THURSDAY, OCTOBER 4, 1917.

THE NEW EDUCATION BILL.

IF there has been any good fruit arising out of all the dreadful evil of the present colossal struggle, it may surely be found in the awakened interest which all classes of the English nation are taking in the question of education.

The events of the war have clearly demonstrated the advantage which accrues to a trained and well-instructed people not merely in the hideous business of war, but also from the point of view of industry and commerce, concerning which it is now freely admitted that our chief competitor, Germany, was already bidding fair to become our most successful rival (in the applications of chemical science she had already surpassed us), even in industries in which we at one time thought we could never be equalled, still less surpassed. So penetrating was the conviction that, by a happy inspiration, it led the Prime Minister to call for the services of a man who, by training, education, experience, and a proved sympathy with education in its widest aspects and its most pervasive forms, would bring to the office of President of the Board of Education a new vision and the enthusiasm which would rouse Parliament and the nation to a due sense of their responsibilities for the effective education of all classes of the people. So we have now as the incumbent of this high and responsible office, not a politician, not a mere seeker after the spoils of office, or one who regards the position as a stepping-stone to more considerable posts, but the Vice-Chancellor of the University of Sheffield, Mr. H. A. L. Fisher. So great is the impression which has already been made in the few months since he entered upon his new duties, as a result of the zeal and intelligence with which he has gripped the problems awaiting solution, that the conviction is growing that such an office ought never again to be the sport of party politics, but should be regarded as one which can be adequately filled and have its full effect only when placed in the hands of a trained mind, experienced in the problems of education and full of sympathy with its varied expression.

Already Mr. Fisher, on the introduction of the Education Estimates during last session, has made clear the importance of education and of the necessity that the teacher shall not only enjoy a better status, but also be more liberally remunerated, and he has induced Parliament to grant him a larger subvention for this purpose than has ever been known in the history of the Board of Education. He has, moreover, signified his intention to ask Parliament to assent to a scheme of pensions for secondary- and technical-school teachers. On August 13, in introducing a measure into the House of Commons to make further provision with respect to education in England and Wales, he made a notable speech in which he outlined his proposals, surveying the entire field of education up to that of the university. Realising the necessity for recruiting the elementary schools with a race of healthy children, he has put forth proposals enabling local authorities to establish nursery schools for children from two to five years of age in which the main regard shall be the health, the nourishment, and the physical welfare of the child. It may be urged with some force that the provision of such schools should be obligatory on the local authorities wherever the circumstances demand it.

Having regard to the enormous national expenditure upon elementary education, and the necessity for conserving its full fruit, the Bill proposes to raise the compulsory full-time school age, without any remissions, to fourteen, and in order to prevent the waste of educational opportunity that now ensues on leaving the elementary school, to provide for further continued education, within the normal working hours, extending to at least eight hours per week for forty weeks in each year—in all, a period of 320 hours—embracing a course of instruction general and special, including physical training, and having regard to their future as parents and citizens as well as to their chosen vocation, for all young people from fourteen years until the age of eighteen is reached. This means the abolition of half-time for children under fourteen years of age, which prevails mainly (it exists scarcely anywhere else) in the textile towns of East Lancashire and the West Riding of Yorkshire. No measure is more fraught with potential good than these comprising the extension of the full-time school age until fourteen and the provision of the means of continued education of adolescents until the age of eighteen. The acceptance of this policy will simply revolutionise English education and raise up a race of young people ready for higher forms of instruction (provision is made for extending the sphere of the elementary school for children up to sixteen years of age) in relation to the wiser and more fruitful use of leisure, the possibility of a humaner life, and the claims of science in respect of all human activities, social and economic.

To give effect to these purposes will entail a vast expenditure in the way of suitable buildings, special equipment, and the provision of specially trained teachers, but the results will more than

justify it. The claims of industry, narrowly viewed, must give way to the supreme claim that every child born to the nation is entitled to the fullest opportunities of development of which his natural powers are capable. There will be a strong opposition in certain industrial areas to these measures, but it is to be hoped that Mr. Fisher will receive the fullest possible support from all who seek the lasting well-being of the nation.

Among other proposals in the Bill is one providing for the establishment of provincial associations under the direct initiative and control of the Board of Education. Whilst it is very desirable that such associations should be formed, having regard to the common interests of areas larger in extent than those of individual education authorities, it should surely be regarded as more consonant with the free spirit of English institutions to have encouraged the voluntary alliance of neighbouring authorities rather than the erection of a bureaucratic organisation centred in the Board of Education in London. It is to be hoped that before proceeding to a second reading this and other sections of the Bill which tend to strengthen the central body at the expense of the local authorities will receive serious consideration. Mr. Fisher has shown commendable enterprise and wisdom in his provincial campaign. He has come face to face with various interests; he has been well received and has created a favourable impression, whilst there has been no lack of determined and well-informed criticism of some important sections of his measure. Doubtless he will have profited much by his intimate contact with men and women of all ranks of life, educational and industrial, and the cause of education will have unquestionably gained much thereby.

HEALTH AND THE STATE.

Health and the State. By Dr. W. A. Brend. Pp. xi + 354. (London: Constable and Co., Ltd., 1917.) Price 10*s.* 6*d.* net.

THE main object of this book is to establish the case for putting our public health affairs in the hands of those who have real knowledge of the subject," and "to demonstrate the need for complete re-organisation of the public health services." It is not necessary to read the whole of the eleven chapters which compose the volume to be fairly convinced that some re-organisation is indeed needed. Perhaps the chapter entitled "The Complexity of Public Health Administration" is sufficient by itself to achieve the author's aim.

Dr. Brend maintains that while there exists a very large mass of scientific knowledge at our disposal, the channels by which it reaches those who might be expected to benefit thereby are imperfect and obstructed. No fewer than eleven Government offices, five central authorities, and six local authorities are concerned to a greater or less extent in public health administration. Knowledge that has run the gauntlet of the Government offices and then weathered the storm of vested interests in the country at large is finally turned into law by a House in which it receives little or no expert scientific criticism. The seventh chapter—more than one-fifth of the book—is devoted to the Insurance Act, and is a remarkable exposition of the discrepancy that exists between knowledge and its application. The proposals and promises of 1911 are compared with the working of the Act to-day; the waste of opportunity for collecting valuable information, and the failure of the Act to apply the best medical treatment to the sick poor who are in need of it, are discussed at length.

Yet withal, the general impression left by the book is that though it is a careful study of present administration and a vigorous piece of destructive criticism, nevertheless the reconstructive proposals outlined are by no means necessarily sound. The author frequently postulates that environment lies at the root of nearly all the ills that flesh is heir to. He maintains that the number of unfit in a State depends more upon environment than upon any other factor, and that the main cause of the continuance of tuberculosis is a bad environment. "Defectiveness in school children, as most diseases elsewhere, is mainly a matter of environment." "Take a patch of, say, fifty acres from the most crowded and worst built district . . . set it down precisely as it is among the pines of Surrey . . . the probability is that the improvement in the health of the inhabitants would be enormous. There are, in fact, patches of bad housing in many country towns and villages presenting the worst features of slums, whose inhabitants, nevertheless, exhibit a high degree of healthiness."

The chief factor at work in bad environment (*i.e.* overcrowding of cities) is, in Dr. Brend's view, an atmosphere polluted by dust and smoke. That polluted air may be harmful, as is polluted water, is not questioned, but the argument contained in the passage cited, that bad housing and slum conditions are in themselves comparatively unimportant, does not appear valid. It is a matter of experience that so long as communities are small and scattered human beings can live under the most primitive conditions without suffering unduly, but even picked individuals when aggregated in large numbers suffer heavily from preventable disease unless the most strict precautions are taken. It is not recorded that the armies of the Napoleonic wars were particularly subjected to dusty, smoke-polluted atmosphere, yet their sickness rate was terribly high. We question whether the fifty crowded acres in Surrey would necessarily prove to be particularly healthy, although, of course, it is not proposed

to deny that the addition of pure air to already existing sanitary services is most desirable.

Dr. Brend advocates as a remedy the expansion or rarefaction of our large towns and the segregation of our factories (a substantial piece of work for the proposed Ministry of Health!). Perhaps in practice the difficulties of removing smoke from existing towns is less than that of removing our populations to better sites. We have sewage systems in all our large towns, and the problem of removing waste products of combustion may be no greater than that of getting rid of the waste products of the body or of the wash-tub.

The demand for a Ministry of Health, the permanent staff of which "must consist almost exclusively of medical and scientific men," has much to recommend it, but we are rendered somewhat dubious of the practical results of their lucubrations when we find the author remarking of vaccination: "It is open to argument whether this precaution is still essential purely as a prophylactic, though *it is of course important during an epidemic among persons brought in contact with the disease.*" We wonder whether Dr. Brend has considered the practical steps requisite to vaccinate persons brought in contact with the disease when, for instance, a tramp suffering from modified small-pox has spread the disease in perhaps half a dozen different towns. Nor are we clear as to the author's reasons for considering that the diagnosis of this disease has improved whilst opportunities of observing it have become enormously lessened.

As a whole the volume is well worthy of study. A wide range of subjects affecting public health is discussed—from the sale of abortefacients to the public health duties of the Treasury.

OPTICAL THEORIES.

Optical Theories, Based on Lectures delivered before the Calcutta University. By Dr. D. N. Mallik. Pp. 181. (Cambridge: At the University Press, 1917.) Price 7*s.* 6*d.* net.

THE subject of physical optics has undergone a strange vicissitude. Not long ago it ranked as one of the great divisions of mathematical science; now it has become almost wholly absorbed by a sister science. The phenomena of optics, by their variety and ever-increasing practical importance, attract and deserve specialised study; but the underlying theory can no longer be studied apart from electricity, and the long succession of theories of the æther in the nineteenth century form a closed chapter in the history of science. There seems little likelihood that the chapter will be reopened. In these circumstances the best approach to the subject may be a matter of doubt, depending a great deal on the temperament of the student. Those who are historically minded will urge that the present position is best apprehended by following the steps which have led to it; others will consider that adherence to the traditional mode of approach tends to root in the mind an obsolete mode of thought, and it is better not to trifle with the freedom which is now offered. Dr. Mallik's book offers a compromise which should be acceptable to both sides. A survey of the more essential properties and differences of the mechanical æthers that were once proposed, subordinated to the purpose of illustrating the difficulties which the electromagnetic theory strides over so easily that they pass almost unnoticed; afterwards, an account of the modern theory and results, contrasted where necessary with the mechanical æthers—these seem to bring out the essential aspects of our present knowledge, without undue neglect of the lessons of the past.

Dr. Mallik divides his subject into four principal chapters: early theories, elastic solid theory, electromagnetic theory, and electron theory. The separation of the two last has some disadvantages. So far as it relates to free æther, the electromagnetic theory is independent of electrons; but in the early extensions to dielectric media the object presumably was to evade, rather than to theorise on, the relations of matter to æther. To make a full discussion of the mechanical implications of this approximate treatment seems unnecessary at the present day; the undeveloped notions of permeability and specific inductive capacity scarcely need to be taken so seriously. An excellent summary of the whole argument is given in the concluding chapter, which shows how far we have travelled since speculations on the optical medium first began. The theory of relativity and the quantum theory are not included in the scope of the book.

The volume is written for fairly advanced students, and the discussion necessarily is mainly mathematical. A great amount of work is surveyed in brief compass; and most readers will find fresh information, and arguments that are new to them. According to the author's plan, only those developments are treated which afford a means of discriminating between rival theories; and the student will do well to follow his guidance through the bewildering mass of investigations which still confront the learner, as well as through the débris of wrecked hypotheses.

OUR BOOKSHELF.

Chile. Pp. 301. (Santiago: The Chilean Government, 1915.)

THIS anonymous volume written in English is doubtless meant to diffuse a knowledge of Chile and particularly of Chilean resources and trade in English-speaking countries, but there is no preface to indicate its aim or the personality of its editor. In about fifty short chapters it contains a comprehensive survey of Chile, its life and conditions, including a good deal of statistical

matter, which might, however, in some cases be fuller and more recent. The volume, as a whole, gives a good idea of the amazing strides which Chile has made during the last century. The great drawback, however, to volumes of this nature, especially when they are anonymous, is the lack of critical spirit. In that respect this volume does not escape. The picture is painted in colours that are often too bright, with the result that it leaves one with the impression of a country so bountifully endowed by Nature as to be almost without drawbacks. For example, the chapter on climate, without ignoring the heavy rainfall, strong winds, and gloomy weather of the far south, contrives to give them considerably less space than the more beneficent Mediterranean climate further north. Apart from this criticism there are few omissions in the book, but some authentic account of the little-known Chilean possessions of Juan Fernandez and Easter Island might have been added.

The English is weak in places; sometimes the meaning must be guessed, and there are misprints on nearly every page. But the most serious charge against the book is the absence of an index and a good map. The only map is a crude, small-scale one of the railways. The numerous illustrations are excellent, but some of the expense they have entailed might profitably have been lavished on sketch maps in the text.

The Journal of the Institute of Metals. Vol. xvii. Edited by G. Shaw Scott. Pp. x+384. (London: The Institute of Metals, 1917.) Price 21*s*.

