diffuse readily through quartz.

In the chapter on the mercurial thermometer some useful information is given as to the construction of the electrically heated testing baths now in use at the National Physical Laboratory; indeed, one of the not least valuable features of the book consists in the data and illustrations given of the thermometer and pyrometer testing equipments of this laboratory.

The chapters on the resistance thermometer and the thermo-couple show that a great deal of experimental work has been devoted to developing the precision of the results obtained with these instruments. It is to be regretted that the author has not been able to deal more fully with their commercial development. We notice the omission of Peake's compensating leads and the very brief mention of the modern recording instruments, base metal thermo-couples, etc.

Four interesting chapters are devoted to the study of radiation and optical pyrometers and the problems connected with them. From the scientific, as well as from the industrial, point of view, the measurement of very high temperatures is of great interest. The instruments in themselves are comparatively simple, but the extrapolation of their scales beyond 1400° C. is a problem of considerable difficulty. A large number of workers will be grateful to Dr. Ezer Griffiths for the concise summary of the work on which this extrapolation is based.

In connection with the explanation of the Wanner optical pyrometer, it should be pointed out that the images of the illuminated patches are circular (being images of the circular diaphragm), and not semi-circular, as stated. The description of the instrument on p. 120 is not so accurately worded as it should be. The diagram is not well printed, and is thus difficult to understand.

A useful bibliography is given at the end of each chapter. A small slip on p. 55 may be mentioned; for Tables xlix. and l., xlvii. and xlviii. should be substituted.

The book is a useful, short summary of the subject, and, although not so complete as one would have desired, may be recommended as an addition to the library of every physics laboratory.

OUR BOOKSHELF.

Biology of Sex for Parents and Teachers. By Dr. T. W. Galloway. Pp. 128. (London: D. C. Heath and Co., n.d.) Price 2*s.* net.

CONVINCED of the need for sex-instruction, Dr. Galloway seeks to give parents and teachers some idea of the biological and ethical principles which should underlie it, and to suggest the spirit in which it should be attempted. He has sympathy with endeavouring by knowledge to avoid disaster, but he sees positive promise in trying to use the sex impulses and instincts educatively. He seeks to present the facts of sex in their broad biological and evolutionary setting, and the lines of instruction suggested seem to us to be shrewd and wise. He would in a graduated and differential way explain to young people that if their sex-development goes awry, the results will show themselves in reducing the efficiency of body and mind. "The purpose of sex-knowledge is to enable you to let yourself develop normally without giving the matter any unnecessary thought." But the power of control over impulses requires strengthening even in the strongest, and the author writes in an experienced, practical way of the ideas and ideals, habits and interrelations that make it less difficult to "keep the heart with all diligence."

Emphasis is wisely laid on the importance of grading the instruction according to intellectual and emotional development and the diversity of social and economic relations. The linking of sex-instruction to biology and hygiene on one hand, and to ethics and eugenics on the other, is a good feature of a concise and clearly written book which can be confidently recommended to parents and teachers. Now and again we have come across a sentence that jars (*e.g.* on p. 119: "Because of this shell, chickens cannot behave like fish in fertilising the egg"), but the workmanship of the book is thoroughly competent.

The Processes of History. By Prof. F. J. Teggart. Pp. ix+162. (New Haven: Yale University Press; London: Humphrey Milford, 1918.) Price 5*s.* 6*d.* net.

THE main argument of this essay is that historians should take into account the natural processes that have moulded human groups, and that the history of no one area can be viewed independently of that of its neighbours. A powerful plea is put forward for the recognition of a history of Eurasia, in which Western events may be treated as the outcome of climatic and other incentives to movement in the broad lands lying to the East. The author urges that Lyellian methods cannot be applied to history, though correct inferences from historic data "should be verifiable by application to things as they are." Our range of view, in seeking for causes of human action, cannot be restricted by epochs and localities, and the dominance of mere narrative in history seems already overthrown. Prof. Teggart regards primitive man as engaged in maintaining a system of life which he has found sufficiently advantageous. In thus minimising the influence of the gifted and ingenious member of the tribe, or of the hunter whose adventurous outlook has brought him into open country from the confining darkness of the woods, he strikes a blow at the theory of leadership as a cause of rapid change and evolution. Tribal movements appear to him to originate in some broad change of condition, and the migration thus enforced by Nature leads to development by collision with men who have followed other modes of life. The book will perhaps be of service in pointing out the problems rather than the methods of modern history. G. A. J. C.

LETTERS TO THE EDITOR.

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

The Perception of Sound.

PROF. KEITH has replied to the physiological criticisms in Prof. Bayliss's most thoughtful letter in NATURE of October 17. I will therefore confine myself principally to the physical objections he has raised.

With regard to the difference between the molecular movement of a liquid subjected to the pressure of a sound-wave, and the molar motion of a minute mass of liquid in the cochlea, it cannot be forgotten that liquids could not conduct sound "unless they were both elastic and compressible."

The fact that water is so difficult to compress, and this only at very high unit pressures, is proof of its high degree of elasticity or tendency for its molecules to return to their undisturbed positions. But an extremely low unit pressure will cause molar motion in a small mass of liquid moving in a vessel of suitable shape. It is to such molar motion that I refer. A reference to my footnote (p. 56 of my book) shows that Helmholtz in his later studies recognised that "an incompressible fluid contained between solid walls is distinguishable from a compressible one in this: that every impulse which reaches any part of its surface communicates itself immediately throughout the whole fluid and sets every part instantly in motion, while in a compressible fluid a wave proceeds from the spot of action and travels with a certain velocity, setting in motion the several particles of the fluid consecutively. Thus if the dimensions of the whole mass are infinitely small in comparison with the wave-length (as it is in the labyrinth water), and if the walls of the petrous bone which enclose it are so solid that we can consider them as absolutely so when compared with the minute pressure under consideration, we deduce the following: The communication of action throughout the whole mass is practically instantaneous, and the labyrinth water under the influence of the sound waves moves virtually as a fluid absolutely incompressible (and therefore incapable of sound waves) would move under the same relations."

I am glad that Prof. Bayliss directs attention to the difficulty he finds in seeing how there is a difference of pressure on the upper and lower surfaces of the basilar membrane when the column is a continuous one.

The answer is that the high pressure on the upper side of the membrane is carried through the bent levers of the Corti arches to do mechanical work in bending the hairlets (see p. 138). In science it is true, as in more homely affairs, that we cannot both eat our cake and have it. As the pressure is passed out on the upper side of the membrane to do work in the scala media in bending thousands of hairlets, there is an equivalent loss of pressure in the passage below the membrane. In a double-acting hydraulic engine we have a somewhat similar condition of things. The high-pressure water is admitted into a cylinder and the piston is pushed forward and backward alternately. The piston-rod carries the pressure to the crank-shaft, thus doing external work. The equivalent unit pressure disappears in the exhaust water which is pushed out at atmospheric pressure. The same displacement of liquid takes place in the exhaust, but the displacement is reduced in pressure by the equivalent amount of work carried out of the system.

Prof. Bayliss asks why there are so many Corti arches when a few might suffice. This I take to be necessary in order to extend the surface of excitation, which I have endeavoured to describe on p. 72; also to provide for the probability that during a lifetime of continuous work many of the Corti arches would fail to function.

With regard to Yoshii's experiments, I have not seen them, but Prof. Keith has informed me that such observations have been made, though he did not describe the conditions under which the experiments had been carried out. If the observations depended upon prolonged exposure to the vibrations of a musical note, I scarcely think they should be regarded as a proof of the localisation of certain strings in the basilar membrane to produce certain notes. It might only mean that some weak part in the system gave way and ceased to function under a stress of fatigue. It seems quite possible, as suggested by Prof. Keith, that notes of high frequency, rising very rapidly to their maximum pressure, might tend to short-circuit towards the narrow end of the membrane, and notes of low frequency, rising slowly to their maximum, might impress the wider end of the membrane, but it must be remembered that the areas at the fenestral end are extremely small, and that Helmholtz himself recognised the practically instantaneous action of the pressure throughout the passage.

The strongest argument against the string instrument theory is that in the basilar membrane all the so-called strings are cemented together sideways, and cannot, therefore, vibrate freely or respond each to its own vibration rate.

In the displacement theory the striate or inelastic portion of the membrane moves downwards as a whole, following the same spiral plane on a hinge coinciding with the tapered edge of the aperture, each strip of its breadth descending a distance increasing from the fenestral end to a maximum at the helicotremal end, and in this way obliging the triangular displacements to increase towards that end uniformly.

In a compound-wave form entering the ear we have indications not only of the original impulses of the pure tones from which the compound is built up, but also of the differential tones, the summational tones, and harmonics.

When we find these all reappearing as sensations in the brain, the conclusion appears to be forced upon us that the ear must be a machine adapted to sustain on their passage to the brain these impulses of which we find indications in the wave-form.

My endeavour has been to examine the structure and working of this marvellous machine which causes the accurate transference of such impulses.

THOMAS WRIGHTSON.

Neasham Hall, Darlington.

THE objections against Sir Thomas Wrightson's theory raised by Prof. Bayliss in NATURE of October 17, though grave, no doubt, to those who can appreciate their cogency, yet appear to one who has attempted to approach the problem from the side of phonetics comparatively slight; while there are objections to the prevalent theory which, if I may be allowed briefly to state and develop them, may perhaps throw some light on the question at large.

I would put the matter this way. The human ear as imagined by Helmholtz is no great improvement on Nature, for it could neither (1) hear a note of music, nor (2) hear a large percentage of the words in the English language.

(1) Advancing on the lines laid down by Sir Charles Bell and J. Müller, "that, *however excited,* each nerve of special sense gives rise to its own peculiar sensation" (Bayliss, "Principles of General Physiology," 1915, p. 513), Helmholtz put forward the hypothesis that each fibre of the auditory nerve "hears in its own peculiar pitch" ("Sensations of Tone," 1885, pp. 148 and 151) without regard, as it seems, to the immediate consequences which it must have for his main theory. For, from the rate of damping determined by him, "it follows that the natural pitch of the internal vibrators, which respond sensibly to a given simple sound, ranges over about a whole tone" (Rayleigh, "Theory of Sound," vol. ii., § 389). That means that when a note is sounded a great number of nerve-fibres are stimulated, for the Helmholtz mechanism of the internal ear requires every string of its remarkable pianoforte to be connected "with a nervous fibre in such a way that this fibre would be excited and experience a sensation every time the string vibrated" (p. 129). The number of strings or internal vibrators allotted to the interval of a whole tone varies. In 1870 it was $66\frac{2}{3}$; in 1877 it was 100; but the number, if more than one, is immaterial here. Assuming that 100 strings of the basilar membrane vibrate in unison with the given note, 99 of these will be executing forced vibrations at other than their proper frequencies, and *ex hypothesi* 99 nerve-fibres will call up 99 dissonant sensations of tone, all of different pitch and of intensities diminishing regularly on either side of a maximum, which is due to the 100th fibre, the peculiar pitch of which agrees with the exciting note. As each nerve-fibre, *however excited,* gives rise to the sensation of its own peculiar pitch, it matters not whether the internal vibrators vibrate with their proper frequencies or with that of the imposed tone. Unless, therefore, there is in the central organ some contrivance, which Helmholtz does not provide, for inhibiting the odd 99 nerve-fibres, or a transformer of some kind to standardise their pitch, it follows that when a tuning-fork is made to vibrate, no note can be heard, but only an unimaginable din. Music would then be impossible; we could never hear anything but noise.

On the other hand, if Helmholtz had allowed each nerve-fibre to communicate the actual pitch of the vibrator connected with it, whether executing a free or a forced vibration, then there could never be a clean-cut, staccato ending to a note, but after a bass note has ceased externally to the ear there would ensue for about one-tenth of a second, according to his estimate—to the ear an appreciable period of time—a similar confused noise of many mistuned strings; for, by p. 144, "an elastic body set into sympathetic vibration by any tone vibrates sympathetically in the pitch number of the exciting tone; but as soon as the exciting tone ceases, it goes on sounding in the pitch number of its own proper tone." The cochlea (limaçon, Schnecke) well deserves its name. For, however many fibres its house may hold, the snail certainly has two horns. Sir Thomas Wrightson's theory presents us with no such dilemma as this.