THE above volume contains the papers presented at the spring meeting of the Institute of Metals, of which an account has already appeared in the columns of NATURE. In addition, it contains the verbal discussion and written communications to which the papers gave rise. It is quite clear from these that the council, in organising a symposium of papers on metal melting, chose a subject which aroused very considerable interest among the members, and that some really valuable information was elicited and has now been placed on record in a form which should be of considerable utility. Equally clear is it that the subject will repay further investigation. The authorities of the Royal Mint are to be commended for having permitted Mr. Hocking to publish so much data based on many years' practice. Mr. Teisen's account of Hermansen's furnace was a very important contribution to the symposium. This producer-gas-fired crucible furnace is the outcome of the fact that owing to the scarcity of fuel and metal in Scandinavia, prices of these commodities are high in those countries as compared with Great Britain. Consequently it was necessary to build a more economical furnace than the type ordinarily used. The latter part of the volume contains the usual abstracts of current papers dealing with non-ferrous metals and alloys, and the present volume of the Journal, taken as a whole, should prove to be one of the most useful published by the Institute.

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.*]

On the Alterations of Tone produced by a Violin "Mute."

EXPERIMENTS on the "wolf-note" of the violin or 'cello (see NATURE, June 29, and September 14, 1916, and *Phil. Mag.*, October, 1916) suggest an explanation of the well-known and striking alterations in the tone of the instrument produced by a "mute," which at first sight seems somewhat difficult of acceptance, viz. that they are due to the lowering of the pitch of the free modes of vibration of the *entire body of the instrument* produced by the added inertia. This view of the action of the mute (which was suggested by way of passing reference in my paper on the "wolf-note") has, I find, excited some incredulity, and its correctness has, in fact, been questioned in a note by Mr. J. W. Giltay in the *Phil. Mag.* for June, 1917. The following brief statement may therefore be of interest as establishing the correctness of my view of this important phenomenon:—

If N_1, N_2, N_3, etc., be the frequencies of the free vibrations of the body (in ascending order), the frequencies as altered by the addition of the "mute" are determined by equating to zero the expression (see Routh's "Advanced Rigid Dynamics," Sec. 76),

$$(N_1^2-n^2)(N_2^2-n^2)\times\text{etc.},-\alpha n^2(n_2^2-n^2)(n_3^2-n^2)\times\text{etc.},$$

where α is a positive quantity proportionate to the added inertia, and n_2, n_3, etc., are the limiting values of N_2, N_3, etc., attained when the load is increased indefinitely [$n_1=0$, and $n_2<N_1$, $n_3<N_2$, etc.]. The forced vibration due to a periodic excitation of frequency n is determined by the same expression, being inversely proportional to it except in the immediate neighbourhood of points of resonance. The sequence of the changes in the forced vibration produced by gradually increasing the load is sufficiently illustrated by considering a case in which n lies between N_1 and N_2. If $n_1<n_2$, the load decreases the forced vibration throughout, but if $n>n_2$, the load at first *increases* the forced vibration until it becomes very large, when n coincides with one of the roots of the equation for free periods, subsequent additions of load decreasing it. The *increase* in the intensity of tone indicated by this theory has actually been observed experimentally by Edwards in the case of the graver tones and harmonics of the violin (*Physical Review*, January, 1911). Edwards's observation that the intensity of tones and harmonics of high pitch is *decreased* by "muting" is also fully explained on this view, as in the case of the higher modes of free vibration of the instrument a very small load would be sufficient to make the frequencies approximate to their limiting values.

Comparison of the effects of loading the bridge of the instrument at various points on the free periods and the tones of the instrument furnishes a further confirmation of the foregoing theory. For instance, on a 'cello tried by me, the lowering of the "wolf-note" pitch produced by a load fixed on *either* of the feet of the bridge was small compared with that obtained by fixing it on top of the bridge, and the observed "mute" effect was correspondingly smaller. In fact, the alterations of free period produced by loading furnish us with quantitative data regarding the relative motion of different parts of the instrument, and of their influence in determining the character of its tones.

C. V. RAMAN.

Calcutta, August 28.

Origin of Flints.

HAVING paid some attention to the study of flints, both in England and Australia, I have read with interest the recent letters to NATURE on this question, and think that possibly some facts from this side of the globe may be worth noting. In the Cainozoic of South Australia and Victoria black flints occur which have the characteristic white coating of the English examples, and, in fact, are indistinguishable from them. They are found both in nodular and tabular form, and occur in lines parallel to the bedding. At Port Macdonell, South Australia, sheets of flint are found 2 in. or 3 in. thick, and, according to Tenison Woods, they are quarried and used for flagstones. These Cainozoic flints appear to be confined to the Miocene (Janjukian) beds, and are closely associated with the polyzoal limestone, a white, chalky deposit consisting of polyzoa and foraminifera.

The evidence of a microscopic examination of these flints goes to prove that the position held by Prof. G. A. J. Cole, that chalk flints represent a more or less complete replacement of the chalky ooze, is the only one tenable from the Australian point of view. The Australian flints are often crowded with the silicified remains of polyzoa, foraminifera, shell-fragments, and occasional sponge-spicules, the last merely included as a component of the ooze and not as selected material. During the formation of the flint the calcareous bodies are frequently dissolved, and only remnants are seen in some cases in the flint sections.

Another point in corroboration of Prof. Cole's contention (based on Liesegang's experiments) is the presence of an impervious bed underlying these Tertiary flint layers. This was pointed out long ago by Tenison Woods, who stated that well-sinkers in South Australia have observed that a layer of flint is always found immediately above the water-level. The factor of an impermeable layer inducing deposition of diffused silica is an important one, and is strongly supported in those instances where I have had an opportunity of observing it.

FREDK. CHAPMAN.

National Museum, Melbourne, Victoria,
August 17.

Butterfly v. Wasp.

I HAVE spent a good many hours lately in a Devonshire garden in which there was a border of massed mauve asters which was a great attraction to butterflies. The border measured 27 ft. by 2½ ft. only, but it was no unusual thing to see on it 150 butterflies—Peacocks, Red Admirals, Tortoiseshell, Clouded Yellows—a very wonderful sight. The object of my letter is to describe to your readers two "scraps" which I witnessed between tortoiseshell butterflies and wasps, in each of which the butterfly was victorious. The method adopted was the same in each case. The butterfly sprang on to the back of the wasp, the head of each being towards the tail of the other, and a furious rough-and-tumble took place some 6 ft. from the ground. The wasp was unable to use its sting, as the butterfly was on its back, and at the end of perhaps five seconds the butterfly, which had been buffeting the wasp with its wings, dropped to within a foot of the grass, relaxed the hold which it had exerted, and allowed its enemy to drop breathless and beaten on to the lawn.

Nature had taught the butterfly to adopt the same tactics (that of concentrating all its energy on the body of its adversary) which enabled G. Carpentier to win his fight with Bombardier Wells.

ARTHUR F CLARKE.

The Vicarage, Rochdale, Lancashire.
September 20.

The Convolvulus Hawk-moth.

I REGRET that I must ask leave to correct a statement in my letter on this moth in NATURE of September 27. I find that it was not in the present year, but in 1902, that the lady counted seven convolvulus hawk-moths flying about the tobacco plants in her garden.

HERBERT MAXWELL.

Monreith, September 29.

THE ETHNOLOGY OF SCOTLAND.

IT is as a fighting man that the Scot makes his first appearance in written history; Tacitus depicts him as ruddy in colour, big in body, strong in limb, and Germanic in origin. In 1866, when Huxley[1] described the human remains discovered by Mr. Samuel Laing in a long-cist cemetery at Keiss, Caithness, which the discoverer regarded as of early Neolithic date, but which are now rightly assigned to a much later period—an early phase of the Iron age—he had clearly reached a conclusion very similar to that of Tacitus:—

But the existence of a tall, long-headed, fair element becomes intelligible at once if we suppose that long before the well-known Norse and Danish invasions a stream of Scandinavians had set in to Scotland and Ireland and formed a large part of our primitive population (p. 134).

Huxley regarded the Scottish people, the Irish, the Norwegians, and the Swedes as possessing a common basal stock or type. Prof. Bryce, of the University of Glasgow, who has done so much to build up an accurate knowledge of the early inhabitants of the south-west of Scotland, accepts Huxley's hypothesis, and supposes that in early Neolithic times—before the long-barrow people, of Mediterranean origin, had reached Arran—Ireland, Scotland, and Scandinavia were already peopled by the same tall, fair, dolichocephalic stock.[2] Dr. W. C. Mackenzie[3] has also come to a somewhat similar conclusion from a study of the place-names of Scotland and Ireland, but supposes that the arrival of the Scandinavian or Germanic people occurred at a post-Neolithic date. The same hypothesis has also been sturdily advocated by Mr. John Munro.[4]

Huxley preferred the term "Scandinavian" to "Germanic" when he wished to designate the tall, big-boned, fair, long-headed Scotsman, because he was well aware that this type prevails only in the western fourth of the modern German Empire. "Celt" and "Celtic," "Teuton" and "Teutonic," "German" and "Germanic," are terms which the modern anthropologist has had to abandon; all have been applied to the type of man Tacitus and Huxley had in mind, and also to physical types which are totally different. To the tall, long-headed Xanthochroi most modern anthropologists would apply the term "Nordic" in preference to "Scandinavian."

When we seek for evidence as to the time and manner in which the Nordic type reached Scot-

1 "Prehistoric Remains of Caithness." By Samuel Laing, M.P. (1866.)
2 "The Cairns of Arran." Proc. Soc. of Antiq. of Scotland, 1902, p. 75; *Scottish Historical Review*, 1905, p. 275.
3 "The Races of Ireland and Scotland." (1916.)
4 "The Story of the British Race." (1899.)

land we naturally turn to the three Scottish universities which have become centres of anthropological investigation—Edinburgh, Glasgow, and Aberdeen. We shall take the last-named university first, because the school of anthropologists which has grown up under Prof. R. W. Reid, Dr. Alexander Low, Mr. James F. Tocher, the late Dr. W. R. Macdonell, and the late Mr. John Gray can show us very precise and remarkable facts bearing on the early history of the people of the north-east of Scotland.[5] All over the county of Aberdeen are found burials in short stone-cists, which certainly date back to an early stage of the Bronze age, and have been given an approximate date of 1500 B.C. by the Hon. John Abercromby. There could not be a sharper contrast between two human types than there is between the Nordic and those squat, bullet-headed, short-cist people of Aberdeenshire. The latter were a wonderfully uniform folk, showing a peculiar type of brachycephaly. To find the nearest approach to that type in a modern population we have to go more than a thousand miles away, to the countries lying at the upper waters of the Elbe and Rhine. In the ancient graves of these same areas of central and south-west Germany the Hon. John Abercromby finds the prototype of the "beakers" which were so often placed in the Aberdeenshire short cists with the dead. Between 3000 and 4000 years ago Aberdeenshire was invaded by a brachycephalic, Slav-like people. We have ample evidence to show that the round-heads of Central Europe broke through the Nordic barrier that still guards the eastern shores of the North Sea about the end of the Neolithic period, some 4000 years ago. Nor need we hesitate to believe that they had the means to cross the North Sea. In that great work,[6] whereby a foundation for a real history of the Scottish people was laid, Sir Daniel Wilson describes the discovery of a boat at a depth of 15 ft. in the carse of Falkirk. The boat was 36 ft. long and 4 ft. wide. We know approximately when the silt of the carse was deposited and the boat embedded; it was when the 25-ft. beach marked the level of the sea and when the hunters of Scotland used that peculiar form of harpoon which marks the transition from the Palæolithic to the Neolithic civilisation. There were apparently big boats in Scotland several thousand years before the Continental or German round-heads landed on the shores of Aberdeenshire.

Unfortunately the anthropologists of Aberdeen University can show us nothing of the people who preceded the round-heads or of the people who followed them. But they have provided us with the means of ascertaining how far the stock introduced by the short-cist people has been perpetuated.[7] In 402 men examined by Mr. John Gray and Mr. James Tocher there were only 5 per cent. who had the peculiar head form and dimensions of the short-cist people; there were 9 per cent. who were technically of the round-headed type with a cephalic index of 80 or more. The prevailing forms varied between the upper limits of long-headedness and the lower of round-headedness. These modern Buchan people were, on an average, about 4 in. taller than the short-cist men and had the fair colouring in hair and eyes of the modern Bavarian. How and when the Nordic type reached Aberdeenshire we have no precise evidence. But it certainly is at present the prevailing type.

We come now to deal with the contributions which the late Sir William Turner, principal of the University of Edinburgh, made to Scottish ethnology. He may be described as one of the best Scotsmen ever born south of the Tweed. When he arrived in Edinburgh in 1854, at the age of twenty-four, to assist Goodsir, he found Daniel Wilson, who had opened so brilliantly the first chapter of Scotland's ancient history, on the point of departure for the University of Toronto, of which, in the course of time, he became the distinguished principal. Another young Englishman, the late Dr. John Beddoe, had just finished his first preliminary survey of the Scots: he found them to be a compound of Saxon, Pict (Iberian), Celtic (a hybrid between the British of the Neolithic and Bronze ages), and Welsh. Turner had a predilection for facts rather than theories, and he began to collect, in a systematic manner, the materials for a craniological history. His numerous pupils became willing assistant collectors, and in the course of fifty years he assembled in his museum the most extensive collection of ancient and modern Scottish crania that has as yet been made. When he retired from the chair of anatomy, to assume the onerous duties of principal of the University of Edinburgh, he devoted his spare hours to the study of his cranial collections. He published two monographs[8] on the Scottish crania, the first, issued in 1903, being a detailed description of 176 skulls of modern people; the second issued in 1915—a few months before his death at the age of eighty-four—in which he gave an account of prehistoric crania and stated his conclusions regarding the races which had become fused to form the Scottish nation. He had, including the Aberdeenshire series already mentioned, forty-nine skulls from short stone-cists, representing Scotsmen of the Bronze age. Of the forty-nine, thirty-eight were discovered in the eastern counties; of these, thirty-four were brachycephalic, of a type very similar to the Aberdeenshire series, yet showing a sufficient degree of difference to lead one to suspect that there was at least a tribal distinction.