(2) In 1916 I found that if I sing to a bass note such a vowel as *oh* or *oo,* and end the note staccato by closing the glottis (the "Glasgow" substitute in speech for occlusive *t* or *k*) while keeping the shape of the mouth unaltered, I hear that the harmonic of the voice which is reinforced by that excellent resonator, the cavity of the mouth, is still audible for a very brief space after the voice has ceased to be heard. From which I infer that the rate of damping in the internal ear is more rapid than that of the body of air in the mouth shaped for certain vowels. But as I do not expect or desire that this inference should be accepted as scientific fact merely on my statement, just as little am I disposed to accept Helmholtz's guess-work as an adequate basis for the calculation which was to have such far-reaching and subversive consequences, overthrowing, for example, the belief of Lagrange and Thomas Young that rapid beats may combine into a sensation of tone. Hence my previous letter (NATURE, May 16, 1918) with a kymograph tracing of the word "utter" intoned at pitch 100 and measured by a tuning-fork of the same pitch. In that tracing it is not a question of a note being reduced to one-tenth of its intensity in the time occupied by 9·5 vibrations, but well within that limit a loud note is reduced to silence. There is the proof that the unchecked estimate which is the very key-stone of the Helmholtz theory of audition is wide of the mark.

The complete cessation of sound in "utter" is an essential feature of English and of other languages. It is astonishing that Ellis, the phonetician, never thought of this when translating Helmholtz. That which is *common* to the first *p, t,* or *k* in "stop, please," "or not to be," "bookcase," by virtue of which these three "sounds" are classed together as voiceless occlusives, is evidently a shock sensation of the sudden cessation of a sound. How the existence of such a sensation is to be reconciled with any resonance theory of audition has long been a puzzle to me. The very term *resonance* seems out of place in the presence of this phenomenon; and when, on May 17, Sir Thomas Wrightson's book came into my hands, the expression "*dead beat*" in his preface appeared to promise an advance towards the solution of a most complicated problem. W. PERRETT.

University College, London, October 23.

The Society of Civil Servants.

APROPOS of the letter which appeared in NATURE of October 24 on the need for scientific workers to organise themselves, I shall be obliged if you will allow me through your columns to direct the attention of scientific workers in the Government service to the recently founded body, the Society of Civil Servants, which is intended to cover the middle and upper grades of the Service—grades which hitherto have been almost wholly unorganised. By its second rule the objects of the society are defined as "to deal with all matters affecting the Civil Service, and to take such action thereon as may be expedient"—a purview of unlimited range. While the society is constituted on the basis of individual membership, members are encouraged to coalesce into whatever sectional associations—called in the rules "grade groups"—may conveniently and naturally come about. It is these "grade groups" that will consider matters such as salaries and scales of promotion which affect their members solely, the society taking up only wide questions affecting the Civil Service generally.

It is an old saying that "Providence helps those who help themselves." Scientific workers have in the past had just cause to complain of the niggardly treatment that they have experienced at the hands of the State. By organising themselves into "grade groups" of the society, according to the various Departments, those in the State employ will have an opportunity of directing attention to their claim for more generous treatment; but should they fail to take advantage of the present opportunity, they will have no one to blame but themselves if in the future they continue to receive the same neglect as in the past. It is no secret that a scheme for the application of the principles of the Whitley report to the

Civil Service has been drawn up by the Ministry of Labour, and is even now being considered by an Inter-Departmental Committee. The recommendations advocated in that report are based on the fundamental hypothesis that both parties to an industry—the employer and the employed—are well organised. If, therefore, men of science desire to have a voice in framing the conditions under which they work for the State, they must organise themselves, and the sooner the better. A beginning has been made, but only a beginning.

G. F. HERBERT SMITH,
Joint Hon. Sec., *pro tem.*, Society of Civil Servants.
2 Old Queen Street, S.W.1, November 5.

Modern Studies in Schools.

I WAS somewhat surprised to read in NATURE of October 3 a vigorous attack upon the Government Committee on Modern Languages on the ground of its having considered nothing but the interests of trade and diplomacy. I trust this will not deter your readers from examining what is generally considered to be a most valuable report. It is certainly a document which has met with the general approval of modern language teachers and others interested in the subject with which it deals. Against the charge made I may point out that of the nine pages of the section entitled "The Value of Modern Studies," nearly three are devoted to the higher aspects of the subject, while the section on the aims of language teaching in schools begins with the sentence, "Language teaching has, and should have, a disciplinary and educative aim," and the treatment of the subject is based on this text.

Most surprising of all is the view expressed in the article that "the opinions of the Committee on educational methods are astonishingly reactionary." If by "educational methods" is meant—as one supposes must be meant, considering the context—"methods of language teaching," the statement is the exact reverse of the truth. The opinions enunciated are the most advanced which have ever appeared in a document issued by a public authority. The Committee recognises the strong position now held by the "direct method," and discusses its merits critically, yet sympathetically. A whole section is devoted to phonetics, and the need for a good phonetic training for teachers is insisted on. Uniformity in grammatical terminology is recommended. Of our own suggestions for examinations, which are usually considered to be of a moderately advanced character, the report says that they are "good so far as they go, but they do not go far enough." An oral test is recommended in all cases, and free composition, it is considered, should either be substituted for or be additional to translation into the foreign tongue. Finally, it is urged that translation in school "should be practised only so far as it is necessary"—a view which probably many teachers will think unsound, but which none will characterise as reactionary.

G. F. BRIDGE,
Hon. Sec., Modern Language Association.

I CORDIALLY agree that teaching for "bread-winning" is the first duty, but "bread-winning" may be "bread-capturing," and it is this spirit, I am afraid, which pervades the report. But manufacturers to-day are more concerned with production and co-operation than with commerce, and they find the need for a wider knowledge of languages for this service, so I am not surprised that the *questionnaire* met with little response.

The aims and methods set forth in the report are of the standard classical type, and they insist on the study of one or, at most, of two languages taught to a high state of proficiency; but the needs of the times, and the average capacities of boys, demand a less specialised course. The difference is fundamental, as Mr. Bridge will admit. We expected a new method and a new outlook, but we got the old. In our opinion, schools should give boys the opportunity of reading many languages, not excluding the Eastern languages or the languages of Africa, and boys should use the languages for research and discovery. Whether this work is disciplinary or educative is of minor importance; or whether it cultivates taste or judgment. Of minor importance, too, as we think, are the various methods of teaching which are recounted by Mr. Bridge. It is true that these are the things which trouble the minds of many schoolmasters, but with deeper aims the methods would take care of themselves. We expected the Committee would have shown the way to more fundamental changes in method, but it did not do so.

THE WRITER OF THE ARTICLE.

THE MINISTRY OF HEALTH BILL AND AFTER.

SINCE October 17, when most of the newspapers gave prominence to an announcement that the Ministry of Health Bill had been re-cast and submitted to the War Cabinet, possibly because the body named has had other things to think of, nothing has been heard of this measure. Much, however, has been said and written of the Ministry itself, and a certain amount, none of it good, of the Local Government Board, the reason being the extent and severity of the influenza outbreak. If some of the speakers and writers are to be believed, the Board, because its methods are "wooden," or because of its "Poor Law taint," is mainly to blame for the epidemic: if there had been a Ministry in existence, the suggestion is that there most certainly would have been no outbreak.

The persons who make these statements are, many of them, those who are responsible for trying to convince the public that if only a Ministry of Health were formed there would follow an immediate and marked improvement in public health.

That many have listened to promises of this kind and look for something in the nature of a quick change is pathetically true. Unfortunately it is true also that disappointment awaits them. It has never been quite clear why it should have been necessary to exaggerate so much as to the benefits likely to follow the establishment of a Health Ministry. The case for a separate Ministry to co-ordinate health effort and ensure that all branches of hygiene, scientific, practical, and administrative, should have proper recognition and support was always sound, and no good can come of these exaggerations. On the contrary, a great deal of harm may result unless it is recognised at once and generally that it may be long, very long, before signs of improvement become apparent.

It has taken, and may still take, a long time to get a Ministry of Health Bill. It will take time

to get the right Minister and to organise the Ministry; and then there is no more than a beginning made. The central organisation is probably the least important part of the health organisation in this country. The most effective portion of the work will have to be done at the periphery, by the local organisations, as it has always been done, or, unfortunately in some cases, left undone.

The problem that faces the first Minister and the new Ministry is the problem of the organisation of the working forces, and when it is attacked it is within the bounds of possibility that the Minister and the Ministry may find that these forces are not distributed throughout the country in a particularly suitable manner. An entirely new method of dividing up the country may very probably have to be devised before anything can be done.

As matters stand at present, health work is distributed most unevenly, for the reason that the necessity for a standard unit has never been recognised. The local authority of each district has been declared to be the sanitary authority; powers and duties in relation to public health have been imposed upon or delegated to it, and that has been the end of it. The size of the area, the population and, more important still, the rateable value and the wealth or poverty of the district have never been taken into account.

The result has been that the work has properly been attended to only in the districts where the means were adequate. The large, prosperous districts did all they possibly could; the small, rich districts did superbly because they were small and because they were rich. In the poorer areas as much as could be afforded was done and more or less was left undone.

Only within the last few years has it been seen that the question of *affording* was one of importance, and that good might result if grants in aid of necessary work were made. The experiment was tried in the case of maternity and child welfare schemes, and the result has been that in practically every area an attempt has been made to cover this work. If the whole of public health work is to be covered in every area, grants in aid of all of it will have to be made. The Minister of Health who recognises this and, having induced the Treasury to see it, gets it put into operation will obtain good results; and if, instead of having a flat rate of grant, he gives a percentage that accords with local needs, he will obtain, in the poorer districts particularly, results still better. If he desires to ensure the best results, in addition to making health work more of a national and less of a purely local charge, he will arrange also for the proper distribution of the work. Most of the larger areas are too large to be effectively worked; many of the smaller areas are too small to be thought worth while working. If possible a standard unit of area and population must be devised, and the need for cutting here and grouping there recognised and put into effect.

This part of the Minister's task will be less easy even than arranging for grants in aid. Vested interests have stood and may still stand, for all that is known, in the way of the formation of the Ministry. Strong as they are, however, they are much less strong than the vested interests that must be overcome if local reorganisation is attempted. Until they are overcome and the nation's work of looking after the health of the nation is properly parcelled out, the best results cannot be expected.

The passing of the Ministry of Health Bill, the discovery of a suitable Minister, and the formation of a sound Ministry may bring satisfaction to many. They will not necessarily bring improvement in the national health; will not necessarily, as many appear to think, bring about a total disappearance of epidemics and a vast and immediate reduction in the amount of disease and the annual death-rate.

Marked improvement will be seen only when the work has been properly organised throughout, when it is recognised that the care of the nation's health is a national business and bound to succeed only if it is properly arranged, properly managed, properly financed, and properly supervised.

A Ministry of Health can, if it will, ensure that these things shall be done; it does not follow that they have been done when the Ministry has been formed.

RACIAL INVESTIGATIONS ON FISHES.

TWO very interesting papers[1] by Dr. Johs. Schmidt deal with the significance to be attached to variation statistics. Taking as his material collections of *Zoarces viviparus*, the viviparous Blenny, from different parts of the North European coasts, Dr. Schmidt makes mathematical analyses of measurements of various selected characters. The paper is tersely and very clearly written in English, and illustrated by numerous simple and adequate charts, and some maps showing the localities sampled. Excellent summaries of the reasoning and conclusions are given in each case.