Turner agreed that the people buried in the short stone-cists were Alpine or Central European in origin and represented the Bronze-age

[5] See Proceedings of the Anatomical and Anthropological Society of Aberdeen University of December, 1902, and subsequent dates.

[6] "The Archæology and Prehistoric Annals of Scotland." By Daniel Wilson. (1851.)

[7] "Physical Characters of the Adults and School-children of East Aberdeenshire." By John Gray and James F. Tocher. Journ. Roy. Anthrop. Inst., 1900, vol. xxx., p. 104.

[8] "Contributions to the Craniology of the People of Scotland." Part i. Trans. Roy. Soc. Edin., 1903, vol. xl., p. 547; part ii., 1915, vol. li., p. 171.

invaders of Scotland. Of the more ancient Scots, those who buried their dead in chambered cairns in the latter part of the Neolithic period, he had only ten examples, five of these being borrowed from Prof. Bryce's Arran series. These chambered-cairn men are as different from the short-cist men in head form as men can be; the people from the chambered cairns have the same cranial shape and dimensions as the people of the long barrows of England. Turner accepted the opinion that both were of the same race and that they were traceable to a Mediterranean stock. One cannot help being impressed by the length and relative narrowness of the face of the more ancient Scottish skulls; we seem to see in them already the peculiar traits so common in the faces of modern Scots.

Sir William Turner had at his disposal two crania which may possibly belong to an earlier date than the skulls from the chambered cairns. They were found by the late Dr. Joseph Anderson, when he discovered and opened the MacArthur cave at Oban in 1895. We know that the MacArthur cave was inhabited at the very earliest phase of the Neolithic period, but as one of the skulls was on the floor of the cave and the other—a very remarkable skull—was only embedded in the upper shelly stratum, we cannot be certain that they represent the ancient inhabitants of the cave. They are both of the Neolithic Scottish type. The more deeply embedded cave skull has a remarkable resemblance to that of Robert Burns; as seen in profile they are almost identical. The cave skull has the remarkable length of 205 mm., that of Burns 206 mm.; they are almost identical in height of vault, but there is a decided difference in width—that of the cave skull being 138 mm., while Burns's cranium had a width of 155 mm. The poet had an enormously capacious skull. The essential differences between the few Neolithic Scots we know of and their modern successors lie in an increased stature and an increased width of head in the latter.

Of the people who lived in Scotland in the early Iron age, the people who succeeded the short-cist round-heads, Sir William Turner had to own we know almost nothing. They apparently burnt their dead. But he accepts on faith that with the introduction of iron a Celtic people came—a long-headed race, which gave the modern impress to the Scottish type. It is possible, as Sir William Turner agreed, that the human remains discovered by Dr. Edward Ewart on the shores of the East Lothian in 1911 may represent people of the early Iron age; in all their physical characters they are akin to the Scots of the Neolithic period. When Sir William Turner came to examine the skulls of the modern Scottish people he found that the cemeteries on the East Coast—particularly in Fife and in the Lothians—carried convincing evidence that the short-cist stock was not extinct. In some cases—particularly in Fife—there were communities in which the round-heads still formed 50 per cent. of the inhabitants and more; of seventy-nine skulls from cemeteries in the Lothians 25 per cent. were brachycephalic, while amongst thirty-one skulls from Renfrew, on the western side of the country, there was not one. The course of twenty or thirty centuries had failed to diffuse the round-headed invaders of the Bronze age among the more ancient long-headed people of the west. He admitted that there must be a Welsh, a Danish, a Scandinavian, and a Saxon element in the modern Scottish, but he would have been the first to admit that the origin of the real bulk of the Scottish people—the descendants of Gaelic-speaking ancestors—remains still an enigma.

We have now to turn for a moment to the conclusions reached by the Anthropological School of the University of Glasgow. From his exploration of the chambered cairns of Arran and of the south-west of Scotland Prof. Bryce draws certain definite inferences.[9] He finds the prototype of their burial cairns in the north of Ireland; we may infer that 4000 years ago or more there existed already a connection and intercourse between the peoples of the north of Ireland and the south-west of Scotland. He agrees that these chambered-cairn Neolithic folk were of the Mediterranean stock; their culture is of the South. He is further of opinion that when these cairn people were entering the back door of Scotland on the west the short-cist, round-headed people from the Continent were entering the front door on the east. The east and the west met in Scotland, but to what degree they mixed we have already seen from Sir William Turner's investigations. How far the west was left untouched by the round-heads, and the extent to which the English and the West Scottish have been evolved from a mixture of similar human stocks, have been brought out vividly by the investigations of Dr. Matthew Young, at one time assistant to Prof. Bryce. In 1916 Dr. Young published a monograph[10] describing the dimensions, characters, and variations seen in a collection of skulls—above 600 in number—derived from a comparatively modern burial ground in Glasgow. In this swatch of the modern population of that great city he found that the round-heads amounted to only 2·2 per cent., against 25 to 30 per cent. presented by several cemeteries on the East Coast. The most remarkable result of his labours, however, was the discovery of a close similarity between the Glasgow skulls and the collection from Whitechapel described by the late Dr. W. R. Macdonell. The degree of resemblance will be seen by comparing some of the chief mean measurements of skulls of adult males:—

	Max. length mm.	Max. width mm.	Average height mm.	Bizygomatic width of face mm.	Length of upper face mm.
Glasgow ...	187·5	139·5	117·0	127	70·9
Whitechapel	189·06	140·6	114·59	130	70·1

[9] *Scottish Historical Review*, April, 1905, p. 275; Proc. Soc. of Antiq. of Scotland, 1902, p. 75.

[10] "A Contribution to the Study of the Scottish Skull." Trans. Roy. Soc. Edin., 1916, vol. li., p. 347.

We are not surprised to note that the Scottish face is somewhat longer and narrower, but we were not quite prepared to find that the Londoner had the larger head. Nor need we really be surprised to find so close a similarity between samples of the population culled from the Clyde and from the Thames estuaries when we remember that since the close of the Bronze period British invaders and immigrants have invariably been members of the Nordic stock. We do not know when that stock first settled in Britain, but it is difficult to account for all the facts now at our disposal unless we accept Huxley's hypothesis that it reached Britain very early—probably, as Prof. Bryce supposes, at an early Neolithic or even more ancient date.

A. KEITH.

THE BEGINNINGS OF PORCELAIN IN CHINA.

IN a charming series of essays on "Fallen Idols," the late Mr. M. L. Solon, of Stoke-on-Trent—one of our most learned students of the history of ceramics—discussed some types of antique pottery which he ranked among the "transient glories of the world," because at one period these vessels, made from common clay, were the idols of the hour, and exceeded in value vessels made from the most precious materials. The idols were but fleeting fashions which have now lapsed into obscure tradition. It is the work of the archæological ceramist to inquire into the nature and character of the pottery of ancient days. In many cases the greater the obscurity and the fewer the number of available facts, the more persistent have been the attempts to illumine dark and hazy tradition by extravagant conjectures. By a curious aberration of the human mind, the absence of positive evidence is very prone to engender assurance and confidence; this condition has ever been an *ignis fatuus*, luring the unwary into quagmires of fancy. What whimsical and grotesque views have grown about the murrhine vases, the *ollae fossiles*, and the buccaro vases! What curious myths have been current with respect to the origin of Chinese porcelain!

It is a pleasure to read Laufer and Nichols's brochure[1] on the beginnings of porcelain in China because here positive evidence occupies an all-important place. The essay should be read in conjunction with Laufer's "Chinese Pottery of the Han Dynasty." The materials for the latter work were collected by Laufer while on a mission in China about 1903 under the auspices of the American Museum of Natural History, and this work was supplemented by a later investigation in China about 1910.

The composition of the Han pottery, as represented by chemical analyses, is a close approximation to that of the better-class Chinese pottery, and the inferior quality of the body of the former appears to be due to the primitive methods of manufacture prevalent in China during that epoch. The porosity, for example, is much greater than that of ware which is usually styled porcelain; indeed, the authors go so far as to call the body a "porcelain froth." This term, of course, is merely a metaphor and is no doubt intended to emphasise the low porosity of the ware. According to Nichols, the *outside* of one vessel he examined was coated with a white slip, and on this was superposed a red glaze. The *inside* of the vessel was coated with a glaze which appears to have been made by mixing the body material with limestone—in the approximate proportion of one of limestone to two of body. Analyses of the green glaze of another specimen correspond with a glaze of the Rockingham type, but without "alumina," and the colour is due to the presence of about 3 per cent. of copper oxide. The crude character of the body is taken to mean that the Han pottery is the "forerunner of true porcelain," and that

> it represents one of the initial or primitive stages of development through which porcelain must have passed before it could reach that stage of perfection for which the Chinese product gained fame throughout the world.

Although many students of pottery consider that true Chinese porcelain first appeared in the Ming dynasty about the fourteenth century, and others carry it back to the Sung dynasty about the tenth century, there are several references to porcelain at an earlier period still—*e.g.* the seventh century—but the controversy on the origin of Chinese porcelain now turns on the meaning which the Chinese assigned to the term *ts'e*, and on the definition of porcelain. If the Han pottery is a porcelain, we can accept Laufer and Nichols's conclusion, and the beginning of porcelain would be carried to near the beginning of the Christian era; but did the term *ts'e* refer to ordinary pottery or to porcelain? There is no mistaking Laufer's view:—

> By arguing that in the beginning the term *ts'e* denoted nothing but ordinary pottery we close our eyes to the real issue and act like the ostrich; in this manner we utterly fail to comprehend the process of evolution of porcelain.

He claims that the term *ts'e* refers to a porcelain-like pottery and should be translated by "porcelanous ware" or some equivalent term, and that the early *ts'e* is represented by the Han pottery. This is scarcely the place to argue this matter, because so much depends on the meanings of the terms employed. The present writer, who knows nothing of the Chinese language, has always taken the early *ts'e* to have been a general term which covered *both* ordinary pottery and porcelain. Laufer's general conclusion that the Han pottery was the immediate precursor of porcelain will no doubt be generally accepted, because the experience gained with this pottery would naturally point the way to the manufacture of higher types of ware. I have shown several experienced men some fragments of the Han pottery which

[1] "The Beginnings of Porcelain in China." Publication 192 of the Field Museum of Natural History, Anthropological Series, Chicago, vol. xvi., No. 2, 1917.

Mr. Laufer has very kindly sent to me, but none considers that the ware itself can be called porcelainic.

Laufer also has a section entitled "Historical Notes on Kaolin," and he shows that no real conclusion as to the origin of Chinese porcelain can be drawn from a consideration of the history of kaolin. It might be added that similar remarks apply to the manufacture of porcelain in Europe, for, contrary to the general belief, it can be proved that the required white-burning clay was a well-known article of commerce in Europe long before the method of making porcelain was developed by Böttger early in the eighteenth century. The Chinese appear to have adopted glazing near the beginning of the Christian era, and Laufer accepts Hobson's conclusion that the idea of glazing pottery was derived directly from the West, by contact with the Hellenistic world, in comparatively late historical times. Although a knowledge of glazing was necessary before the Chinese could manufacture porcelain ware, yet in this achievement "the creative genius of the Chinese was not guided by outside influences, but relied on its own powerful resources."

J. W. MELLOR.

NOTES.

AN exhibition of medical war specimens will be opened in the museum of the Royal College of Surgeons of England, Lincoln's Inn Fields, by Sir Alfred Keogh, G.C.B., Director-General of the Army Medical Service, on Thursday, October 11, at 3 p.m. The greater part of the exhibition is devoted to specimens collected by officers of the R.A.M.C. during the present war, but there are also representations of the wounds and injuries of former wars, borrowed from the museums of the College of Surgeons, of the Army Medical College, Millbank, of St. Thomas's Hospital, and of University College Hospital. The specimens have been prepared and arranged by the members of the museum staff of the college. At the same time, the honorary fellowship of the college is to be presented to Sir Alfred Keogh.

A NATIONAL institute is to be established in Italy having for its objects the investigation of the relations between malaria and agriculture, the study of the direct and indirect causes of the unhealthiness of malarial districts, and the organisation of a campaign against those causes.

WE note from *Engineering* for September 28 that the operation of lifting into place the central span of the new Quebec Bridge was completed successfully on Thursday last, September 27. The work was commenced on Tuesday, and extended over three days. The weight of the span is about 5000 tons, and the height of lift 150 ft.

THE council of the Chemical Society announces that three lectures are to be given at the ordinary scientific meetings during the forthcoming session as follows:—December 6, "The Relation between Chemical Constitution and Physiological Action," Dr. F. L. Pyman; February 21, 1918, "Recent Studies on Active Nitrogen," Prof. the Hon. R. J. Strutt; April 18, the Hugo Müller lecture, entitled "The Old and the New Mineralogy," Sir Henry A. Miers. It is also hoped to announce at a later date that Dr. Horace T. Brown will deliver the lecture entitled "The Principles of Diffusion: their Analogies and Applications," which was unavoidably postponed last session. Arrangements have also been made for informal meetings to be held on November 15, March 21, and May 16.

WE learn from the *Secretary*, the journal of the Chartered Institute of Secretaries, that a *questionnaire* was recently circulated among members of the institute in order to obtain opinions as to the desirability of adopting a decimal system in place of the present British coinage, and the substitution of the metric system for the existing United Kingdom weights and measures. Of those who replied, 85 per cent. favoured a change to a decimal system of coinage as likely to be beneficial to the business in which they were engaged; and of the replies which expressed a preference, 66 per cent. favoured a £ basis of coinage rather than an "Imperial crown" or dollar basis. To an inquiry as to whether overseas business was hindered by the use of the present British coinage 50 per cent. of the replies indicated that this business was not so hindered; while in 64 per cent. of the replies a decimal system has been found of service for internal purposes in the business. In the case of weights and measures, 86 per cent. of the replies favoured a change to the metric system, and 53 per cent. of these had already adopted the change. Improved and extended business relations with traders in other countries were reported in 75 per cent. of the replies favouring the change. In 61 per cent. the business is stated to be hindered by the use of British weights and measures.

THE jubilee of the Albert Institute of Literature, Science, and Art, Dundee, was commemorated on September 20. It took its origin from the desire to perpetuate the memory of the Prince Consort by erecting a building devoted to the furtherance of the subjects which had occupied so much of his attention. The movement began in 1863, and the Town Council, when giving ground for the building, stipulated that accommodation should be provided within the structure for a free public library, in the event of Dundee adopting the Library Act. The Albert Institute was designed by Sir G. Gilbert Scott, and was opened in September, 1867, when the British Association occupied the Albert Hall in the building, and the public library was begun. An additional building was erected in 1872 as a museum and picture gallery, and ultimately the whole structure was handed over to the community. The story of this institute is one of continual progress. Large additions were made to the museum in 1887, and a separate technological museum was established in 1900. The libraries now consist of central lending and reference libraries, six branch libraries, partly paid for during the past ten years by Mr. Andrew Carnegie, two museums, two sculpture galleries, and six picture galleries. The donations to these departments in buildings, books, specimens, and pictures amount to more than 160,000*l.*, given by citizens and by Mr. Carnegie. At present the libraries contain 170,000 volumes, and the annual issue is about 420,000 volumes. The museums have departments for natural history, ethnography, geology, and technology. The picture galleries contain representative works by eminent modern artists. At the commemoration addresses were delivered by Principal Sir John Herkless, Dr. Hew Morrison, Bailie Martin, Dr. John Ross, Mr. R. F. Martin, and others.

MR. RUFUS D. PULLAR, head of the well-known firm of Messrs. J. Pullar and Sons, Perth, whose death in Edinburgh on September 22 we recorded last week, was born in Perth in 1861, and was the elder son of Sir Robert Pullar. The firm was founded in 1820, and

afterwards became one of the largest dyeworks in Great Britain, having a floorage area of more than 100,000 square yards, and being equipped for cleaning, dyeing, and finishing every kind of textile material. As a young man Mr. Pullar studied chemistry at Edinburgh University and the Yorkshire College at Leeds, and he visited the most important dyeworks in France, Germany, Switzerland, and the United States. Since the outbreak of war he spared neither time nor labour in the national cause, and was prominently associated from the beginning with Government action concerning the development of British chemical industries, particularly the colour industry. Mr. Pullar was connected with nearly all the philanthropic and educational movements in his native county. He was a fellow of the Chemical Society, a member of the Society of Chemical Industry, and for the two years 1915–16 was president of the Society of Dyers and Colourists, and chairman of the Dyewares Supply Committee formed by that society in October, 1914. In December, 1914, he was appointed a member of the Board of Trade Advisory Committee, which was entrusted with the difficult task of drafting a scheme to ensure the manufacture of dyes in this country on an adequate scale. This ultimately led to the formation of British Dyes, Ltd. He was also a member of the Provisional Committee of the Association of British Chemical Manufacturers. His membership of the Perthshire Appeal Tribunal and his duties as a Commissioner under the National Service scheme also made a heavy draft on his energies, and his many public activities, coupled with some recent labour difficulties, led to a breakdown in his health.

By the death of Philippe de Vilmorin on June 30, at the early age of forty-five, a notable and brilliant figure has been removed from the horticultural world, one that science can ill afford to lose. Inheritor of a great name, and head of a great firm with unrivalled resources, de Vilmorin placed both freely at the service of the science to the interests of which he was devoted. The precision in methods of plant-breeding which Mendel's discovery introduced at once appealed to him. He started experimental work in these directions, and some of his results with wheat and peas have already been published and are well known to geneticists. But while deeply interested in the purely scientific side of genetic studies, de Vilmorin was fully alive to their immense practical importance, and gave every encouragement to his staff at Verrières-le-Buisson to work along these lines. The achievements of Louis and Henri de Vilmorin, his father and his grandfather, had made him realise that the continued prosperity of a great and progressive firm must depend eventually upon the attitude adopted towards scientific discovery. He was actuated by an earnest desire to bring the so-called practical and the scientific workers into closer contact with one another, and spared neither time nor means to effect his object. A great opportunity came to him when the fourth International Congress on Genetics met at Paris in 1911, and de Vilmorin availed himself of it to the utmost. He undertook the arduous work of secretary, in which position his influence and prestige were exerted to bring together for their mutual profit a representative gathering from horticultural and biological circles. His great personal charm played no small part in making the congress the great success that it undoubtedly was. He undertook the further task of collecting and editing the contributions made to the congress, and the beautiful and valuable volume of reports issued owes as much to his enthusiasm as to his generosity. De Vilmorin also assisted in the progress of horticulture in other directions. He published papers on the beet-sugar industry of the United States, on the culture of ginseng in Korea and Manchuria, and on the tobaccos of commerce. He was also responsible for three important publications of his firm—"Les Fleurs de Pleine Terre," "Le Manuel de Floriculture," and the "Hortus Vilmorinianus." The first two are standard works on flower gardening, while the last is a valuable report on the behaviour of rare and little-known plants tested by the firm. Philippe de Vilmorin filled a unique place in the scientific world. No man was better endowed for helping to bridge over the gulf that long existed between the horticulturist and the botanist, between the garden and the laboratory. He played a great part in such success as has already been achieved. He would have played a greater part had his life been spared.

THE question of the religious or magical significance underlying the customs of bull-baiting or cattle-driving has been discussed without much result. Mr. W. Crooke, in *Folk-Lore* (vol. xxviii., No. 2), has collected a number of instances from India and elsewhere in which, at the critical seasons of agriculture, particularly at the sowing and transplanting of rice, the plough cattle are driven from their stalls and exposed to considerable violence. This may be conjectured to be a method of arousing their vitality and that of the crops. The late Major Tremearne believed that the form of bull-baiting practised in Nigeria was probably a fertility rite. The question is still obscure, and much more material must be collected before any definite conclusion can be reached.

IN the September issue of *Man* the Rev. A. T. Bryant describes the Zulu cult of the dead. Their religion makes no definite statement on the doctrine of the immortality of the soul. The soul is generally believed to survive death, and sacrifice is offered to it practically continuously for an indefinite period of time; but how long it will continue to live, and whether or not it will endure for ever, are not defined. A man dies, but only in his flesh; his spirit still endures; if it does not go to the bosom of Nkulunkulu, the Creator, it goes where he is supposed to be, to the nearest veldt. There it becomes changed, and in due course reappears in visible form in the guise of a snake—not a previously existing snake, but it simply materialises into one. To kill one of these spirit snakes was in former times a serious offence, and tests are prescribed by which such snakes can readily be identified, one distinction from other varieties being that they are all harmless.

PROF. FUTAKI discusses the cause of typhus fever in *The New East* for August (vol. i., No. 3). He and his co-workers claim to have demonstrated the presence of a delicate spiral micro-organism or spirochæte in this disease. It measures 6–8 microns in length, and is mostly found in the kidneys and suprarenal capsules. Monkeys can be infected by injection of the blood of a patient at an early stage of the disease, and similar spirochætes are present in the monkey's kidney.

IN *Science* for August 17 (vol. xlvi., No. 1181) Mr. N. A. Cobb contributes a general article on *intra-vitam* staining of tissues. For the examination of such objects perfectly corrected lenses must be employed, and Mr. Cobb recommends the use of one apochromatic objective (2 mm.) as a condenser for another apochromatic objective. This necessitates mounting the object to be examined between two thin cover-glasses, which may be supported upon a special carrier. By this arrangement the condenser objective may be brought into proper focus.

IN a circular issued by the Local Government Board attention is directed to the probability of the occurrence of indigenous cases of malaria in England.

This is rendered possible by the return to England of numbers of men who have had malaria in the Eastern campaigns. These men in many instances still carry the parasites in their blood, and, given the presence of the intermediary anopheline mosquitoes, considerable risk of the transmission of the disease must exist. In fact, cases of indigenous malaria arising in this way have recently been recorded. The Board invites the co-operation of medical practitioners and medical officers of health, and has made arrangements whereby specimens of blood may be examined. Inquiries are also being instituted into the local prevalence of anopheline mosquitoes.

A VERY useful pamphlet on bee plants and their honey has been drawn up by Mr. Grieve, of Whin's Vegetable Drug Plant Farm and Medicinal Herb Nursery, Chalfont St. Peter, Bucks. The various useful bee plants are referred to in special paragraphs, and notes of value as to the plants themselves and the character of their honey are given. The time of year at which the plants are in flower is also mentioned. Some attention is paid to poisonous honey, and the classic case of the rhododendron and azalea honey near Trebizond referred to by Xenophon is quoted. The uses of honey, its quality, and also the treatment of bee stings are given their due share of attention, and the pamphlet should prove of value to all interested in the beekeeping industry.

WE have received Bulletin No. 10 of the Department of Fisheries of the United Province of Bengal and Bihar and Orissa. It is a statement of the quantities of fish imported into Calcutta in the year ending March 31 last. The promptitude in publication is to be remarked, but this is explained by the circumstance that the data are evidently copies of "traffic returns," being statements of the quantities of fish carried by the various railways and other means of conveyance. No mention of the kinds of fish, or of their value, is given.

A DESCRIPTION of the Gymnosomatous Pteropods of the coastal waters off Ireland is given by Miss Anne L. Massy in the July number of the Proceedings of the Royal Dublin Society. The report is interesting because of our meagre knowledge of the group as it exists in British and Irish seas. The collections were made, by plankton and other nets, by the Irish fishery cruiser *Helga* off the west, south, and east coasts of Ireland during the years 1901–4. The Pteropods are not an abundant group among the specimens taken by the *Helga*, and they occur mostly in deep water between latitudes 50° to 52° N. and longitudes 11° to 13° W. Miss Massy has identified twelve species, and six of these are new to science, while four others are now recorded, for the first time, from British or Irish seas. Most of the species are deep-water forms, but one, *Pneumodermopsis paucidens* (Boas), is a shallow-water animal, and is fairly common between Inishbofin (in County Galway) and St. George's Channel, and is abundant enough to be of some value as a source of food for fishes.

WE have received from Dr. C. C. Easterbrook the interesting reports of the Crichton Royal Institution, Dumfries, for 1913 and 1914, as bearing upon the review by Sir Robert Armstrong-Jones of "Shell-shock" in NATURE of September 6, and entitled "The Psychopathy of the Barbed Wire." In specially marked paragraphs these reports emphasise (*a*) the definite dependence of the mind upon the body, "for mental illness, like other illnesses, is primarily a matter of derangement of health"; further, "in mental affections the mental machinery (*i.e.* the cells of the cerebral cortex) is disordered in its working and thrown out of gear"; (*b*) the concern expressed by all psychiatrists long before the war that mental disease among the poor should receive statutory sanction for treatment without the medical certificate, which, when issued, registers insanity as well as pauperism. As stated by Sir Robert, these suggestions made by the authors of "Shell-shock, etc.," are plainly the reflection of the considered opinion of all those who practise among the mentally afflicted. They have for many years urged the early treatment of these cases, both in the interests of the patient, who recovers earlier, and upon grounds of public economy. Lastly, (*c*) the reports show the dependence of mental illness upon the nervous or neurotic constitution, which "is a precursor of and a *sine qua non* of an attack of insanity." The reports support the view that the nervous constitution "is to be found among the nearer blood-relations." Although Dr. Easterbrook criticises the inferential value of hereditary histories of nervous and mental diseases, he yet derives "anomalous dispositions" in great part from racial, ancestral, and familial traits, with the result that the sufferer "loses his nerves" in consequence of a faulty heredity.