A "population-analysis" by variation statistics can scarcely resolve any biological problem; it merely arranges the material and suggests lines of experiment. Let there be two fish populations, belonging to the same species, in different seas, which do not interbreed, and let certain measurable characters be chosen for study. Frequency-distributions with respect to each character and locality are made, average values of the selected character are calculated, and the fluctuations, or probable errors, are then found. If the differences observed are greater than the fluctuations, the usual conclusion is that the organisms are differentiated: that they belong to different "races," or elementary species. Dr. Schmidt contends that such a conclusion would, as a rule, be unsound. It may be that repeated sampling of a population gives the same average values for the characters —the same "racial picture"; nevertheless, to speak of a "race" and found it on such evidence

[1] *Comptes rendus des Travaux du Laboratoire de Carlsberg*, 13me vol., liv. 3, 14me vol., No. 1, 1917.

might mean little or nothing. By splitting up a large sample of Blennies into groups representing successive years of age, Dr. Schmidt obtained significantly different average values. By taking average values of a character in a number of mothers, and average values of the same character in a number of their offspring, he again obtained different "racial pictures." Finally, by taking different broods of young from the same mothers and rearing these in different conditions significantly different average values for the characters were again obtained. Character differences are thus both "genotypical" and "phænotypical," in Johannsen's terminology. The "race" is a mixture of "genotypes," pure lines of descent in which there is constancy of value of character, and variational studies only give statistical expressions for these mixtures of genes.

The average racial character is much more the result of the mixture, in various proportions, of genes than due to the environment; nevertheless, the latter may be very important. Thus Dr. Schmidt shows that all the freshwater eels of Europe are racially the same, the average values of the diagnostic characters being practically identical; this is because the environment is really the same, that of the deep water in the Atlantic, where all those eels are spawned and undergo larval development, fixing certain characters for the rest of the lifetime. But the Blennies are non-migratory fishes, and each locality has its own stock. Selection has therefore operated in helping to produce the differences that variation statistics reveal. The environment also acts directly, as is indicated by the experiments recorded in Dr. Schmidt's second paper, producing significant character differences which need not, of course, be transmissible.

J. J.

CANON ALFRED MERLE NORMAN, F.R.S.

IT has often been remarked that the study of science in this country has been notably advanced by the efforts of those who have never been professionally engaged in it. Canon Norman, who died on October 26, belonged to the best type of this class of scientific worker. His name will be long remembered for the conspicuous service he rendered to the study of the marine Invertebrate fauna of the Atlantic and Arctic areas, and for the special interest he took in deep-sea dredging at the time when the wonders of the abysses were first being revealed. The youngest son of John Norman, D.L., of Iwood, Congresbury, and Claverham House, Yatton, Somerset, he was born at Exeter in 1831, and was educated at Winchester and Christ Church, Oxford, where he took his first degree in 1852.[1] He was ordained deacon in 1856, and priest in 1857. After holding several curacies he was presented to the living of Burnmoor, Co. Durham, in 1866, where he spent nearly thirty years, becoming rector of Houghton-le-Spring, in the same county, in 1895, and rural dean. He was obliged by illness to give up this appointment in 1898, and he soon afterwards settled at Berkhamsted, Herts, where he died. He had become Hon. Canon of Durham Cathedral in 1885.

When quite a child A. M. Norman was interested in botany by his brother, the Hon. John Paxton Norman, officiating Chief Justice of Bengal, who was assassinated by a fanatic in 1871. At Winchester he studied entomology, and at Oxford he devoted his attention specially to the Mollusca of the county, of which he published an account. While acting as private tutor in the house of the Dowager Countess of Glasgow, at Cumbrae, in 1854-55, he first seriously took up the study of the marine fauna, and from that time he spent nearly all his summer vacations in dredging round the British Isles, Norway, and Madeira, and in the Mediterranean. He thus formed the nucleus of his famous collection of the marine Invertebrates of the Arctic circumpolar seas and of the temperate North Atlantic, together with the inland representatives of the same classes of animals which inhabit the Palæarctic region. This collection was estimated to consist of about 10,000 species and named varieties in 1895. While a large part of it was obtained by himself, many of his choicest treasures were specimens of historical interest which had been purchased or given to him. It was thus extraordinarily rich in type-specimens acquired in these various ways, and it surpassed in importance anything of the same kind existing elsewhere. Before his death Canon Norman transferred it to the British Museum (Natural History), and he presented his almost equally noteworthy collection of books and pamphlets to the zoological departments of the University of Cambridge.

In these days of specialisation the breadth of Canon Norman's interests may well be considered remarkable. It would be difficult to find another modern zoologist able to write with authority on two groups so different as the Polyzoa and the Crustacea, for example. Not only was Dr. Norman an acknowledged authority on both of them, but he was equally well acquainted with others, such as Mollusca, Tunicata, Foraminifera, and sponges. Most of his work was systematic, and a good idea of its general character can be obtained from his papers entitled "A Month on the Trondhjem Fiord," published in 1893 and 1894. It is scarcely necessary to add that he made many additions to the British fauna in many diverse groups, besides describing large numbers of new species.

The remarkable genus Rhabdopleura was dredged by Canon Norman in ninety fathoms off the Shetland Islands and sent to Prof. G. J. Allman, by whom it was described. This organism had no near allies among forms then known, and its affinities were not properly understood until after the discovery by the *Challenger* of Cephalodiscus, a second member of the same group. Another of his specially noteworthy discoveries

[1] These personal details have been taken from "Bucks, Beds, and Herts in the Twentieth Century." (Brighton: W. T. Pike and Co.)

was the enigmatic encrusting organism obtained by him in the neighbourhood of Madeira, and afterwards named *Merlia normani*, in his honour, by Mr. R. Kirkpatrick. A third genus of remarkable interest which we owe to his enthusiasm is the parasitic Crustacean, Synagoga, belonging to the Ascothoracica, a highly specialised and degenerate subdivision of the Cirripedia.

But it must be emphasised that Canon Norman was much more than a describer of new species and a discoverer of interesting forms. His researches have been of real value in enlarging our knowledge of the marine fauna in general, and few others have contributed more than he did to the faunistic study of the sea.

As one who for many years had the privilege of his friendship I can speak with the most sincere admiration of his genial character, his perfect sincerity, and the high ideals by which he regulated his life. Of his work as a parish priest I am not competent to speak, but I believe that his ministrations were very highly valued by those who came under his influence. Canon Norman was a man of altogether lovable type, and it was impossible to be in his company without feeling the better for it. These characteristics lasted to the end of his life, during the closing years of which he had borne the infirmities of serious illness with an unclouded mind and a fine courage, and without losing the qualities which endeared him to his friends. SIDNEY F. HARMER.

PROF. OLAUS HENRICI, F.R.S.

OLAUS MAGNUS FRIEDRICH ERDMANN HENRICI was born in the year 1840 at Meldorf, on the west coast of Holstein. After leaving the gymnasium at Meldorf at the age of sixteen, he worked in some engineering works at Flensburg. Thence at the age of nineteen he went to the Karlsruhe Polytechnicum, where he had the inestimable advantage of coming under the influence of Clebsch, by whose advice he devoted himself entirely to the study of mathematics. At the age of twenty-two he went to Heidelberg, where he attended Hesse's lectures, and obtained the degree of Ph.D. He then studied under Weierstrass and Kronecker in Berlin. After a short time spent as *Privatdozent* at Kiel, he came to England in 1865.

For four years Henrici worked at engineering problems. During this time he published a little book on skeleton structures (now called pin-jointed structures), and he supplemented his earnings by giving private lessons to schoolboys. In 1870, after a short time spent as assistant to Prof. Hirst at University College, London, he succeeded him in the professorship of pure mathematics, and retained this position for ten years, when he exchanged it for the professorship of applied mathematics. In 1884 he left University College for the professorship of mechanics and mathematics at the Central Technical College, where he entered on a new field of work in the organisation of a laboratory of mechanics, which has been the model of many others, and has had an important influence on the education of English engineers. In 1911 Henrici retired to Chandler's Ford, in Hampshire, where he died on August 10 last.

Henrici was a fellow of the Royal Society, and at one time a member of its council. He was president of the London Mathematical Society for two years, and chairman of Section A of the British Association in 1883. In 1884 the University of St. Andrews conferred upon him the honorary degree of LL.D. He acted as examiner in the University of London from 1875 to 1880, and in this capacity made his influence felt on the introduction of modern methods into the teaching of geometry. In 1877 he married the daughter of the late Rev. Dr. Kennedy and sister of Sir Alexander Kennedy, who survives him. There was one child of the marriage, Major E. O. Henrici, of the Royal Engineers.

Henrici was the author of mathematical papers published in *Crelle's Journal* and the Proceedings of the London Mathematical Society. He contributed several articles to the "Encyclopædia Britannica," amongst which that on "Projective Geometry" stands out as a model of lucidity and form of expression. He wrote jointly with his son a valuable memoir on the theory of measurement by metal tapes and wires in catenary, which made it possible to calculate distances on slopes up to 1 in 3 to an accuracy of one in a million. He was the author of a remarkable little book on "Congruent Figures," in which his ideas of the mode of treating elementary geometry are expounded. It covers in a small compass most of the ground of the first four books of Euclid's "Elements." At one time he purposed to write a sequel to it on "Similar Figures," but it would appear from his address to Section A of the British Association in 1883 that he failed to find a method of treating this part of the subject which entirely satisfied him.

The introduction into English teaching of the methods of vector analysis greatly interested Henrici, but of his ideas there remains in permanent form only what is published in the little book on "Vectors and Rotors" written by his assistant, Mr. G. C. Turner, from notes of his lectures. It deals only with the elementary parts of the subject. The matter contained in this book was to form the earlier portion of a more elaborate treatise. A great amount of manuscript has been left by Henrici, and it is much to be desired that someone will be found to go through it with care and save what is possible of his ideas.

Henrici was greatly interested in the construction of models to illustrate his teaching. One of these, made of rods, showed two confocal hyperboloids connected together so that they could be deformed, always, however, remaining confocal. It had a remarkable history, which he gave in the catalogue of the Exhibition of Mathematical Models at Munich in 1892.

Perhaps the most strikingly original piece of work he did was the invention of the harmonic analyser for representing the equation of a curve

in the form of a Fourier series, which he described in the *Philosophical Magazine* for July, 1894.

Henrici will be remembered chiefly as a great teacher. He had learned during his early struggle for a livelihood in London to aim at perfection in form of expression, and he refrained from publishing anything until he felt satisfied as to its form. But for this characteristic we might have had his books on "Similar Figures" and "Vector Analysis."

As one of the large body of Henrici's pupils, the present writer is able to bear testimony to the singular lucidity of his teaching and to his readiness to explain difficulties at all times. With qualities such as these it is easy to understand the mingled respect and affection with which his pupils regarded him. They feel that a great master of his art has passed to his rest.

M. J. M. HILL.

NOTES.

THE epidemic of influenza which has ravaged the country during the last month or so seems to be abating, at least in London, where, however, 1256 deaths were attributed to it in the week ending October 26. The experience of previous epidemics in London has been that excessive mortality from influenza in any single epidemic does not continue beyond a period of about six weeks. Contrary to what has been stated in the public Press, a summer epidemic like that of last July is unusual, and the occurrence of a second epidemic like the present within three months of a previous one is almost unknown. While the influenza bacillus was found only in a small proportion of cases in July, now it seems to be fairly prevalent, but the pneumonia complicating the disease, and to which the mortality is chiefly attributable, appears to be caused mainly by secondary infection with the pneumococcus or the streptococcus. In a small localised influenza epidemic which occurred in a hospital in France Majors Foster and Cookson establish an incubation period of forty-eight hours for the disease, also that infection spreads only within a narrow radius (*Lancet*, November 2, p. 588).