RED sandal (*Pterocarpus santalinus*, Linn., f.) was formerly valued for the red colouring matter santalin found in the heart-wood, and was exported to Europe from Madras in large quantities for use as a dye. This use outside India has been superseded by aniline dyes, and the wood is now used for the construction of house-posts, as it is never attacked by white ants. The tree grows on the slopes of the Cuddapah and neighbouring hills in the Madras Presidency, and a useful account of the tree and its growth, etc., with a map of its distribution and photographs, is given by Mr. T. A. Whitehead in Forest Bulletin No. 34, India. "Redwood" was frequently used as ballast in home-going ships in early days, and was referred to as "Caliature," a name which Rumphius traces to the town of Kistnapatam, eighty-two miles north of Madras, which, according to an old glossary, is the Greek Sopatma, or otherwise "Calitore." In a Portuguese map of 1672 a village Caletur is indicated, and it is interesting that, though the place was known to foreigners as Calitore or Caletur, it was not recognised by that name by British factors.

TOWARDS the middle of June in the present year considerable tracts of the Pennine Hill pastures were found to be infested with the caterpillar of the antler moth (*Charaeas graminis*, L.) in extraordinary numbers, causing serious damage to the grazing. The outbreak was investigated at the time by officers of the Board of Agriculture and others, and forms the subject of two reports which are published in the August issue of the Board's *Journal*. Messrs. A. C. Cole and A. D. Imms contribute a report on observations in the Peak District. They record that the principal grass attacked was that known locally as "bent" grass (*Nardus stricta*), whilst cotton grass (Eriophorum) and other species appeared to suffer less severely. The more succulent and finer grasses escaped attack, as did also bilberry, white bedstraw, heather, and bracken. The altitude appeared to be a distinct factor in the limitation of the infestation, no caterpillar being found at an elevation less than 900 ft., although from that altitude up to 1700 ft. it was prevalent. The two most efficient barriers were found to be water and stone walls. These observations are substantially confirmed by Mr. J. Snell's report on the outbreak in Yorkshire. He also found *Nardus stricta* to be badly attacked, and further observed the caterpillar feeding on *Aira*

caespitosa, some of the finer grasses, and other plants. Messrs. Cole and Imms offer suggestions as to possible causes of the outbreak, and both reports agree in recommending the cutting of trenches across the grass-land as a preventive measure. The effectiveness of spraying measures is also discussed.

THE cutting off of supplies of potassium salts from the German deposits has forcibly directed attention to other sources hitherto neglected. Of the many waste products investigated few appear to offer better prospects of economic utilisation than the flue-dust of blast-furnaces. That soluble potassium salts are present in these flue-dusts is no new discovery, but only of late have they received serious consideration. According to tests by Mr. H. T. Cranfield, published in the August issue of the *Journal of the Board of Agriculture*, the potash-content of these flue-dusts is extremely variable, the total (acid-soluble) potash ranging in the twelve samples quoted from 2·97 to 15·89 per cent. K_2O, whilst the water-soluble potash ranged from 1·23 to 9·25 per cent. The flue-dusts vary greatly in colour, and, generally speaking, the lighter-coloured materials are richest in potassium salts. Potassium sulphate is the principal of these salts, the chloride being also present in smaller proportion. It is suggested that the total annual output of potash in these flue-dusts is probably not fewer than 15,000 tons, of which quite one-half is soluble in water. These data furnish adequate justification for the Order recently issued by the Ministry of Munitions whereby the sale and treatment of blast-furnace dust are brought under control.

IN continuation of the experiments on the temperature-gradient in the lavas of Kilauea, referred to in NATURE of June 28 (vol. xcix., p. 352), Mr. T. A. Jaggar, jun., records that bright lines in the lava-lake give temperatures of about 1020°—that is, about 250° above those of the lake magma 3 ft. below the surface (Bull. Hawaiian Volcano Observatory, March, 1917, p. 34). The same author contributes an article on "The Thermal Gradient at Kilauea" to the Journal of the Washington Academy of Sciences, vol. vii., p. 397, in which he further emphasises the generation of heat at the surface "through completion of the reaction between rising unstable gas mixtures and through union with atmospheric oxygen." The liquid lava in the lake is 14 metres deep, and rests on a seemingly pasty bottom. The lower 5 metres of the lake have a temperature of 1120° to 1170°; this is attributed to the release of air from foundered blocks, which reacts with the volcanic gases and produces reheating.

THE mean monthly temperatures of the surface waters of the Atlantic Ocean north of lat. 50° N. are the subject of a paper by Dr. C. Ryder which appears as one of the publications of the Danish Meteorological Institute. In 1892 the institute published the isotherms for six months of the year calculated from fourteen years' observations. The present paper marks a great advance, for it comprises all months of the year, is based on forty years' observations, and extends to lat. 50° S. Most of the observations are from Danish vessels, and unfortunately data are lacking for the sea a few degrees east of Iceland in most months. A chart is given for each month of the year, based on the mean temperatures calculated for stations of 1° squares. The information is also tabulated in mean values for the four decades of the period covered. This arrangement was desirable for many reasons, not least because the transition from steam to sail resulted in certain areas being more frequented in some decades than in others. Perhaps the most instructive chart is that on which the isotherm of 9° C. has been drawn for all months of the year. The January, February, and March isotherms almost coincide. In April the northern trend is marked in the east, and in succeeding months the isotherm swings north until it touches the north-west and south-east coasts of Iceland in August. Then again it withdraws southward. In the west there is far less divergence between the relative monthly positions of the isotherm, for the cold southward current is maintained throughout the year.

THE problem of temperature measurement and the pyrometric control of furnace-casting and ingot-teeming temperatures in steel manufacture is one the importance of which it would be difficult to overrate. Hitherto on account of its supposed difficulty its solution has not been attempted. Publication No. 91 of the Technologic Papers of the Bureau of Standards is therefore to be welcomed in that it takes up this problem, and the conclusion reached by Dr. Burgess, the author, is that it does not really present serious difficulties or uncertainties. Observations have been taken in several steel plants. The most satisfactory instrument to use is an optical pyrometer using monochromatic light, and permitting observation from a distance of streams of metal. It is shown that the necessary corrections to the observed readings for emissivity of metals and oxides to give true temperatures are sufficiently well known, but there may be uncertainty in the case of liquid slags. For streams of liquid iron or steel the most probable value of emissivity to take, with a pyrometer using red light of wave-length $\lambda=0{\cdot}65\ \mu$, is $e=0{\cdot}40$, corresponding to a correction of 139° for an observed temperature of 1500° C. The value of e for liquid slags is usually about 0·65, but varies with the composition of the slag. It appears from the author's results that the temperatures of the roof of an open-hearth furnace bear no necessary relation to that of the metal bath, which again it is shown may have zones of considerable differences in temperature, depending upon the operation of the furnace. The temperature of the roof of an open-hearth furnace, depending upon the firing practice, may vary very rapidly, and within wide limits, from 1550°–1750° C. That of the bath is usually kept between 1600° and 1670° C. There appears to be a remarkable degree of uniformity in casting temperatures actually acquired by the melters in practice. Thus for nineteen consecutive Bessemer heats the teeming temperatures of the ingots were all between 1500° and 1555° C., and a similar degree of concordance was found in the open-hearth practice of several mills.

IN view of the importance of Fourier's series in physical applications, much interest attaches to a paper by Prof. H. S. Carslaw on "A Trigonometrical Sum and the Gibbs Phenomenon in Fourier's Series" (*American Journal of Mathematics*, vol. xxxix., No. 2, 1917). In this paper Prof. Carslaw gives a proof of the property first noticed by Gibbs, namely, that when a function becomes discontinuous the sum to infinity of its Fourier expansion does not always merely change at an infinitely steep gradient from the initial to the final value of the function, but that in certain cases it may, in the neighbourhood of the discontinuity, fluctuate between a maximum and a minimum value *outside* the limits of value of the function itself. In other words, the maximum and minimum values of the sum of a finite number of terms of the expansion, just before and after the discontinuity, may be outside the limits of value of the function itself, the maximum exceeding the larger value of the function, and the minimum being less than the smaller value by amounts which remain finite, even if the number of terms be increased indefinitely. The proof is well illustrated by the diagrams at the end of Prof. Carslaw's paper, not-

withstanding the fact that similar diagrams for the expansion considered in the paper have frequently occurred in text-books.

THE business of the *Electrician* Printing and Publishing Co., Ltd., having been acquired by Messrs. Benn Bros., Ltd., 8 Bouverie Street, E.C.4, the forthcoming books of the former company, announced in NATURE of September 20, will be published by Messrs. Benn.

OUR ASTRONOMICAL COLUMN.

SEPTEMBER METEORS.—Mr. Denning writes that a fair number of meteors, including several brilliant fireballs, were observed in September. There was a well-defined shower, not far from the Pole, at 314°+79° at the middle of the month, and at the period from September 19–24 the chief radiant points were at 4°+27°, 59°+35°, 271°+22°, 290°+52°, 343°+14°, and 352°+2°. A very brilliant meteor was observed on September 21 at 10h. 3m., from the radiant in Cygnus. As seen from Bristol it was brighter than Venus, and fell from a height of 67 to 28 miles. On September 23, at 7h. 42m., a fireball illuminated the sky as seen from Clevedon, and it had a long, slow, and nearly horizontal flight from a radiant at 322°−23° in Capricornus. Its path was about 166 miles from over the English Channel to Welshpool, and it descended from 64 to 32 miles. Though it had a very extended path, only two observations of it were received, viz. from Clevedon (Somerset) and Fowey (Cornwall), but the sky was cloudy at many places.

COMET 1916*b* (WOLF).—The following is a continuation of the ephemeris, for Greenwich midnight, given by Messrs. Crawford and Alter in Lick Observatory Bulletin No. 295:—

1917	R.A.	Decl.	Log Δ	Brightness
	h. m. s.	° ′ ″		
Oct. 4 ...	23 38 17	−1 8 2	0·0891	1·22
6 ...	38 22	1 45 27	0·0972	
8 ...	38 31	2 21 9	0·1055	1·10
10 ...	38 43	2 55 5	0·1141	
12 ...	38 58	3 27 14	0·1227	0·99
14 ...	39 18	3 57 37	0·1315	
16 ...	39 41	4 26 13	0·1404	0·89
18 ...	40 7	4 53 3	0·1495	
20 ...	40 38	5 18 9	0·1586	0·79
22 ...	41 13	5 41 33	0·1678	
24 ...	41 51	6 3 16	0·1770	0·71
26 ...	42 34	6 23 21	0·1863	
28 ...	43 20	6 41 51	0·1956	0·63
30 ...	44 10	6 58 49	0·2049	
Nov. 1 ...	45 3	7 14 17	0·2142	0·56
3 ...	23 46 0	−7 28 20	0·2235	

The comet is situated below the Square of Pegasus, and is well placed for observation. It is, however, much fainter than might have been expected from the fact that it was discovered more than a year before perihelion passage. Between August 13 and August 22, according to observations by Quénisset, the magnitude of the comet fell from 8 to 9.

A COLOUR SCALE FOR STARS.—An attempt to establish a scale of colours adapted to observations of stars and planets has been made by Prof. W. H. Pickering (*Popular Astronomy*, vol. xxv., p. 419). The numerical values assigned to the different colours are:—5, deep-blue; 6, sky-blue; 7, light-blue; 8 pale-blue; 9, bluish-white; 10, white; 11, yellow; 12, orange; 13, reddish-orange; 14, orange-red; 15, light-red; 16, deep-red. The typical colours are shown in circular patches on a coloured plate, which is to be viewed by one eye under carefully adjusted illumination, while the planet, or star out of focus, is viewed with the other eye at the telescope. To secure constant conditions of comparison, the illuminating source is to be slightly modified as required, so that certain standard stars of type K always register 11. The average results for stars of different types are compared with the colour indices (differences between photographic and visual magnitudes) in the following table:—

Type	Colour scale	Colour index
Oe ...	7·0 ...	—
B ...	6·7 ...	−0·3
A ...	7·4 ...	0·0
F ...	7·6 ...	+0·3
G ...	9·5 ...	+0·7
K ...	11·5 ...	+1·2
M ...	12·0 ...	+1·6
N ...	13·7 ...	+2·5

An extensive investigation of star colours has also been made by H. E. Lau (*Astronomische Nachrichten*, No. 4900). The scale in this case is white=0, yellow=5, and red=10. The influence of atmospheric absorption and the effect of magnitude have been examined, and a catalogue showing the colours of more than 700 of the brighter stars is given.

AN AUSTRALIAN CHEMICAL INSTITUTE.

AN Australian Chemical Institute has been formed with its headquarters in Sydney, and branches in every State of the Commonwealth. The provincial committees include the professors and other teachers of chemistry in the universities and most of the professional chemists in the several States. The institute has been framed on much the same lines as the Institute of Chemistry for Great Britain and Ireland. The objects set forth are:—(1) To raise the status and advance the interests of the profession of chemistry; (2) to promote the usefulness and efficiency of persons practising the same; (3) to afford facilities for the better education and examination of persons desirous of qualifying as technical analysts and chemical advisers; (4) to obtain power to grant legally recognised certificates of competency. Persons eligible for membership must possess certain qualifications, such as the degree of a recognised British university where they have studied chemistry for not fewer than three years, or an approved diploma in some branch of chemistry granted by an approved technical college or school of mines (no mention is made of the length of study required from such), or be fellows or associates of the Institute of Chemistry of Great Britain and Ireland, or who have satisfied examiners appointed by the council that they have attained a necessary standard of chemical education; other persons may be admitted by the council without examination for special reasons on the recommendation of the committee of a branch.