A SCHEME for a national organisation, to be called the Scientific Research Association, to secure a more effective promotion, co-ordination, and endowment of research has been developed recently by a small provisional committee, the acting secretary of which is Mr. A. G. Tansley, F.R.S., Grantchester, Cambridge. The idea is to set up machinery for collecting intelligence as to what is being done and what are the current and prospective needs. Subject committees would act as intelligence bureaux, which would put workers in touch with the best existing facilities for pursuing research in the various branches of science, and at the same time collect information as to current work and needs. This information would be co-ordinated by the council of the association, which would act as an intermediary between the subject committees on one hand, and Government and public bodies disposing of funds available for the endowment of research on the other. The aim of the association would be in no way to interfere with the activities of any existing body, but to co-operate intimately with all bodies and institutions concerned with research, and to act as a co-ordinating agency in all that relates to research. Adherence to the aims of the association has been obtained from a large number of representative men of science throughout the country, and it is hoped to bring the association into relationship with the whole body of research workers in pure science.

THE Lord Mayor of Manchester (Sir Alexander Porter) presided on October 31 at a meeting which he had convened to consider the question of holding an exhibition of British scientific products in Manchester in December and January next. The meeting decided that the proposed exhibition should be held, and that the offer of the City Council to make the building of the College of Technology available for the purpose should be accepted. The proposed exhibition will be similar to that organised by the British Science Guild, which attracted so much attention when it was held recently in King's College, London. Its object will be to show Lancashire people, especially manufacturers and merchants, how many of the products which before the war they were accustomed to obtain from Central Europe are now being manufactured in this country, and how many altogether new products have been invented in Britain since the war began. The exhibition should also give an impetus to the application of science to the industries of Lancashire by showing how much some of these industries, as well as other British industries, owe to the work which British men of science have accomplished during the war. A sufficient sum of money has been guaranteed to cover the necessary expenses of the exhibition. It is hoped that further contributions to the guarantee fund will continue to be received so as to enable the scope of the exhibition to be extended and to include exhibits that will be of special interest to Lancashire. Offers to contribute to the guarantee fund and all other communications relating to the exhibition should be addressed to the Secretary of the Exhibition Committee, College of Technology, Manchester.

WE learn from the *British Medical Journal* that the following resolutions, recently adopted unanimously by the Paris Academy of Sciences of the Institute of France, were unanimously endorsed by the Academy of Medicine on October 15:—(1) The academy, believing personal relations between scientific men of the two groups of belligerents to be impossible until reparation and expiation of the crimes which have put the Central Empires under the ban of mankind permit them again to enter the concert of civilised nations, has adopted the following resolutions:—(2) The Central Empires shall be compelled by a provision of the treaty of peace to retire from international scientific associations established by diplomatic conventions and implying personal relations between the members. This exclusion would not apply to common action solely concerning administrative relations indispensable between such public service as those affecting the regulation of navigation, railways, telegraphs, etc. (3) As soon as circumstances allow, those international conventions not belonging to the two categories noted above shall be denounced by each of the competent groups of the Entente and of the United States of America in accordance with the statutes and regulations of each of them. New associations recognised to be needed for the progress of the sciences and their application shall be established forthwith by the Allies and the United States with the contingent co-operation of neutrals. (4) The Governments of the Allied countries and of the United States shall refrain from sending delegates to any international assembly at which representatives of the Central Empires would be expected to figure. It is desirable that the nationals of the Entente countries and of the United States should adopt the same line of conduct and not take part in any enterprise in

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which the nationals of the Empires would collaborate. (5) Inquiry should be made as to the steps to be taken to establish intimate collaboration between the Allies and the United States, particularly in the domain of allied science and in the publication of certain bibliographical works.

THE death is announced of Prof. Samuel Wendell Williston, of Chicago, aged sixty-six. Prof. Williston began his career as one of the collectors employed by Prof. O. C. Marsh in the 'seventies to obtain vertebrate fossils from the western territories of the United States. During the winter season he helped Prof. Marsh to prepare the fossils in the Yale University Museum, and at the same time he pursued medical studies which eventually resulted in his graduating as M.D. He was always a keen naturalist, and, being prevented from publishing his observations on palæontology, he turned to dipterous insects, and soon became one of the leading authorities in America on that branch of entomology. Leaving Prof. Marsh in the early 'eighties, Williston was appointed professor of geology and palæontology in the State University of Kansas, at Lawrence, where he established a flourishing school and brought together a great collection of Kansas fossils. Among numerous important papers he wrote especially on the Pterodactyls and the marine reptiles found in the chalk of Kansas. In 1902 Prof. Williston removed to the newly founded chair of palæontology in the University of Chicago, where he not only continued his researches on Cretaceous reptiles, but also collected and investigated the still more interesting Permian reptiles from Texas and Illinois. His writings form no inconsiderable part of the valuable contributions to vertebrate palæontology received from America during the last thirty years, and several of his devoted pupils and associates have followed worthily in his wake.

BY the death on October 23, at ninety years of age, of Mr. Robert Brudenell Carter, consulting ophthalmic surgeon to St. George's Hospital, the medical profession and the public have lost a striking personality. Since the Crimean War to within a few weeks of his death Mr. Brudenell Carter was a constant contributor to the *Times*. On most medical subjects in which the public was directly interested he contributed leading articles, which were always marked by clear language and sound reasoning. He wrote extensively also on hygienic and educational matters. As examples may be mentioned his paper on the constituents of London dust and its effects on health. His conclusions led him to advocate the substitution in our houses of parquet floors for carpets and the abolition, so far as possible, of blinds and curtains—recommendations which he conscientiously carried out in his own house. His pamphlet on "The Artificial Production of Stupidity in Schools" might still be read with profit by our educational authorities. He was always a strenuous opponent of the so-called system of homœopathy, and his correspondence with the late Lord Grimthorpe in the *Times* on this subject will be remembered. With his purely medical writings, which were numerous, this is not the place to deal, but his book entitled "Eyesight Good and Bad," which was written for the general public, may be mentioned. It was a succinct and clear explanation of the physiology of normal vision and of the causes of its common defects. Mr. Brudenell Carter was an active member of the General Medical Council, a body little known to the public, the most important function of which is to protect the public against improper practices by medical men. The writer was privileged to see him on his ninetieth birthday, and found him lying on a sofa, in full possession of his faculties, and although his voice was weak, he discussed freely and with his usual good sense the topics of the day.

THE Christmas course of juvenile lectures at the Royal Institution will be delivered by Prof. D'Arcy Thompson upon the subject of "The Fish of the Sea."

THE FitzPatrick lectures of the Royal College of Physicians of London will be given at the college at 5 o'clock on November 12 and 14 by Dr. Arnold Chaplin. The subject will be "Medicine in England during the Reign of George III."

THE death is announced in the *British Medical Journal* of Dr. F. F. Wesbrook, president of the University of British Columbia, formerly professor of pathology in the University of Manitoba, and professor of public health and bacteriology in the University of Minnesota.

THE death is announced, in his sixty-fourth year, of Prof. William Leslie Hooper, who had been professor of electrical engineering at Tufts College, Massachusetts, since 1890. He had previously been for seven years assistant professor of physics in the same institution. Prof. Hooper was the author of "Electrical Problems," published in 1902.

MAJOR BAIRD, Parliamentary Secretary to the Air Board, announced in the House of Commons on November 3 that the post of Medical Administrator of the Board has been offered to Col. M. H. G. Fell, C.M.G. One of the conditions of the office is that the Administrator will be guided by the principles laid down by the Watson-Cheyne Committee. Col. Fell is at present engaged in visiting stations in this country and abroad, and his answer has not yet been received.

IN the *Times* of October 29 Col. H. A. Haines describes the discovery of a human skeleton with military equipment in a shallow grave in the chalk near Rochester, Kent. The feet of the skeleton were directed eastward, a spear-head lay near the right shoulder, and the boss of a shield was found over the ankles. Another piece of iron occurred behind the waist. Writing in the same newspaper on October 31, Sir Hercules Read points out that the burial may be regarded as that of a Jutish settler in Kent of the fifth or sixth century. The fragment of iron near the waist may have been either a knife or a strike-a-light to be used with a flint.

THE second national reunion of the Argentine Society of Natural Sciences will be held in Mendoza in the spring of 1919. We have just received Nos. 14 to 16 of *Physis*, the society's journal, which shows much activity, especially in entomology and botany. In No. 16 Mr. Carlos Ameghino returns to the subject of fossil man at Miramar, where the numerous implements are supposed to be contemporaneous with the remains of extinct mammals. Among other implements he describes and figures bolas of the modern South American type made of fossil bone. He arrives at the remarkable conclusion that while Europe was still inhabited by men of the Neanderthal race, Argentina was already peopled by advanced tribes of *Homo sapiens*.

THE annual Harveian oration was delivered by Dr. Percy Kidd at the Royal College of Physicians on October 18. The subject was the doctrine of consumption in Harvey's time and to-day. Dr. Kidd surveyed the views of medical writers on phthisis or

consumption from the time of Hippocrates. The seventeenth century, which produced Harvey's great work on the circulation, constituted an epoch in the study of consumption, and two names stand out pre-eminently in this connection—Franciscus Sylvius and Richard Morton. The latter had a clear conception of the nature of consumption of the lungs, stated his opinion that the formation of tubercles constitutes the first stage in the phthisical process, and recognised a special scrofulous variety of the disease. Both Sylvius and Morton insisted upon the contagious nature of the affection. The work and views of subsequent investigators were reviewed, and, finally, the recent results of a statistical investigation by Brownlee, indicating that there are at least two types of phthisis, were commented upon.

IN connection with the Sir Walter Raleigh tercentenary, of which we gave an account last week, we are reminded that there is some reason for regarding Raleigh as one of the pioneers of evolution. He was not far from the general idea of transformism. Thus in his "History of the World" (book i., chap. vii.) he says: "For mine owne opinion I find no difference but only in magnitude between the Cat of Europe and the Ounce of India. . . . The common crow and rooke of India is full of red feathers in the droun'd and low islands of Caribana, and the blackbird and thrush hath his feathers mixt with black and carnation in the north parts of Virginia. The Dogfish of England is the Sharke of the South Ocean." What is suggested is certainly that one kind of animal may have diverse forms in diverse conditions. Raleigh goes on to say that differences in colour and magnitude cannot make "a difference of Species," using the argument that if they did it would be necessary to regard negroes, not as men, but as some kind of strange beasts; "and so the giants of the South America should be of another kind than the people of this part of the World"; and he adds: "We also see it dayly that the nature of fruits are changed by transplantation." It need scarcely be said that Raleigh did not see the transformation of species as Darwin saw it, but the general idea of transformism was surely his.

A COLLISION, when the vessel on which he was returning on leave from West Africa was within three hours' steaming from Holyhead, caused the death, on October 3, of Mr. C. O. Farquharson, mycologist in Nigeria. A graduate in arts and in science of the University of Aberdeen, Mr. Farquharson was a student of the best type, more keen to know thoroughly what he set himself to learn than preoccupied with mere success in examinations. Botany was especially attractive to him, and he proved himself acute and trustworthy in personal investigation of problems in both field and laboratory. He devoted attention to the parasitic fungi, and gladly accepted the position of mycologist in Nigeria. Mr. Farquharson threw himself into the duties with whole-hearted enthusiasm, striving to gain the fullest knowledge of the methods likely to prove helpful in the discovery of the causes and treatment of diseases of economic plants, not confining his attention to those due to fungi. He was also interested in the endeavour to obtain improved races of such plants, whether native or introduced. Moreover, he did good service in the investigation of the botany and entomology of Nigeria, as evinced by a paper on the Myxomycetes of that territory in the *Journal of Botany* in 1916, and by collections and notes on insects communicated to Prof. Poulton. Mr. Farquharson first began to study insects under the influence of Mr. W. A. Lamborn, who, as Government entomologist, became his colleague at Moor Plantation, Ibadan, Southern Nigeria, in May, 1913. After Mr. Lamborn's departure in May, 1914, he corresponded with Prof. Poulton, his last letter being dated August 31, 1918, the day before he sailed in the ill-fated *Burutu*. Mr. Farquharson was a very acute and patient naturalist, who was instinctively drawn to attack the most obscure and difficult problems of bionomics. Many of his valuable observations on insect life, especially on ants and the forms associated with them, are published in the Proceedings of the Entomological Society from December, 1913, onwards, and it is confidently believed that the appearance of his unpublished work will show even more clearly how high were the hopes that perished with him. Mr. Farquharson's character and disposition were such as to win him affection and respect, and his death brings a sense of grievous loss to those who knew him intimately. His place will be difficult to fill. He was in his thirty-first year.