The council does not intend to hold any examination for admission before January, 1918, but lecturers or teachers of chemistry at an Australian university, technical college, or school of mines, or approved secondary school, chemists who are in charge of a Government laboratory, or have been in charge of a laboratory attached to a commercial or industrial establishment for three years, chemists or analysts who have been in practice for three years, and certain others will be eligible for membership without examination before that date. Chemists who have been absent from Australia on war service may be admitted without examination after January 1, 1918, at the discretion of the council. One of the stated duties of the council is to take any steps that may appear to be advisable to improve the rate of remuneration of chemists in private practice or in the employment of

the Federal or State Governments or commercial establishments; another duty is to appoint committees for fixing standard methods of chemical analysis, for the publication of memoirs or bulletins, and for the standardisation of fees for professional work. It is intended to apply for a charter for the institute. A number of the professorial and professional chemists in Australia are fellows of the Institute of Chemistry of Great Britain and Ireland, and probably one of the principal reasons for forming a similar institute in Australia is in consequence of the difficulties connected with the holding of the former's examinations in Australia, due to the great distance and other causes now increased by the war.

CHILD-STUDY AND EDUCATION.[1]

THE special merit of the "Memorandum on the Educational Principles upon which should be based all Future School Reform" is that it dwells on the need for basing education upon a true theory of child-nature. It consists of an introduction by Prof. Adams, five sections written by "experts," and a series of "recommendations." All who are interested in educational progress should urge these "recommendations" on education authorities.

From the title one might suppose that these "principles" have been stated once for all by the council of the society. Fortunately this is not so. In the recommendations we find two "principles" only, viz. that reform must be based on knowledge, and that knowledge must be obtained through real investigation.

The suggestions as to how additional data are to be sought are both wise and practical, though there is much that is unscientific and altogether out of place in sections 3 and 4, which, as Prof. Adams puts it, "have the special merit of correlating age and advancement," and he adds that teachers will read with some eagerness what the experts have to say on this. But, in this memorandum, "merit" should be replaced by "*de*merit." If there were such a correlation, the only way to improve education would be to extend the period of pupil-age. The basis of the memorandum is that there is no such correlation—that with a truer psychology, intelligence and knowledge will be greater at a given age. Naturally, then, no trace of these excrescent sections appears in the "recommendations."

The memorandum is called for. There is considerable evidence that, under the influence of traditional beliefs, we are to-day perpetuating mistakes in education no less serious than those in medicine before Pasteur's discoveries overthrew the traditional wisdom of physicians. One instance may here be given. The writer knows of a boy, three years eight months old, who, never having *lessons*, has been brought up in an environment providing as free and full opportunity for mental as for physical development. At two he did the Montessori exercises with ease and accuracy when presented to him, and did not care to repeat them more than once or twice. At two and a half his guardian wrote:—"He has a scrupulous sense of order, great carefulness, and a deft handling of everything he touches. He is allowed to explore and handle everything he wishes, even the most delicate articles, merely enjoining on him to be very careful," and more in the same strain, and he scarcely ever broke anything. Later, at three and a half:—"Whenever he sees anything new to him, he at once wants to know its name and all about it; he is quick to observe the different leaf buds on the trees, and can distinguish and name many trees by their buds alone; sometimes he will bring in a little branch, run to our 'Nature-book,' and compare it with the pictures, finding out which it is for himself. He is also full of interest in birds and knows twenty different kinds by name," and so on. This child has been remarkably free from ailments, as have been all the other children whom the writer can trace who have been brought up in this way, being allowed the free choice of mental as well as of physical occupations; treated always as intelligent, but never forced to mental exertion. And we find among the products of this method great *old* men such as Lord Kelvin.

This is the method indicated by Nature. The brain of the very young child is proportionately far more developed than any other part of his physical system; why should we assume that it is the part to be given the least opportunity for early growth and development through the exercise of the activities peculiar to it? As in such matters experience is the only guide, the writer would be very glad if those who have trustworthy data on the question of early education would communicate with him at Trinity College, Dublin.

E. P. CULVERWELL.

[1] Published by the Child-Study Society, 50 Buckingham Palace Road, London, S.W.1. Price 4*d*. post free.

THE HYDRAULIC RESOURCES OF FRANCE.

IN view of the partial dependence of France on other sources for her coal supplies, the question of utilising water-power becomes an increasingly vital factor in her economic development. Considerable interest therefore attaches to an article appearing in *La Nature* for June 23, which incidentally furnishes also a comparison with the resources of other countries in this respect. Various computations have been made as regards France; one made in 1911 places her resources at 9,200,000 horse-power of water-power available for a minimum of 180 days in the year. This is against Norway's 7,500,000 h.p., Sweden's 6,750,000 h.p., Austria-Hungary's 6,450,000 h.p., Italy's 5,500,000 h.p., Spain's 5,000,000 h.p., Switzerland's 1,500,000 h.p., Germany's 1,425,500 h.p., and Great Britain's 396,000 h.p. In this connection Norway's available supply is 36·60 h.p. per square kilometre of area, that of Sweden 20 h.p., of Austria-Hungary 19·46 h.p., Spain and Italy 10 h.p. each, England and Germany 2 to 3 h.p. each. France's resources, according to recent estimates, are about 25 h.p. for the same area. The quantity of water available in the Alpine regions alone of France represents about 4,000,000 h.p.

The value of the water-power resources of France has long been recognised, and while she has utilised them to a greater extent than certain other European countries have theirs, about nine-tenths are still unharnessed. Germany, on the other hand, though rich in coal, has utilised about 31 per cent. of her available supply of water-power.

Contrary to expectations, the war, instead of relaxing attempts to employ water for power-raising in France, has greatly stimulated activity in this direction, in spite of dearth of labour and materials. The article gives interesting details of plants already completed or in course of erection.

Much is hoped for by utilising barrage water at high pressures; especially is this the case in respect of the electrometallurgical and electrochemical industries, which are sure to develop when new works come into existence and more experience is gained.

France's annual requirements of coal are estimated in the near future to be thirty million tons per annum, and as prices are likely to increase considerably, the author's plea for the extended applications of water-power is justifiable. He asks what this 9,000,000 h.p. of available "white coal" represents in terms of

ordinary coal. According to calculations which were made at one time by M. Loucher, each horse-power-hour produced on a locomotive is equivalent to a consumption of 2·5 kilos. of coal. Consequently, the water-power yet to be utilised represents 20,000 tons of coal per hour, or, say, 180,000,000 tons per annum.

The author admits, of course, that certain industries cannot dispense with coal, but suggests the use of hydro-electric power wherever applicable. Railways such as the Midi, the Paris-Lyons-Mediterranean, and the greater part of the Orleans should be electrified. Large cities, like Paris, should follow the example of Lyons. He pictures the advantages to Parisians in respect of suburban transit, their industries, and lighting, had the Rhone barrage at Genissiat been completed before the war.

Certain trades, as has been said, can dispense with coal if electric power is available, such as the textile, chemical, and paper trades. Metallurgy, glass-making, pottery, and zinc refining use up enormous quantities of coal. But this state of things will not always persist; synthetic pig-iron will one day replace the present commodity; the electrometallurgy of zinc is now a practical proposition; the ceramic art is capable of modernisation; and electric bakeries are not merely utopian.

In addition to being a source of heat, "white coal" is also a source of cold; low temperatures are necessary for obtaining synthetic nitrogenous products, cyanamide, electrolytic potassium and permanganate—substances which could, under the new *régime*, be produced cheaply in France. Further, "white coal" would help agriculture, not only by providing manures, nitrates, and cyanamides, but for driving tractors, lighting farms, irrigating pasture land, working pumps, ventilators, drying plants, separators—and in a host of other ways. E. S. HODGSON.

ETHNOLOGICAL WORK IN QUEENSLAND.

IN vol. xxix., part i., of the Proceedings of the Royal Society of Queensland, the president, Dr. R. Hamlyn Harris, under the title of "Some Anthropological Considerations of Queensland and the History of its Ethnography," supplies an interesting review, with a full bibliography, of the ethnological work which has been done in the State. In 1914, at Talgai, on the Darling Downs, a skull was found in a river deposit in which remains of Diprotodon and other extinct marsupials had already been discovered. The geological evidence is not quite satisfactory, but there are some reasons for believing that it belongs to the Pliocene period. Dr. G. A. Smith, of Sydney University, believes that it is the skull of a young Proto-Australian which is practically indistinguishable from that of a present-day native. It shows a very primitive facial skeleton, the jaw and teeth of which display remarkable features, even more primitive than those hitherto described in any human skull, except in Piltdown. In particular are noticeable the great squareness and enormous size of the palate and teeth, and the semi-anthropoid nature of the articulation of the upper canines with their mandibular opponents. In the same neighbourhood, in 1906, a couple of rough implements of Palæolithic type were unearthed.

In the same paper Dr. Hamlyn Harris discusses some other interesting questions. The principal centre of mummification in Queensland was on the east coast, around Cairns and the Johnstone river, extending in a southerly direction. This singularly restricted area suggests that the habit of mummification was not introduced from Malaysia, nor *viâ* Cape York, but that it was brought from the far islands of Torres Straits by natives who were carried on to the north-eastern coast of Queensland, more or less by chance. This in some measure corroborates the views of Prof. Elliot Smith, who suggests the Cape York Peninsula, *viâ* Torres Straits, as the hypothetical route in the migrations of the culture bearers who were responsible for the diffusion of the "heliolithic culture complex." Dr. Hamlyn Harris suggests that in geological times Australia was in land connection with Asia, not only with New Guinea, but probably also with Timor, and certain Queensland birds and animals are more closely allied to Asiatic than to Papuan species. He fully accepts the conclusion of Dr. Rivers and Prof. Elliot Smith that the oceanic cultures have been mainly derived from contact with other races. Mornington Island, on the Gulf of Carpentaria, preserves an almost unique example of Australian aboriginal culture which has not been affected by foreign influences.

THE SOILS OF HAWAII.

THE island of Hawaii is the largest of the group of Sandwich Islands, which were formally annexed to the United States in 1898. It is mountainous and volcanic, and the soil is highly productive; sugar and pineapples are the staple industries, but coffee, honey, hides, sisal, bananas, rice, wool, cotton, and rubber are also exported. As usual with American possessions, a strong agricultural experiment station has been developed; in this particular case the work was done under the auspices of the Sugar Planters' Association. The director, Dr. H. P. Agee, and the staff have carried out some excellent investigations on the problems connected with the local agriculture. The latest publication is by the chemist, Mr. P. S. Burgess, and deals with the soils of the island. These are of special interest because they are of volcanic origin, and are situated in a different climatic zone from our own, so that they differ in many respects from the ordinary soils of Great Britain or America, especially in their large content of oxides of iron and aluminium, and their small content of silica. Thus the average of a number of analyses is:—

	Fe_2O_3	Al_2O_3	SiO_2	
Hawaiian soils ...	28·0	20·7	32·6	per cent.
American soils ...	3·8	5·1	85·5	,, ,,

The soils to which we are accustomed have been formed in such a way that their chief constituent is insoluble silica or silicates; the Hawaiian soils, on the other hand, contain large quantities of iron and aluminium oxides; they are known as laterites; other instances occur in Java. This difference in composition especially affects the finest grade of material, the clay, which in the Hawaiian soils consists mainly of iron and aluminium oxides, while in the soils of temperate zones it consists chiefly of silicates. In consequence the behaviour to water is profoundly modified, and the hygroscopic coefficients and other constants are quite different from those obtained on normal soils.

Bacteriological investigations have been put in hand, but, as usual with American stations, the work is mainly concerned with the amount of decomposition effected by the organisms, and not with the organisms themselves. The results suggest that a detailed comparison of typical organisms would be of considerable interest.

So far as we know, the Hawaiian Sugar Planters' Experiment Station is the only station issuing English bulletins which has the opportunity of fully investigating laterite soils. It has, therefore, an unusually good range of problems. There can be little doubt that a detailed comparison of these soils with typical soils of the eastern seaboard of the United States would throw much light on the problems of soil chemistry and soil physics. E. J. R.

EXPERIMENTAL PHONETICS AND ITS UTILITY TO THE LINGUIST.[1]

THE art of speaking a foreign language demands (among other things) an ability to perform all kinds of difficult movements with the tongue and other parts of the speech-mechanism. Such ability may be acquired by the learner, if he is provided with precise instructions as to what he must do. It is the function of the phonetician to supply these instructions.

Instructions as to how to pronounce must, in order

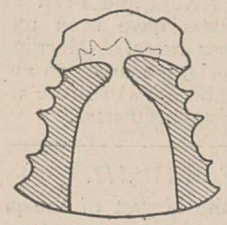

FIG. 1.—Palatogram of *s*.

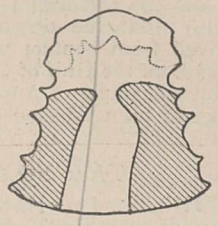

FIG. 2.—Palatogram of the English sound of *sh*.

to be efficacious, be based on accurate analysis of the pronunciation. Many of the facts of pronunciation can be ascertained by direct observation (by auditive, visual, tactile, and muscular sensation) on the part of those who have a specially trained ear and a highly developed control over their vocal organs. These methods are extremely important, and no satisfactory analysis of a language can be made without them. Other methods, however, may be used to supplement these, namely, mechanical analysis by means of a specially designed apparatus. Analysis of this kind constitutes the branch of phonetics known as experimental phonetics. It is with these mechanical aids to analysis that we are here concerned.

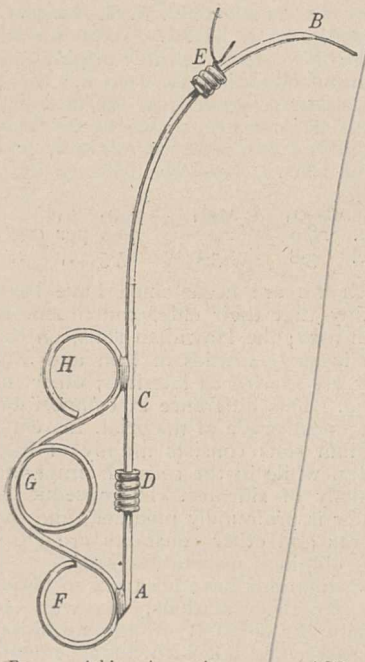

FIG. 3.—Atkinson's mouth-measurer. ACB, tube; D, handle of wire; E, tooth-stop; FGH, handle.

It will be well to give first a few examples to show how information regarding *tongue-positions* may be ascertained experimentally.

One way of getting information is that known as *palatography*. It consists in using a special kind of artificial palate, in order to find out what parts of the roof of the mouth are touched by the tongue in the production of different speech-sounds.

The requirements of this special type of artificial palate are that it should be very thin, should fit very accurately, should be dark coloured, and should cover the whole of the hard palate, alveolars, and the underside of the upper front teeth. Such palates may be made of vulcanite, or metal, or other substances.

When the palate is to be used, it is dusted over with powdered chalk; it is then inserted into the mouth; the sound to be studied is pronounced, and the palate is taken out. It will be found that the chalk has been removed by the tongue at every point which the tongue has touched in articulating the sound. So the areas touched by the tongue appear dark, while the parts of the palate which are not touched remain white.

The shapes of the dark areas may be recorded by photography if desired, but it is generally sufficiently accurate, and a good deal more convenient, simply to copy the dark areas on to a previously prepared outline diagram of the palate. (The result is, of course, a projection of the true shape.) The finished diagrams are called *palatograms*. Palatograms will be found to corroborate observations of tongue-positions made by other methods.

Figs. 1 and 2 are examples of palatograms.

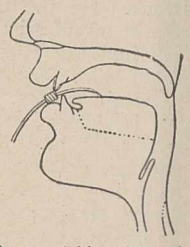

FIG. 4.—Atkinson's mouth-measurer in position.

We will now turn to methods of ascertaining the *shapes* assumed by the tongue in the articulation of speech-sounds, and more particularly the shapes of a section of the tongue down the mesial line, and their relations to the centre-line of the palate.

One method of ascertaining these shapes was invented by Dr. E. A. Meyer, of Stockholm. It consists in using an artificial palate down the middle line of which are fixed some lead threads which hang vertically. These threads are of such a thickness that the pressure from the tongue will bend them when a speech-sound is produced; but they are strong enough to remain in the position into which they are pushed. So that if the palate is taken out of the mouth after pronouncing a speech-sound, the lead wires show the

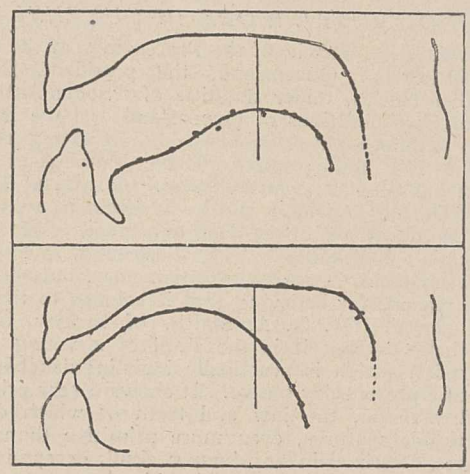

FIG. 5.—Tongue-positions of the English vowels in *bath* and *beat* as ascertained by Atkinson's mouth-measurer.

outline of the tongue-position compared with that of the palate. There is a means of transferring these outlines to paper.

A second apparatus for obtaining similar results is the "mouth-measurer" invented by H. W. Atkinson.[2] There is a tube of the shape ACB, shown in Fig. 3, and inside the tube is a wire which can be pushed along (by means of the handle D) and made to project to different lengths from the end of the tube. A projecting piece of metal, called a "tooth-stop" (E), is

[1] Abridged from a discourse delivered at the Royal Institution on February 9 by Mr. Daniel Jones.

[2] Obtainable from Mr. H. W. Atkinson, West View, Eastbury Avenue, Northwood, Middlesex. (Price 5*s*. 6*d*. for set of two mouth-measurers, with accessories.)

attached to the tube; it can be fixed at various points. FGH is a wire handle.

To use the instrument, it is placed in the mouth either in the manner shown in Fig. 4, or else so that

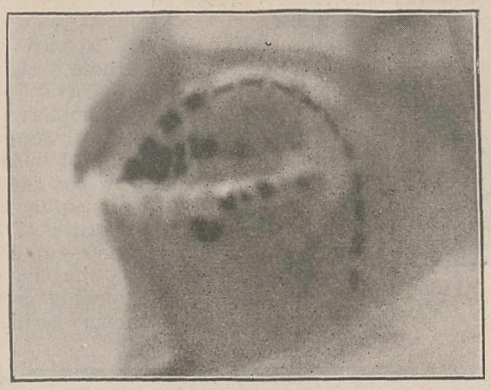

FIG. 6.—X-ray photograph of cardinal vowel *i* (as in French).

the tube is in contact with the teeth at the tooth-stop and also in contact with some point of the palate (the position of the apparatus depending on the nature

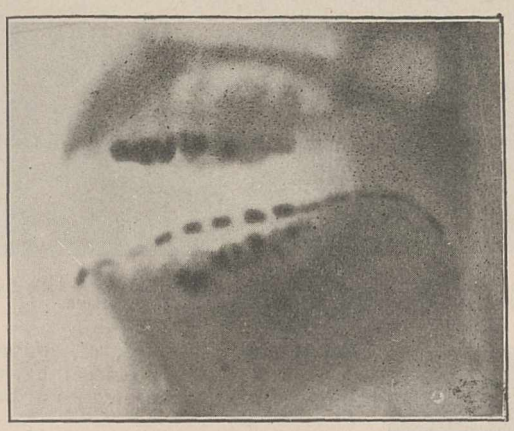

FIG. 7.—X-ray photograph of cardinal *a*.

of the sound to be analysed). The wire is then pushed along until the end of it is felt to touch the tongue. The instrument is withdrawn and applied to a pre-

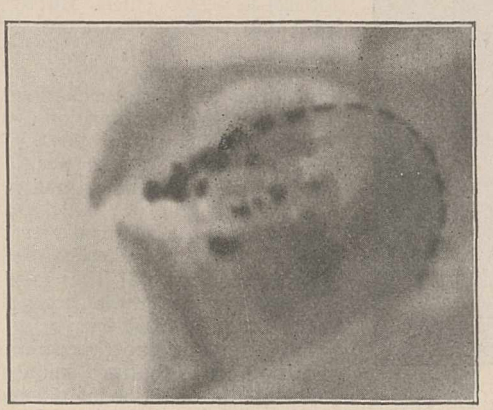

FIG. 8.—X-ray photograph of cardinal *u*.

viously prepared diagram of the shape of the observer's palate. The position of the end of the wire is then marked on the paper.

Further observations are then taken with the tooth-stop fixed at other points. In this way the positions of other points of the surface of the tongue are ascertained. In the end we get on our paper a series of, say, ten or more points which show with fair accuracy the shape of the most important part of the tongue.

Fig. 5 shows specimens of results obtained by this means. They were prepared by Mr. Atkinson, and are reproduced here by his kind permission.

A third method of obtaining sectional diagrams of tongue-positions is X-ray photography. In order to

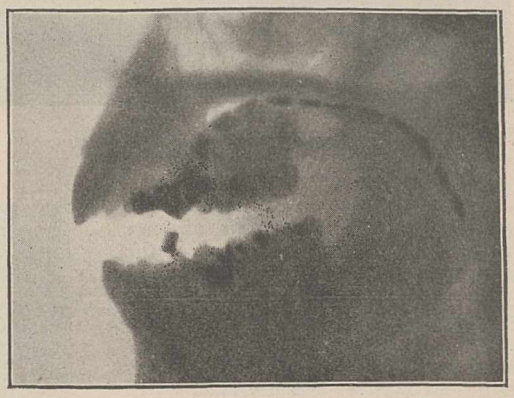

FIG. 9.—X-ray photograph of the scund *k* as in *cave*.

get good results by this process it is necessary to make use of some opaque substance to show the outline of the tongue. The plan which has given the most successful results is to place on the tongue a little chain of small lead plates. (This plan was originally devised by Dr. E. A. Meyer.)

Figs. 6 to 10 are photographs of this description taken by Dr. H. Trevelyan George, of St. Bartholomew's Hospital, who has displayed much ingenuity and patience in getting over the numerous difficulties which present themselves in the course of work of this nature.

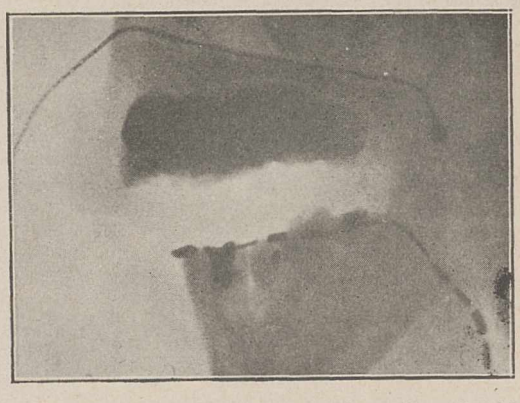

FIG. 10.—X-ray photograph of Welsh *o*, as in *ton*, "wave." Said by Mr. Stephen Jones, Assistant for Experimental Phonetics at University College, London. Tongue-position shown by lower chain. The upper chain passes through the nose, and shows the shape of the upper side of the soft palate.

Another element of speech which can be successfully studied by the methods of experimental phonetics is the vibration of the vocal chords. Some speech-sounds (*e.g.* normal *v* or *z*) are accompanied by vibration of the vocal chords, others (e.g. *f*, *s*) are not; others, again, are accompanied by vibration during a part of their length. It is important for linguistic purposes to ascertain with accuracy the precise points where vibration of the vocal chords begins and ends in connected speech.

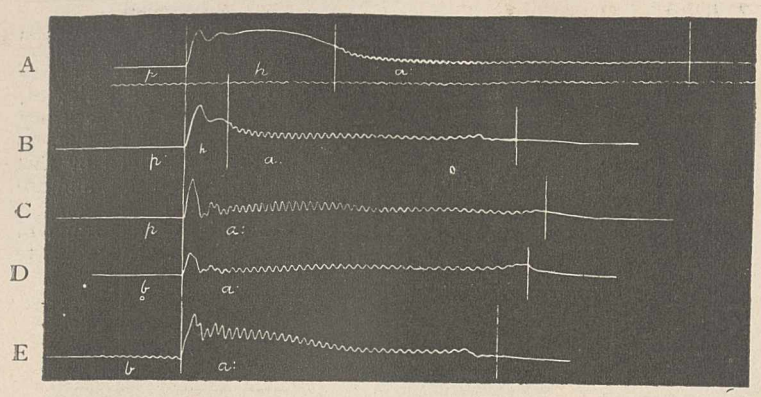

FIG. 11.—Mouth-tracings of (A) fully aspirated *p*; (B) partially aspirated *p*; (C) unaspirated *p*; (D) unvoiced *b*; and (E) fully voiced *b*—each followed by the vowel *a*.

There are several ways of recording mechanically the presence or absence of voice. The method which gives the most satisfactory results from the point of view of the linguist consists in using a kymograph fitted with one or more tambours of Marey's model. This method was described in NATURE for June 9 last, and readers are referred to that article for details.

Figs. 11, 12, and 13 are some additional kymographic tracings illustrating linguistic phenomena.

The above examples show to what extent experimental phonetics may be useful to the language learner. It furnishes him with much of the information he wants in regard to pronunciation. The practical linguist should make these ascertained facts the basis of his study of the pronunciation of the language he is learning. He will be able to infer from them how he must proceed in order to get his own organs of speech to perform the movements required by the foreign language.

In conclusion, it may be as well to point out that as these scientific methods of analysis are useful to the linguist, so also the accomplishments of the linguist are sometimes found to have their uses to the man of science.

Thus it is possible by means of a speech process to demonstrate in a remarkable way the existence of harmonics in a musical note—to show, for instance, that if the note *c* is sung, there is sounding simultaneously the well-known series of harmonics, *c'*, *g'*, *c''*, *e''*, *g''*, etc. This fact is made evident by putting the mouth into a series of positions which will act as resonators and reinforce different harmonics one after the other. If only one position is taken up by the mouth, some harmonic or other is necessarily reinforced, though it is extremely difficult to detect which. But by making rapid changes from one mouth-position to another, the successive harmonics become clearly audible *by contrast*. The speech-movement which makes these harmonics come out most clearly is to start by holding the tongue in the position of the English sound of *ng* and rounding the lips and gradually separating them. At close quarters the effect is that of an arpeggio played on a tiny harp. If the voice-note is changed, the same arpeggio is heard in a different key.