THE Calcutta Mint has overcome the difficulty of supplying metals for coinage during the war owing to increasing demands and recent withdrawals of the old copper pieces. The difficulty of procuring nickel was serious, until it was noticed that the ordnance factories were advertising for sale as scrap large quantities of cupro-nickel derived from used bullets, but contaminated with lead. This metal was utilised in the Mint, and as many as 226 tons of cupro-nickel were used in this way in producing 2,750,000 two-anna nickel pieces issued during the closing months of last year.

IN the Journal of the Royal Anthropological Institute (vol. xlviii., part i., 1918) Prof. H. J. Fleure and Miss L. Winstanley contribute a paper on "Anthropology and our Older Histories." The Irish chronicler Nennius, the "Brut," and Geoffrey of Monmouth are examined in connection with early race movements. The evidence is naturally scrappy and uncertain, but the authors suggest that studies of this kind may be a connecting link between history and anthropology, the distributional examination of place-names being of linguistic value. "Thus archæology and anthropology hint at an unsuspected value of the older and supposedly legendary historians, and suggest that even the chronology of these older historians may have a good deal behind it."

AN interesting case of complete absence of sensations from skin receptors, and of some other special senses, is described in the *Lancet* of October 19. The senses absent are touch, both superficial and deep, pain, heat and cold, muscular sense, taste, and smell. The state has been present for twenty years, but the subject possesses more than the average intelligence. In the absence of guidance from the eyes, he is unable to make any movement as requested, saying that he has no knowledge of whether he is making any movement or not. On the other hand, the more automatic movements of walking and swimming, not requiring conscious co-operation, can be executed correctly without the eyes. It is also clear that the proprioceptive mechanism of the muscles is intact, since, with eyes closed, the limbs can be placed by another person in any position and remain there (Sherrington's "plastic" phenomenon), although the patient is unaware of what position they are in. With visual control, all movements are perfectly normally executed. The subject is ignorant of any feelings of fatigue, and seems to be devoid of most forms of emotion. He has no love of country or of home, and makes neither friends nor enemies. Nevertheless, he is an efficient soldier, and always willing to help in hospital work.

THE annual report of the Department of Fisheries for Bengal and Bihar and Orissa is officially limited to a maximum of eight pages. Mr. Southwell, the Director of Fisheries, gives a short summary of the work of his department, a list of papers relating to marine and fresh-water biology published elsewhere, and a general account of the fishing industry so far as it comes within his cognisance.

THE annual report of the Dove Marine Laboratory at Cullercoats deals with marine biological investigations carried on along the same general lines as in past years. The report on the routine examination of samples of local herrings is interesting in that it suggests changes due to restricted fishing on the East Coast. Up to 1915 the herring shoals were characterised by the predominance of fish of four years of age (that is, herrings with three winter rings on the scales), but in 1916 and 1917 the North-East English shoals contained a majority of five-year-olds. Spawning apparently occurred at the end of August and the beginning of September. Other papers in Prof. Meek's report deal with the growth rates and numbers of ecdyses in Crustacea and with plankton and general faunistic research. Prof. Meek's paper on the growth of Crustacea is noteworthy as an attempt to clear up much that is confusing with regard to this matter.

THE *Fish Trades Gazette* of October 26 contains an interesting article on "Fisheries Reconstruction in Germany," in which the author summarises a memorandum prepared by the Economic Union of the German Deep-sea Fisheries. A great deal is being done in the sphere of technical and scientific research. At Munich "there has been founded a great research institute for the study of the chemistry of food—a direct result of the difficulties from the war—with, in the meantime, a temporary home in the University. It is meant to serve the interests of the whole Empire, and will be richly endowed. A sum of from 3,000,000 to 4,000,000 marks (150,000*l.* to 200,000*l.*) has been set aside for building and equipment, and the annual endowment will be between 100,000 and 200,000 marks (5000*l.* to 10,000*l.*). The director is Prof. Dr. Theodor Paull. . . . In the section dealing with fish it is intended to make researches on the chemical composition and digestibility of fish of every species, fresh and preserved; on the influence of cold and other agents on its preservation and transport; on various methods of preparing fish for the table; and on the so-called 'fish-poison,' or poisoning by bad fish."

NOW that ferro-concrete shipbuilding seems to have come to stay, it is interesting to note that, according to *Hansa* for September 14, no composition is necessary to protect ships' hulls from attack by sea-water. This opinion is expressed as the result of several observations on ferro-concrete structures in German harbours.

A FACTORY has been started in Sweden, according to *Teknisk Ukeblad* for August 30, for extracting oil from alum schist. Large quantities of this schist are found in the Lamma Nerika district, yielding benzine and crude oils. The latter can be used for oil-engines or converted into paraffin and lubricating oils. The factory can treat 30,000 tons of schist per annum, giving 1200 tons of oil. The supply of schist in Sweden is practically inexhaustible, and other similar factories will shortly be started.

WATER is decomposed by electric current at the rate of 0·3354 grm. per ampere per hour. The products are 0·416 litre of hydrogen and 0·208 litre of oxygen from the quantity of water named. If, when suitable arrangements for setting up hydraulic pressure have been made, a current be passed through the water, decomposition will take place, and the gases generated will produce pressure of any desired intensity. According to the *Chemiker-Zeitung* (September 4), it is possible to produce pressures as high as 1860 atmospheres in this way.

IN an article in the May and July issues of the *New Zealand Journal of Science and Technology* Mr. M. A. Eliott describes the growth of the frozen-meat industry of New Zealand, and maintains that the demands on it will be still further increased after the war. At the present time about six million sheep and lambs and a quarter of a million cattle are exported per annum, a fleet of fifty properly insulated steamers equipped with refrigerating machinery, and making two and a half journeys per annum, being engaged in the trade. Cold stores have recently been erected in the Colony capable of holding one year's export. The Home Government is alive to the importance of a food supply such as this, and has appointed a Food Investigation Board to deal with the problems arising out of the preservation, storage, and transport of food materials.

PROF. J. T. LUNDBYE, in a paper read recently before the Danish Society of Engineers, gave an account of the various units of light used in European countries, and the intensity of light required for satisfactory illumination under various conditions. A simple method is given (*Ingeniøren*, August 28) for obtaining the intensity of light by measuring the distance at which letters of known size can be read with different lights. Up to a certain point this distance increases very rapidly with the intensity of light, but when the intensity exceeds a certain limit the increase in distance is small. A pair of smoked glasses, which intercept a known quantity of light, and a decimal rule are the only apparatus required. The luminous intensity is found by measuring the distance at which a given specimen of print can be seen through smoked glasses, and then measuring the distance at which it can be seen without them. The ratio between these two operations forms a measure of the luminous intensity.

PROF. KAMMERLINGH ONNES has recently succeeded in demonstrating the possibility of the existence of permanent electric currents without the action of an e.m.f. The resistance of conductors vanishes very suddenly below certain critical temperatures, and a conductor brought to the non-conducting state can carry currents up to a critical value, above which the resistance suddenly reappears. The super-conducting state is not attainable when the conductor is exposed to a magnetic field above a critical value. Tests are described (*Schweizerische Elektrotechnische Zeitschrift*, August 31) in which a current was induced in a lead spiral in its super-conducting state, and continued to flow with a decrease of only 1 per cent. per hour.

IT is common knowledge that the general methods of running boiler plants are not efficient. A good deal of attention has been given recently in the technical Press to the scientific control of steam-raising plants, and the first of a series of articles by Messrs. Brownlie, Compston, and Royse on exact data on the running of steam-boiler plants appears in *Engineering* for November 1. During the past ten years the authors have tested 250 typical steam-boiler plants, comprising 1000 boilers. The present article deals with the efficiency of the economiser. This appliance generally consists of rows of vertical cast-

iron pipes placed in the flue between the boilers and the chimney. The feed-water passes through the pipes on its way to the boilers, and takes up some of the heat from the waste furnace gases, which thus reach the base of the chimney at a temperature lower than would otherwise be the case. The exterior surfaces of the tubes are kept clean by scrapers, which travel automatically up and down the tubes. In 155 plants fitted with economisers the average efficiency of the appliance was 11·4 per cent. The possible practical efficiency is 17½ per cent. to 20 per cent. Only 17 per cent. of the plants were saving 15 per cent. or more of the coal-bill, and more than 30 per cent. of the plants were saving less than 10 per cent. The fault does not lie with the economiser as an appliance, but is due to the fact that the economical generation of steam is not understood, and economisers are often not installed on correct lines. The authors estimate that a saving in this country of from 7,000,000 to 10,000,000 tons of coal per annum could be obtained by the use of economisers installed on correct scientific lines.

THE Décimal Association, 212 and 213 Finsbury Pavement House, Finsbury Pavement, London, E.C.2, has published in pamphlet form the article on "The Metric System and Decimal Coinage" contributed by Mr. Harry Allcock to the issue of NATURE for June 6, 1918. It will be remembered that the article was concerned with the attitude towards the metric system of weights and measures and decimal coinage taken by Lord Balfour of Burleigh's Committee on Commercial and Industrial Policy after the War, and it was shown that the decisions arrived at were open to serious criticism.

DR. L. L. FERMOR has pointed out to us, in connection with our notice of his recent paper on hollandite (NATURE, vol. ci., p. 392), that he used the term "bipyramidal" as a synonym for the older "pyramidal" in the paper itself. He also shows that the name "romanéchite" is correctly accented, according to French usage, although derived from the place-name Romanèche, a good analogy being the three words *cher, chère,* and *chéri.*

THE LIBRARY PRESS, LTD. (26 Portugal Street, W.C.2), will publish shortly a translation, by B. Miall, of Prof. J. Amar's "The Physiology of Industrial Organisation and the Re-employment of the Disabled." The book is being edited by Prof. A. F. Stanley Kent, who will supply to it an introduction and notes.

OUR ASTRONOMICAL COLUMN.

THE DARK-LINE SPECTRUM OF NOVA AQUILÆ.—Dr. J. Lunt has sent to NATURE some interesting details relating to the transient dark-line spectrum of Nova Aquilæ, as photographed at the Cape Observatory with the McClean spectrograph on June 10, 11, and 12. Apart from the bright and dark hydrogen spectrum which was in process of development, the spectrum was a continuous one crossed by a true absorption spectrum consisting principally of the enhanced lines of titanium, iron, chromium, strontium, calcium, magnesium, and helium. As shown by iron comparison spectra, the entire series of lines was displaced to the violet by an amount representing a radial velocity of 1500 km. per second (June 11 and 12). The violet edges of broad absorption lines, left partially uncovered by broad bright bands, do not appear to be in question, and the displacement is regarded as a true Doppler effect, due to the actual motion of a stellar body possessing an intensely heated atmosphere of metallic vapours. As in the case of other novæ, the fine dark H and K lines appeared nearly in their normal positions, but Dr. Lunt thinks it erroneous to consider their small displacements as representing the velocity of the star; it seems to him more probable that these lines do not originate in the nova itself, but in a nebulous mass lying in the line of sight. The residual incandescent and disturbed nebulous matter left behind after the passage of a rapidly moving star into a nebula would seem to offer a sufficient explanation of the bright-line spectrum. To account for the supposed enormous velocity of the nova, Dr. Lunt suggests that our own system may have a velocity comparable with those found for spiral nebulæ, and that the velocity may result, in part from this motion, and in part from the high velocity of a wandering star which has come from outside our system.

As in Nova Geminorum, there were two sets of dark hydrogen and helium lines during the earlier stages, the first of which showed the same displacement as the enhanced metallic lines. On June 15 the second set had become comparatively narrow and sharp, and showed a displacement equivalent to 2286 km. per second; except for the K line, these have no counterpart in the enhanced line spectrum, and their meaning remains obscure.