This phonetic experiment may or may not prove to have some direct value in the direction of elucidating problems of sound-quality, but at any rate it is useful as a practical demonstration of the presence of harmonics in a musical sound.

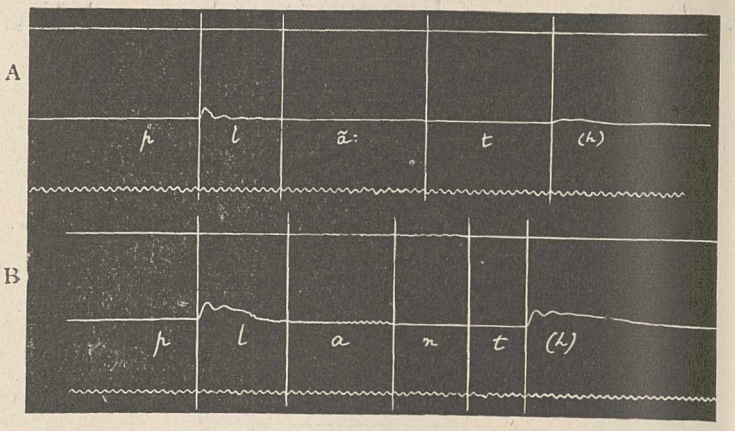

FIG. 12.—Simultaneous mouth- and nose-tracings of (A) French *plante* (female voice); (B) English *plant* (male voice). Note the absence of *n* in French.

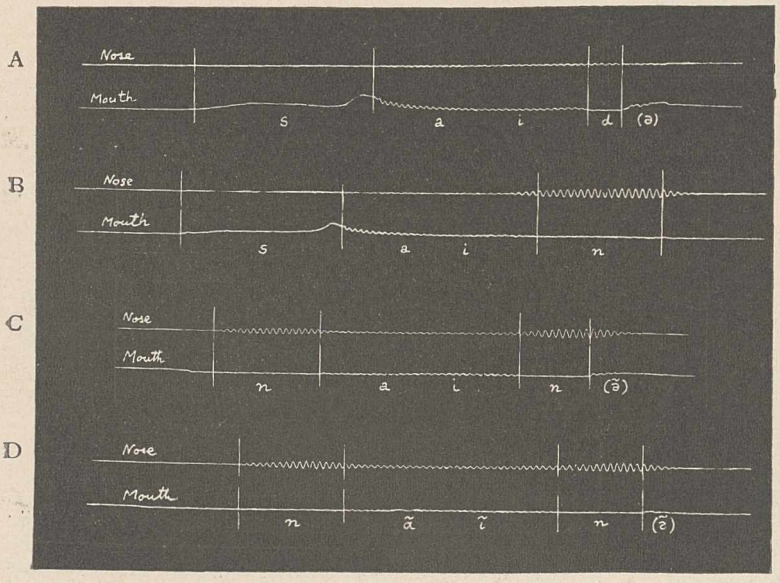

FIG. 13.—Simultaneous mouth- and nose-tracings of (A) *side*; (B) *sign*; (C) *nine*; and (D) *nine* pronounced in cockney-fashion. Note the difference in the nose-tracings. The words were all said on the monotone B♭  this being the note to which the nose-tambour happened to respond best.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—During the session 1917–18 Prof. John Adams, professor of education in the University, will give two courses of lectures which will be open without fee to teachers. The first course will begin on October 13, and will be on "Collective Psychology." The second course will be on "Attention," and will begin on January 19, 1918. A course of lectures on "The Practical Applications of the Study of Weather" will be given at the Meteorological Office, South Kensington, by Sir Napier Shaw, on Fridays during the second term, beginning on January 25. The fortnightly meetings of the Meteorological Office for the discussion of important contributions to current meteorology in Colonial or foreign journals will be resumed at 5 p.m. on Monday, October 22. The lectures are addressed to advanced students of the University and to others interested in the subject. Admission is free, by ticket to be obtained on application at the Meteorological Office. The following are among the public lectures in Imperial studies arranged for the first term of the session 1917–18:—*At University College*: October 8, Types of Climate in the Empire, Prof. L. W. Lyde; October 18, The Effect of the War on Municipal Engineering and Public Health, H. Percy Boulnois; October 22, Phonetics and its Value from the Imperial Standpoint, D. Jones; October 31, Scientific Methods of Language Study and their Importance to the Empire, Harold E. Palmer; six Newmarch lectures on Statistics, Economics, and some Problems of the Day, Henry Higgs, beginning on November 7. *At King's College*: October 31, The Problems of the Pacific, Basil H. Thomson; November 14, The Development of Tropical Africa (the name of the lecturer will be announced later). *At the London School of Economics*: October 12, The Commercial Geography of the Empire, Prof. A. W. Kirkaldy; October 19, Coal, Arthur F. Pease; November 2, Mineral Oil, Prof. J. S. S. Brame; November 16, The Rarer Key Minerals, Sydney J. Johnstone. Arrangements as to further lectures will be announced later. The subjects dealt with will be iron and manganese ores, artificial manures, fodder, timber, wood-pulp and paper-making materials, fibres, tea, meat, leather and tanning materials.

A MESSAGE from the New York correspondent of the *Times* states that the trustees of Columbia University have expelled Prof. H. J. L. Dana and Prof. J. McKeen Cattell, professor of psychology, whose disloyal attitude was "doing grave injustice" to the institution. Dr. Murray Butler pointed out, in a statement recently made by him, that before the entrance of the United States into the war complete freedom of expression could not be denied to members of faculty, but after the declaration of war by Congress it became the duty of everyone either on the rolls of the faculty or on the rolls of students to support the loyal enforcement of all the laws of the United States.

A MEETING will be held in the theatre of the Institution of Civil Engineers on October 25, at 3.30 p.m., for the purpose of considering the establishment of a central organisation for improvement in, and better co-ordination of, engineering training and the appointment of a representative committee of engineering and educational interests to initiate action. Sir Maurice Fitzmaurice, C.M.G., president of the Institution of Civil Engineers, will preside, and representative engineers and educationists from all branches of these professions have signified their intention to be present. Those interested are requested to communicate with Mr. A. P. M. Fleming, British Westinghouse Co., Trafford Park, Manchester, or Mr. A. E. Berriman, chief engineer, Daimler Co., Coventry, who are acting as honorary organisers for the committee responsible for arranging this meeting.

THE summer course of lectures given by Prof. Conrady, on the designing and computing of telescope systems, in connection with the newly formed department of technical optics at the Imperial College of Science and Technology, South Kensington, has been a great success. Sixty-six students enrolled, of which number no fewer than forty-two came direct from the workshop. This result is especially gratifying when it is remembered that the course was an entirely new experiment, as it constituted the first attempt, it is believed, in the history of optics to deal with the subject of designing and computing in a course of public lectures. At an early date—of which due notice will be given—further courses of lectures will be given on optical designing by Prof. Conrady, and on "The Construction, Theory, and Use of Optical Measuring Instruments" by Mr. L. C. Martin.

THE number of universities and colleges in the British Isles providing training for medical men and professional chemists is now large enough to make many parents and guardians feel the need for guidance in making a selection, and they will welcome the special educational issues recently published by the *Lancet* (August 25), the *British Medical Journal* (September 8), and the *Chemical News* (September 7). In each case detailed information is given of the courses of study, the staffs, fees, and so on, at each important college, and in the case of our medical contemporaries guidance is provided as to the facilities for practical study at the more important hospitals. Descriptive articles by writers of experience also explain the steps necessary for students who desire to become practising medical men or chemists. From the *British Medical Journal* we gather that the effects of the war upon the medical profession, and especially upon medical education, have been profound and far-reaching. Last year the Army and Navy together were employing upwards of 12,000 medical men, and this number must now be much greater. Before the war some 3300 medical officers were accredited to the Services year by year. As regards the number of medical students, between the years 1910 and 1914 the annual entry of first-year medical students averaged some 1440. Since the war the number of these entries has increased by several hundreds a year. In May, 1916, the whole number of medical students was 6103, including 1379 women; in January, 1917, the whole number was 6682, including 1735 women. The third-year students, from whom most of the newly qualified practitioners of 1919 will come, numbered in January last only 572 men and 261 women. It is now clear that certainly in 1918 and 1919 a serious shortage of newly qualified medical practitioners must be looked for, though an increase may be expected in 1920 and 1921.

CALENDARS and prospectuses continue to reach us from colleges and technical institutions in different parts of the country, and the particulars they provide of the courses of study which have been arranged for the forthcoming session show that the authorities have spared no pains to meet the need for scientific and technical education in the districts for which they are responsible. The character of the work carried on at Birkbeck College, London, is indicated by the fact that thirty members of the staff are recognised teachers of the University of London, sixty-eight students passed University examinations during last session, of whom twenty-three graduated in arts and science, and four war degrees also were conferred. The usefulness of the college is much curtailed by its limited accommodation. The pressing need is for in-

creased space, and it may be hoped that ere long the governing body will be provided with sufficient funds to make it possible to secure college buildings worthy of the excellent work which has been accomplished here. The work at Armstrong College, Newcastle-upon-Tyne, is being done under difficulties. The college buildings have been in the occupation of the War Office since August, 1914, and the various departments are housed temporarily in different buildings. Pass and honours degrees are awarded, on the conditions laid down in the prospectus, in both pure and applied science. Candidates who have qualified for the pass degree of B.Sc. may proceed, with the approval of the Board of the Faculty of Science, with the course of study in the honours school, and in applied science can take up one of the following subjects:—Agriculture, mechanical, marine, civil, or electrical engineering, naval architecture, mining, metallurgy. The Edinburgh and East of Scotland College of Agriculture, which was founded in 1901 to provide for agricultural education and research in the central and south-eastern counties of Scotland, has arranged classes in conjunction with the science faculty of Edinburgh University, constituting a full course of theoretical and practical teaching in agriculture and the allied sciences. The services of the college staff are at the disposal of farmers who are investigating new conditions or special problems arising out of farming operations. Full particulars can be obtained from the offices of the college, 13 George Square, Edinburgh.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, September 17.—M. Camille Jordan in the chair.—A. **Lacroix**: The peridotites of the Pyrenees and the other intrusive non-felspathic rocks which accompany them. Descriptions of the lherzolites, cortlandites, ariegites, and hornblendites, together with complete chemical analyses of twenty-one specimens.—M. **Petrovitch**: A new method of numerical evaluation of the coefficients of series.—C. **Benediks**: A new thermo-electric effect. The author's results are contrary to the law of Magnus, and show that in a homogeneous metallic circuit an asymmetrical distribution of temperature may give rise to an electromotive force.—J. B. **Tauleigne** and G. **Mazo**: The method of monocular stereoscopy especially applicable to radiography.—M. **Mazérès**: A new method of extraction with the radioscopic screen: the method of concordances.—D. **Keilin**: A new Nematode, *Aproctonema entomophagum*. The new species was found as a parasite in the larvæ of *Sciara pullula*.—E. **Roubaud**: Can French Anopheles transmit malaria in non-marshy regions? *A. maculipennis* from the Paris district has been proved to be capable of transmitting malaria (*Plasmodium vivax* and *P. praecox*), and do not possess any special refractory properties. Since malarial cases are being introduced from the Eastern front, it is obvious that special precautions against the spread of the disease are indicated.—A. **Laveran**: Remarks on the preceding communication of M. Roubaud. An account of the measures which have been taken in France to prevent the spread of malaria from infected soldiers.

BOOKS RECEIVED.

Survey of India. General Report, 1915–16. From October 1, 1915, to September 30, 1916. (Calcutta.) 2*s*. 8*d*.

Memoirs of the Geological Survey of India. Vol. xlii., part 2. Vol. xlv., part 1. (Calcutta.) Each 4*s*.

Composition and Nutritive Value of Feeding Stuffs. By Prof. T. B. Wood. (Cambridge: At the University Press.) 1*s*. net.

Memoirs of the Geological Survey, England and Wales. Explanation of Sheet 329. The Geology of the Country around Bournemouth. Second edition. By H. J. O. White. Pp. vi+79. With separate map. (London: H.M.S.O.) 2*s*. net.

The Discovery of America, 1492–1584. Edited by P. F. Alexander. Pp. xviii+212. (Cambridge: At the University Press.) 3*s*. net.

Insetti delle Case e dell' Uomo e Malattie che Diffondono. By Prof. A. Berlese. Pp. xii+293. (Milano: U. Hoepli.) 4.50 lire.

Celestial Objects for Common Telescopes. By the Rev. T. W. Webb. Sixth edition, thoroughly revised by the Rev. T. E. Espin. Two vols. Vol. i., pp. xx+253; vol. ii., pp. viii+320. (London: Longmans and Co.) Each 7*s*. 6*d*. net.

The Elements of Refrigeration. By Prof. A. M. Greene, jun. Pp. vi+472. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 18*s*. 6*d*. net.

Alternating-Current Electricity and its Applications to Industry. Second Course. By W. H. Timbie and Prof. H. H. Higbie. Pp. ix+729. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 13*s*. 6*d*. net.

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