OBSERVATIONS OF MINOR PLANETS.—Shortly before the outbreak of war an important international scheme of work on these bodies had been arranged, to secure that all should be sufficiently observed without waste of labour through overlapping. Though the organisation was shattered by war, the observations continue. Marseilles Observatory undertook the circulation of ephemerides and information generally; the recently published *Journal des Observateurs* (vol. ii., No. 9) contains observations of sixty-six planets made during the past year by MM. Gonnessiat and Sy at Algiers Observatory. They include some positions of Juno and Vesta. It is a matter for regret that the Nautical Almanac has discontinued its ephemerides of the four principal asteroids. No predicted positions of them are now available except the approximate ones in the list published annually at Berlin.

A BRIGHT METEOR.—*Astr. Nach.* (No. 4961) cantains an account of a bright meteor which fell near Treysa, in Hessen, 9° 10′ E. Gr., 50° 55′ N., on 1916 April 3, 2h. 25m. G.M.T., the sun's altitude being 30° 50′. It was seen over a circle of 135 km. radius, and heard over a circle of 50–60 km. radius, besides a few isolated points at 100 km. distance. The earth-point was calculated, and a prolonged search at length revealed the meteor in a wood. It had made a hole 1·60 metres deep, at an inclination of 60° to the horizon, in a direction from N. 15° W. to S. 15° E., agreeing well with the calculated values. It was composed of iron, and weighed 63 kg. A. Wegener, whose calculations led to its discovery, estimated that its final velocity was in the neighbourhood of 1 or 2 km./sec. The position of the radiant inferred from the observations during flight is 357°+80°, and from the direction of the hole in the ground 20°+78°. The difference is only 5° in great circle.

THE HOT WORKING OF STEEL.

IT is generally held that, in order to obtain the best mechanical properties of which a steel is capable, it is necessary, after having cast it in the form of an ingot, to subject it to a large amount of deformation either by forging or rolling or pressing at a high temperature. Many official specifications, in fact, require a given reduction of the original section of the ingot. These requirements are expressed as "the coefficient

of working," which is equivalent to the ratio of the initial to the final section, or, what comes to the same thing, that of the final to the original length. The minimum values assigned to this coefficient are generally three or four, and sometimes higher. Doubts as to the necessity of this, however, have been raised. Prof. Howe, in his treatise "The Metallurgy of Steel," after weighing the evidence on the subject, wrote many years ago that "cumulatively the evidence raises a presumption in favour of the view that the supposed special effect of kneading and pressure, as such, does not exist or is relatively unimportant." Prof. Tchernoff, the eminent Russian metallurgist, has gone even further, and claims to have proved that the effects of forging can be produced by heat treatment alone. In view of the great practical importance of the question, it is somewhat surprising that it has not been made the subject of decisive experiments until quite recently.

Much experimental work is, of course, carried out in metallurgical works which is never published, and from the character of the discussion on M. Charpy's paper entitled "The Influence of Hot Deformation on the Qualities of Steel," presented at the autumn meeting of the Iron and Steel Institute, it would appear that a certain amount of information on this subject is already available. Nevertheless, M. Charpy is entitled to the credit of having been the first in recent years to attempt to obtain an answer to the question with the view of publishing his results and submitting them to discussion.

M. Charpy's experiments may be classified under two heads. In the first place, he attempted to trace the actual character of the deformation when steel ingots are worked either by hot forging or hot rolling. By ingenious methods he was able to show conclusively that in the former the deformation is very far from uniform, that extremely variable local deformations are produced, and that in a given instance, where the mean coefficient of working was 4·8, the extreme values were 2·37 and 7·30. This was one of the simplest cases possible, namely, the transformation of a cylinder into one of smaller diameter; and there can be no question that in a more complicated forging the local deformation would be even more diverse. In the latter case the deformations are very much more regular, and they may be considered as practically uniform. At any rate, lines originally parallel with the axis of rolling were shown to remain rectilinear and parallel during the course of deformation.

In the second place, the author describes certain experiments, designed with great care, to determine the influence of hot working on the properties of the steel. Test pieces prepared from rolled bars, in which the coefficients of working were 1·7, 3·2, and 6·1, were subjected to tensile tests, impact-bend tests, and impact tests on notched bars. The test bars were all cut from the same parts of the ingot, and were situated at one-third of the distance between the surface and the axis so as to avoid the influence of segregation and axial porosities. The bars were quenched and annealed under exactly similar conditions. It was found that the hot rolling of the steel does not appreciably affect the tenacity or elongation either longitudinally or transversely, but that it improves the reduction of area and resistance to impact longitudinally, and considerably diminishes these values transversely. The extent of the variation depends on the quality of the steel, and is more marked the lower its purity. This is a very important result to have established, for it shows that the effects of hot mechanical work must be considered as they affect the properties of the steel both longitudinally and transversely. The author declares that the favourable influence attributed to hot working rests solely on the fact that, in the great majority of cases, only the results of longitudinal tests have been taken into consideration, and that the conclusions arrived at have been unwarrantably extended to materials where the main stress is transverse. His conclusion is that for pieces working under transverse stresses, such as guns, longitudinal extension by hot working has undoubtedly an injurious effect, and that, so far from specifying a minimum reduction of cross-section of the original ingot, it would be much better to reduce it as little as possible. H. C. H. CARPENTER.

EDUCATION AND LIFE.

AMONG the Acts which will make memorable the closing session of the present Parliament none will be held of more momentous import than the Education Act of 1918, limited in its scope to England and Wales; or the scarcely less important measure dealing with Scottish education, which passed its third reading in the House of Commons on October 17. Both measures will have a potent effect on the future education of the two kingdoms, and be fruitful of great results for the educational and physical well-being of the children of the nation. It is therefore to be regretted that Prof. Robert Wallace, professor of agriculture in the University of Edinburgh, should have thought it well to occupy the attention of his students, on the occasion of the opening of the University session on October 8, with a denunciation of the policy of both measures, and that he has now issued and circulated the lecture as a pamphlet (Edinburgh: Oliver and Boyd, price 6*d*.) to Members of Parliament and the Press. Prof. Wallace is apparently persuaded that children between the ages of eight and fourteen should, for their practical instruction, participate actively in agricultural and manufacturing industry on the ground that 85 per cent. of the children of the nation must earn their living by hand-labour, and he would therefore introduce them at a tender and immature age into close intimacy with adults in field, factory, and workshop.

That is not, in the estimation of most thoughtful persons, parents, teachers, and administrators, a desirable policy to pursue in the best and permanent interests of the children and of the nation. Both measures provide not only for a fairly adequate training in literature and in science, but also for effective, practical instruction for both eye and hand, as well as for the physical health and training of the child, and that at just the period of his life when he is most susceptible of treatment and of the permanent effect of such training. Few Acts have been subjected to so large a measure of public discussion as the Education Act of 1918, or have won so general an approval. Its chief purpose, whilst providing for the general well-being of the childhood of the nation, so vital a matter in present circumstances, is to give full opportunity for those who are naturally gifted to share in the highest educational advantages which the nation can offer. Despite Prof. Wallace's strictures, it is demonstrable that the Education Act of 1870 has had a marked effect on the moral health of the nation; for whilst in 1865 70 per 10,000 of the population were convicted of crime, fewer than 30 per 10,000 were so convicted in 1913. And there is abundant testimony, some of which was cited by Mr. Fisher on the introduction of his measure, to the wonderful initiative and intelligent grasp of the young men trained in the elementary schools who, in their scores of thousands, joined the national forces

in 1914. The crux of the success of both measures lies with the teachers, who must now, whatever the cost, alike in respect of payment, prospects, and pensions, be attracted to the most vital and worthy of the national services.

THE SCOTTISH JOURNAL OF AGRICULTURE.

THE appearance of an official organ of the Board of Agriculture for Scotland marks an important development in the activity of that body, which, though created but six years ago, has already accomplished much good work in the development and guidance of agriculture and forestry north of the Border. On the educational side of its work it has co-ordinated under its ægis the agricultural colleges and other educational agencies with a success which is noted with warm approval in the report of the Agricultural Sub-Committee of the Reconstruction Committee. Much useful information has also been furnished for the Scottish farmer in the annual reports and leaflets issued by the Board. Its rapidly growing activities rendered inevitable, however, the creation of some more suitable medium of publication of matters of general interest to the agricultural community, and this has been found in the new journal, of which the first three quarterly issues are now available. In appearance and general character the *Journal* is not unlike the older-established *Journal* of the English Board, but the resemblance is little more than superficial, and the design to cater for the specific needs of Scotland is clearly evident throughout.

Original articles of educational value form the most prominent feature, and are supplemented with notes on varied topics of current interest, summaries of official notices and statistics, and a useful review of recent agricultural periodical literature.

The interest aroused in practical circles in Scotland, as in other parts of the kingdom, in the subject of the costs of production of agricultural products is indicated by the inclusion of articles on this subject in each of the three issues, no fewer than four articles dealing with the cost of production of milk alone. Crop production is represented by articles on oats, potatoes, and flax. Other articles selected at random, such as the effects of the war on Scottish forestry, the improvement of hill pasture, the restocking of deer forests, farmers and income tax, rural housing, and women's institutes, illustrate the varied and interesting character of the problems discussed, and incidentally the wide scope of the activities of the Board.

The *Journal* is secure of a hearty welcome from the Scottish agricultural public, and will assuredly in due course be in considerable demand throughout far wider circles of British agriculture as a standard educational publication. C. C.

CHEMISTRY IN EDUCATION AND INDUSTRY.[1]

IN the early eighties of last century the great Livery Companies of the City of London combined for the promotion of technical and scientific education in this country; by reason of their great wealth, the administrative capacity at their command, and their complete freedom from State interference, the City Companies were admirably fitted for this task. Amongst their circle they numbered many men of high scientific and technical standing, such as the late Sir Frederick Abel and Mr. George Matthey, both of whom worked nobly to ensure the success of the new movement. Without describing in more detail the scheme which was adopted, it will suffice to note that the great Livery Companies established and financed, first, the City and Guilds Technical College, and, a year or two later, the larger Central Institution at South Kensington. Both these institutions were designed with the view of popularising scientific and technical education and of counteracting to some extent the overwhelming influence of the older universities; both Oxford and Cambridge, with their glorious history and their scholastic traditions, remained very exclusive, and contributed but little at that time towards the advanced teaching in pure and applied science of which our country stood in urgent need.

We have always been accustomed to attribute importance to aristocracy of birth and family position. This attitude is probably sound; other things being equal, the son of able and influential parents is more likely than another to exhibit ability and a sense of responsibility; we find no cause to revise this opinion in the light of the record of our great families during the last four years. During recent times, however, the conclusion must have thrust itself more and more upon us all that there is another aristocracy, equal in nobility to the first, if not greater—an aristocracy of real achievement and of intellectual attainment. Promotion to this modern aristocracy is slow and painful, but is worth attaining; it can be attained by any young man who possesses the requisite physical and mental equipment. The City Fathers understood this forty or fifty years ago; they realised that one of the greatest needs of the British Empire was the proper utilisation and cultivation of every intellectual talent latent in its children; they believed it desirable that these potentialities should be directed into the wide channels opened by the advance of science and the exploitation of the scientific industries. Acting upon these convictions, they founded our two colleges.

As time went on, the municipal authorities established technical schools and similar institutions broadcast, and the initial striking success of the City and Guilds Colleges waned somewhat under the stress of competition. Although the instinct which guided the Livery Companies in their great scheme of technical instruction was sound, one cannot but think that that instinct played them false at a later date; the closing of the chemical laboratories at the Central Technical College was a real calamity to the nation, as well as a disaster to science. The country needed facilities for still more advanced education and research in applied science—needed them so urgently that the Government has had to provide them at South Kensington. An institution for this purpose established under the auspices of the City Companies could scarcely fail to become really great, whilst under Government administration it incurs some danger of becoming merely colossal.

The scheme initiated by the City and Guilds of London some forty or fifty years ago, having for its object the promotion of scientific and technical education, attracted a number of ardent teachers well known to us all, of whom F. W. Streatfeild was one. With the collaboration of this band of workers the new movement rapidly became fruitful, not only by pouring a host of well-trained workers into the scientific industries of the country, but also by the way in which its very success stimulated other public bodies to emulation, and ultimately provoked intense competition. Since, as we have had to deplore, the original scheme was not raised above this competition by a further spontaneous effort of its initiators, it is only gaining but slowly upon its initial success. At the same time,

[1] From the first Streatfeild Memorial Lecture delivered at the City and Guilds Technical College, Finsbury, on October 17, by Prof. W. J. Pope, F.R.S.

this college remains still flourishing and still fulfilling an essential function amongst the educational institutions of the country.

It is possible to discern roughly three recent periods in the historical development of the teaching and study of pure and applied science in Great Britain. First, the half-century preceding 1914, when progress was comparatively slow owing to the apathy of the general public towards all branches of exact knowledge. During this period our former teachers played a prominent part both as teachers and as propagandists, but progress in our scientific industries was impeded, not only by general and official ignorance, but also by stern competition from the Continent. The second period is one of transition; it embraces the last four years, and is now rapidly coming to an end. In the autumn of 1914 practically all branches of technical production in this country were on the verge of breakdown owing to the sharp arrest of imports of numberless chemical and engineering products, many of them of small financial importance, but all of them essential to our technical production. The whole nation realised, suddenly but tardily, that the neglect of applied science had brought it to the brink of ruin. The last four years of transition have been a period of unprecedented technical activity in Great Britain; during this time we have had to learn how to manufacture multitudes of scientific products which we were previously content to purchase ready-made from abroad, and the whole country has become one vast chemical and engineering workshop. When the history of this time of stress comes to be written it will be made clear that the rapidity and success with which this country has organised its scientific industries and brought them to a production of essentials far exceeding that of Central Europe are entirely miraculous.

The third period, the period of reconstruction, lies in the immediate future, and we see every sign that it will be accompanied by unexampled developments on both the chemical and engineering sides of technical science. During the past four years a vast provision of chemical and engineering equipment has been accumulated; our country has regained control of all the sources existing in the Empire of raw materials which had been previously exploited by Germany, and our people have been learning that this war was rendered possible only by British neglect of applied science, and particularly of chemical technology. Within this period the country has become an enormous producer of such necessary materials as oleum—fuming sulphuric acid—and nitric acid; these are the prime essentials of a flourishing chemical industry. It has also undertaken with success the manufacture of large numbers of fine chemicals, such as coal-tar dyes and pharmaceutical products. The country now produces materials like tungsten and similar metals essential to the manufacture of hardened steels of different kinds for use in cutting-tools, armour-plate, and the like. The installation of works processes for these has been effected hurriedly, and years of careful technical investigation will be needed in order to improve methods and establish processes upon an economical basis. Inasmuch as success in applied science is possible only through the intensive cultivation of pure science, it is to be foreseen that before us lies a period of great scientific and technical activity in Great Britain.

The importance of all this lies in the fact that the future is in your hands. Streatfeild, Castell-Evans, Meldola, Thompson, and Ayrton, who have passed away, and other veterans happily still with us, like Perry and Armstrong, did their best work in the first of our three periods; the men of my generation are expending their energies in the present transitional period. It is upon the students now at college that the main burden of the coming reconstructional work will fall. If you carry out your work with the success achieved by Streatfeild and his colleagues in the performance of their duties, if you approach your future work in the spirit with which my contemporaries have attacked theirs, we need have no doubt that this Empire of ours will continue to influence the world for good long after you and I are dead and forgotten.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The installation of the new Chancellor, Lord Robert Cecil, is to take place on November 12 in the Town Hall. The occasion is to be marked by the conferment of honorary degrees on the French and Italian Ambassadors, Sir George Buchanan, Mr. Austen Chamberlain, Mrs. Fawcett, Sir Maurice Hankey, Lord Moulton, and Lord Phillimore. The following representatives of other universities are also to be present at the ceremony:—Sir Alfred Dale (Vice-Chancellor of Liverpool), Sir Gregory Foster (Provost of University College, London), Prof. Gillespie (Pro-Vice-Chancellor of Leeds), Dr. Alex. Hill (Principal of University College, Southampton), Sir Isambard Owen (Vice-Chancellor of Bristol), and Prof. Ripper (Vice-Chancellor of Sheffield).

LONDON.—The following have been elected deans of faculties for the period 1918–20:—*Medicine:* Sir Bertrand E. Dawson (London Hospital Medical College); *Science:* Prof. A. N. Whitehead (Imperial College, Royal College of Science); *Engineering:* Prof. H. C. H. Carpenter (Imperial College, Royal School of Mines); and *Economics:* The Hon. W. P. Reeves (London School of Economics).

THE nineteenth annual general meeting of the Association of Public School Science Masters will be held on Tuesday, December 31, and Wednesday, January 1, and will be opened with an address by the president, Sir Ronald Ross. The subjects to be discussed are:—The importance of restricting specialisation in university scholarship examinations and giving weight to general education; the modernisation of the teaching of biology; the position of systematic biology and kindred subjects in a school course; science in the general education of boys; the teaching of elementary science by the form master; the difficulty of securing diligence and accuracy in teaching general science to small boys; and courses in general science for Sixth Forms, both classical and non-classical.

TEACHERS of geography will be interested in an account by Miss Christina Krysto entitled "Bringing the World to our Foreign-language Soldiers," published in the August issue of the *National Geographic Magazine*, which describes the methods of teaching at Camp Kearny, California. Ordinary handbooks were found useless for the purpose of teaching the facts of the geography of Europe to Mexican and other foreign recruits. The first step was a series of conversations intended to lead the pupils to the understanding of new facts. These were supplemented by geographical charts with photographs. The comparison of the distinction between the results gained in the case of Italians and Mexicans is full of interest, and will supply useful suggestions for the teaching of geography after the conclusion of the war.

THE current calendar of the Merchant Venturers' Technical College, in which the faculty of engineering of the University of Bristol is provided and maintained, gives particulars of the exemptions accorded to graduates of the University and students of the faculty by various examining bodies and learned societies. The Institution of Civil Engineers recognises the B.Sc. degree with honours in civil or mechanical engineering as exempting from examination for associate membership if a regular course of study, occupying not less than three academic years, has been pursued in the University. The institution also recognises the pass degree as exempting similarly if, in addition to the other conditions, the entrance examination to the engineering course in the University has been passed in the subjects prescribed by the institution. These degrees are also similarly recognised as qualifications for appointments as assistant engineers in the Public Works Departments of India and Egypt. The possession of the B.Sc. degree in civil or mechanical engineering is allowed to count as one year towards the three years' practical training required by candidates for the appointment of Assistant Civil Engineer in the Works Department of the Admiralty. The B.Sc. degree in mechanical engineering exempts from the associate membership examination of the Institution of Mechanical Engineers, and the degree in electrical engineering exempts from examination for the associate membership of the Institution of Electrical Engineers. Finally, the B.Sc. degree, or success in the intermediate examination for that degree, is accepted in lieu of the Army entrance examination.

CERTAIN representative science teachers and others interested in natural science in Yorkshire have decided to form an association with the object of encouraging a broad outlook on scientific problems, and of providing a means whereby they may be kept in touch with modern scientific views. The hearty support given to this proposal from many quarters justifies the view that such a natural science association would be welcome in Yorkshire, and a provisional committee has been appointed to undertake its organisation. Its aims have been formulated as follows:—(1) To afford opportunity for intercourse and co-operation amongst those interested in natural science (chemistry, physics, botany, zoology, and other natural sciences); (2) to discuss the teaching of science in all its bearings; (3) to discuss modern developments in science, and the applications of science in industry; (4) to arrange for visits to places of scientific interest; and (5) to afford a medium for the formulation of collective opinion upon matters affecting the place of science in the life of the community. Membership will be open to all who are interested in the objects of the association, and it is proposed that the subscription shall be 5*s*. per annum. The inaugural general meeting will take place on Saturday, November 23, at 3 p.m., in the University of Leeds, when the president-elect, Prof. W. Bateson, will deliver an address on "Science and Nationality." All who are interested in the movement are cordially invited to be present. Any further information may be obtained from the chairman of the provisional committee, Dr. Harold Wager, the University, Leeds, or from the hon. secretaries, Mr. F. Fairbrother, the Grammar School, Leeds, and Miss R. F. Shove, the University, Leeds.

M. PAUL OTLET has an interesting article on "Le traitement de la littérature scientifique" in the *Revue générale des Sciences* for September 15–30. His claim is that Governments should give more attention to the various methods by which the results of scientific investigation can be made widely known. Among such methods he includes the publication of periodicals, abstracts, annual reports, bibliographies, dictionaries, and text-books. As an example to be followed he quotes the International Institute of Agriculture at Rome. This institute, founded in 1905 by international co-operation, has already an income of 900,000 francs, possesses a library of 70,000 volumes and pamphlets, and receives annually 2600 reviews and journals sent to Rome from the fifty-six co-operating countries. The institute issues three monthly bulletins, two annual volumes of statistics, three other publications appearing once or twice a year, a bibliography of agronomy, and many special monographs. M. Otlet looks forward to the foundation of a similar institute for science, supported by all the Governments of the world, or, at all events, by the Allied Governments. The International Catalogue of Scientific Literature would be a part of this institute, which would also publish abstracts of all scientific papers and periodical *résumés* of work in special branches of science, possess a library to which all scientific periodicals should be sent as they appear, and make arrangements for lending books and papers to subscribers. Finally, M. Otlet asks for an international or inter-Allied investigation into the whole domain of science (pure, applied, economic, and social), including the direction of original research, its application to industries, records of results, scientific literature of all kinds, the teaching of science, and the diffusion of scientific knowledge. The investigation would be followed by a congress with power to make the necessary agreements between the co-operating Governments, and to bring existing associations, institutions, and private undertakings into the general scheme. By such unification of the scientific activities of the world it is hoped to accelerate the progress of science and of its applications.

SOCIETIES AND ACADEMIES.

LONDON.

Zoological Society, October 22.—Dr. A. Smith Woodward, vice-president, in the chair.—Sir E. G. **Loder,** Bart.: Notes on the beavers at Leonardslee, 1916–18. Evidence was given of the hitherto unrecorded fact that beavers may breed twice in a season.—G. A. **Boulenger**: Madagascar frogs of the genus Mantidactylus, Blgr.—Prof. H. M. **Lefroy**: The Wheat Commission on Wheat Weevil in Australia.

MANCHESTER.

Literary and Philosophical Society, October 15.—Mr. W. Thomson, president, in the chair.—J. W. **Jackson**: Discovery of quartz-pebble beds in the Carboniferous Limestone of Caldon Low, Staffs. These pebble-beds form the dip slope of the Low on its N.N.W. side, overlooking Caldon village. At the latter place a large series of fossils, reminiscent of the "Brachiopod beds" of Castleton, etc., has been obtained by Mr. W. E. Alkins. The beds here apparently follow the pebble-beds in true sequence. The two pebble-beds differ greatly in composition, that of Caldon Low being made up almost entirely of rounded pebbles of vein-stone-quartz with fragments of chert, while that of Castleton consists of Carboniferous Limestone pebbles.

SHEFFIELD.

Society of Glass Technology, October 23.—Dr. M. W. Travers in the chair.—Prof. J. W. **Cobb**: Refractory materials and the glass industry. Prof. Cobb emphasised the fact that, although temperatures in glass manufacture were by no means abnormally high, yet the nature of the chemical reactions taking place was

such as to render the problem of refractories extremely difficult. There was the corrosive action of the molten glass upon the container to contend with, and, in addition, the corrosive action of hot dust upon flues and furnace interiors. The nature of the various refractory materials used in the glass industry was then dealt with, and the effect of grain size on the refractoriness and strength of silica bricks received thorough treatment. Special emphasis was laid upon the necessity for the smallest joints in building up refractory materials, and furnace building should be regarded from the point of view of masonry rather than from that of bricklaying. The paper closed with a discussion of the evil effects on refractories of penetration of glass and batch materials and the importance of thermal conductivity.—Dr. M. W. **Travers**: The firing of glass pots. By means of a striking collection of specimens the author showed that the life of a glass pot was materially increased if, before filling in, the pot was completely "vitrified." Ways and means of carrying this out were given, and the reason why vitrification before filling gave such good results was fully discussed.—S. N. **Jenkinson**: The requirements of clay for glass-pot making. A brief survey was made of the position of the glass refractories trade, both in 1914 and at the present time, and the necessity for some specification of materials was shown to be urgent. The proposed specification drawn up by the Refractories Committee for clay for pots was then dealt with and its various sections discussed. The question of size, nature, quality, and function of "grog" received full treatment.—Mr. **Coad-Pryor**: Action of certain types of glass upon pots. The author discussed the reason for the quicker solution of the bottom of glass pots as opposed to the sides. Several interesting experiments were described dealing with this problem.—Dr. **Turner** and J. H. **Davidson**: The solubility of pot material in glass. The influence of grain size upon rate of melting was shown.

PARIS.

Academy of Sciences, October 14.—M. P. Painlevé in the chair.—E. **Fournier**: General expressions for the resistance of water to the translation of hulls and their teachings.—E. **Goursat**: The problem of Bäcklund.—E. **Cartan**: The varieties of Riemann in three dimensions.—J. **Guillaume**: Observations of Borrelly's comet made with the *coudé* equatorial at the Lyons Observatory. Data for October 1 and 3 are given. On October 1 the comet showed as a nebulosity with undefined edges about 20″ diameter, with a central condensation. Magnitude 10·5 to 11.—M. **Dechevrens**: An electrical tide in the soil derived from the oceanic tide. Observations made at the Saint Louis Observatory, Jersey, between October, 1917, and August, 1918. The gas and water mains connected through a galvanometer gave an e.m.f. of about 0·1 volt, and this has been recorded photographically.—F. **Morvillez**: The conducting apparatus of the leaves of the Saxifrages.—P. **Godin**: Pedagogic interest of the laws of growth.—J. **Amar**: The laws of feminine work and of cerebral activity. The curve of endurance in women is low and undulating, and the physical work amounts to less than 40 per cent. of that of men. It is irregular and lacks continuity.—P. **Duval** and A. **Grigaut**: Intoxication by war wounds.

SYDNEY.

Linnean Society of New South Wales, May 29.—Prof. H. G. Chapman, president, in the chair.—Dr. R. J. **Tillyard**: The Panorpid complex. Part i.: The wing-coupling apparatus, with special reference to the Lepidoptera. The author shows that the most archaic type of wing-coupling apparatus was situated at the base of the wing, and consisted of four parts, two belonging to the forewing and two to the hindwing. These are named (1) on the forewing, the jugal lobe and jugal bristles; (2) on the hindwing, the humeral lobe and the frenulum. These four structures are only preserved in their entirety at the present day in two ancient families of the Mecoptera, the Choristidæ and Nannochoristidæ. The same type occurs in the Planipennia, with the absence of the jugal bristles. The evolution of these structures throughout the other orders of the complex is followed out, the paper dealing finally with the highly specialised types of coupling found in the wings of the Lepidoptera. The Micropterygidæ are shown to possess the archaic jugo-frenate type found in the Planipennia, but with certain specialisations. From the unspecialised jugo-frenate type there are developed in two different directions (1) the true jugate type, found in Hepialidæ and Prototheoridæ, and (2) the true frenate type, found in the other families, though with further specialisation to the amplexiform type in three groups that have lost the frenulum. The author suggests that the Lepidoptera should be divided into two sub-orders, Homoneura and Heteroneura, according to the state of their wing-venation, and that the former sub-order should be again subdivided into two divisions, the Jugo-frenata (Micropterygidæ s. lat.) and the Jugata (Hepialidæ and Prototheoridæ).—Prof. W. N. **Benson**: The geology and petrology of the Great Serpentine Belt of New South Wales. Part vii.: The geology of the Loomberah district and a portion of the Goonoo Goonoo estate, with two palæontological appendices by F. Chapman. The area in question, containing nearly 100 square miles, lies between the Tamworth district and the Nundle district, described in earlier parts of this series of papers. By the present work, therefore, the detail-mapping of a length of fifty miles of the Great Serpentine Belt is completed, permitting the correlation of the formations throughout. The present area has not been described previously. The points of interest arising in it are chiefly the occurrence of a third fossiliferous limestone zone in the Devonian series, with various important faunal peculiarities; the presence of a remarkable development of the highly albitic intrusive rocks, keratophyres; the abnormal absence of serpentine from the serpentine line; and the presence of dip-faults, breaking across the strike of the Devonian rocks, which may be of Carboniferous origin, but have been planes of movement in post-Permo-Carboniferous times.

July 31.—Prof. H. G. Chapman, president, in the chair.—Prof. W. N. **Benson**: The geology and petrology of the Great Serpentine Belt. Part vii. (continued). Several types of massive igneous rocks have been obtained that were not previously recognised in the Devonian rocks of the Great Serpentine Belt. A very typical example of pillow-structure developed in the spilitic rocks of this region is described and figured. This is the clearest example yet known in Australia.—Dr. R. J. **Tillyard**: Studies in Australian Mecoptera. No. ii.: The wing-venation of *Chorista australis*, Klug. Freshly turned pupæ of this rare Panorpid were obtained by digging and sifting soil in a selected locality. The result is the first study of wing-venation for the order Mecoptera, based on an examination of the pupal wing-tracheation. The pupal wings were dissected off and studied under water in the usual manner. A very remarkable result was obtained. There are only two tracheæ in the wing, one belonging to the costo-radial group and entering the radius, the other belonging to the cubito-anal group and entering the media. Hence the Mecoptera must be regarded as highly specialised in this respect,

like the Trichoptera and Diptera, but unlike the Planipennia and Lepidoptera, which retain all their main tracheæ. In the fresh pupa of Chorista the fusions which take place later on between certain veins are not yet accomplished, and hence the imaginal venation can be interpreted with certainty. Use is also made of the distribution of the macrotrichia to determine the limits of Cu_1.—W. W. **L'Estrange** and Dr. R. **Greig-Smith**: The springing of tins of preserved fruit. The blowing of tins containing fruits preserved in syrup appears to be due to the action of yeasts or other gas-forming organisms drawn into the containers through leaks in the joints while cooling after the cooking process. Although various organisms from defective containers were examined, none survived the temperatures to which the contents of containers were subjected during the canning process.

August 28.—Prof. H. G. Chapman, president, in the chair.—Dr. R. J. **Tillyard**: Mesozoic insects of Queensland. No. 3, Odonata and Protodonata. In the order Odonata two new forms are described from the Upper Triassic beds of Ipswich. One of these is placed in the family Lestidæ, forming the sole representative of a new sub-family Triassolestinæ. It shows close affinities with the Epiophlebiinæ, being more or less intermediate between this sub-family and the more reduced types like Synlestes. The other dragon-fly fossil is not placed, being only the tip of a wing, but it has sufficient characters of interest to merit a name. In the order Protodonata a very remarkable new fossil, *Aëroplana mirabilis*, is described, and is made the sole representative of a new sub-order Aëroplanoptera. The characters of this extraordinary insect are fully discussed, and a comparison made with Meganeura (Upper Carboniferous of Commentry). From this reasons are given why the insect should be placed in this order, though it stands very far apart from any known type, and might, perhaps, be considered better placed in a new order. A reconstruction of both wings of this fossil is shown in one of the plates.—J. **Mitchell**: The Carboniferous Trilobites of Australia. Of the nine species of Australian Carboniferous Trilobites previously recorded, five only are considered worthy of recognition. Thirteen species of Phillipsia, one of Griffithides, and one of Brachymetopas are described as new.

BOOKS RECEIVED.

Contributions to Embryology. Vol. viii. Nos. 24, 25, and 26. Pp. 198+plates. (Washington: The Carnegie Institution of Washington.)

Winter Botany. By Prof. W. Trelease. Pp. xxxii+394. (Urbana: Prof. W. Trelease.) 2.50 dollars.

The Cambridge Pocket Diary, 1918–19. (Cambridge: At the University Press.) 2*s*. net.

Reports of the Progress of Applied Chemistry. Vol. ii., 1917. Pp. 536. (London: Society of Chemical Industry.) 6*s*. 6*d*.

Alfred Russel Wallace: The Story of a Great Discoverer. By L. T. Hogben. Pp. 64. (London: S.P.C.K.) 2*s*. net.

A Manual of the Common Invertebrate Animals, Exclusive of Insects. By Prof. H. S. Pratt. Pp. 737. (Chicago: A. C. McClurg and Co.)

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 7

ROYAL SOCIETY, at 4.30.—Prof. G. E. Hale: The Nature of Sun-spots.—E. O. Hercus and T. H. Laby: The Thermal Conductivity of Air.—T. K. Chinmayanandam: Haidinger's Rings in Mica.

CHEMICAL SOCIETY, at 8.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Tenth Kelvin Lecture—L. B. Atkinson: The Dynamical Theory of Electric Engines.

FRIDAY, NOVEMBER 8.

ROYAL ASTRONOMICAL SOCIETY, at 5.—H. C. Plummer: The Distribution of the Stars.—Rev. A. L. Cortie: (1) The Spectrum of the Corona, 1914, August 21; (2) The Earlier Spectrum of Nova Aquilæ.—R. J. Pocock: The Relation between Mean Parallax and Magnitude.—H. H. Turner: Note on the Nebulosity round Nova Persei.—R. Watson: Observations of the Light Variation of Nova Aquilæ, 1918.—A. S. Eddington: The Pulsations of a Gaseous Star and the Problem of the Cepheid Variables. Part I.—S. Chapman: The Energy of Magnetic Storms.—Prof. G. E. Hale: The 100-inch Telescope of the Mount Wilson Observatory.—*Probable Paper*: Royal Observatory, Greenwich: Magnitudes of Nova Aquilæ from June 10 to November 1, 1918.

MALACOLOGICAL SOCIETY, at 7.—The Rev. Dr. A. H. Cooke: The Radula of Thais, Drupa, Concholepas, Cronia, Rapana, and the Allied Genera.—W. T. Webster: Notes on the Life-history of *Planorbis corneus* and other Freshwater Mollusca.

PHYSICAL SOCIETY, at 5.—Prof. J. C. McLennan: Low-voltage Arcs in Metallic Vapours.—Dr. W. Wilson: Relativity and Gravitation.—C. R. Gibson: Experiments Illustrating Colour-blindness.

MONDAY, NOVEMBER 11.

ROYAL GEOGRAPHICAL SOCIETY, at 8.—Col. G. S. F. Napier: The Road from Baghdad to Baku.

THURSDAY, NOVEMBER 14.

ROYAL SOCIETY, at 4.30.—*Probable Papers*:—A. Mallock: Sounds produced by Drops falling on Water.—G. H. Hardy and S. Ramanujan: The Coefficients in the Expansions of certain Modular Functions.—Hon. R. J. Strutt: The Light Scattered by Gases; Its Polarisation and Intensity.—Dr. F. Horton and Ann C. Davies.—An Investigation of the Ionising Power of the Positive Ions from a glowing Tantalum Filament in Helium.

OPTICAL SOCIETY, at 8.—T. Smith: Some Generalised Forms of an Optical Equation.—H. S. Ryland: The Manufacture of Binoculars.

FRIDAY, NOVEMBER 15.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—*Adjourned Discussion*: Prof. C. A. Edwards and F. W. Willis: A Law Concerning the Resistance to Penetration of Metals which are Capable of Plastic Deformation, and a New Hardness Scale in Fundamental Units.—R. G. C. Batson: The Value of the Indentation Method in the Determination of Hardness; and Dr. W. C. Unwin: The Ludwik Hardness Test.—T. T. Heaton: Electric Welding.

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