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

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THURSDAY, OCTOBER 24, 1918.

WASTE AND WEALTH.

Wealth from Waste: Elimination of Waste. A World Problem. By Prof. H. J. Spooner. With a Foreword by the Rt. Hon. Lord Leverhulme. Pp. xvi+316. (London: G. Routledge and Sons, Ltd., 1918.) Price 7s. 6d. net.

IN spite of its limitations, and notwithstanding certain faults of style and taste, this book is calculated to serve a useful purpose, and it makes its appearance at an opportune time. Thrift is not a national characteristic of the southern half of Great Britain, whatever it may be of the other half.

The author quotes a remark of Archdeacon Potter made at an economy meeting at Mitford in the early part of 1916 as evidence of a fact which, unfortunately, cannot be controverted: "I have travelled all over the world, and I have never known any nation or people so wilfully wasteful as the people of our own country. In no other country do people so absolutely fling away God's goods as they do in England." In proof of this statement Prof. Spooner, in the course of some 300 pages, piles Ossa on Pelion. His book is an attempt to show that in practically every department of our national life and activity "wicked waste is occurring everywhere, far and wide: waste of money, waste of food, waste of materials, labour, fuel, energy, and time, waste of human strength and thought, waste of health, and waste of life itself." This is a sweeping generalisation, which, by its over-emphasis, is calculated to prejudice the main conclusion the author seeks to establish, which is that this waste is avoidable, and ought, therefore, to be prevented. If the argument were stated more temperately it would carry greater conviction. Some waste, as the whole scheme of Nature testifies, *pace* Lord Leverhulme, is inevitable. The author implicitly admits this when he allows that there are justifiable wastes and dangerous economies. What he terms "absolute waste," due to corrosion and wear, is, in many cases, unavoidable. Exaggeration never strengthens a case in the eyes of a well-informed reader, and it is the well-informed reader that counts in the long run. Still, when every allowance is made for the author's somewhat too zealous efforts to prove his main contention, enough remains to show that much may be done in the direction of greater economy and in the reduction of waste—a conclusion which nobody will gainsay.

In a series of chapters the author seeks to enforce the lessons of the war. He makes an urgent appeal for better municipal organisation; he shows how time is wasted in factories and in commercial matters; how the public time is wasted in Parliament and in judicial procedure; he directs attention to the waste due to traditional and conservative methods in works management, and to the mischievous policy of restricting output; he shows how much waste is due to human fatigue; what wastage there is of life, limb, and health, and what is its economic effect; the waste due to infant mortality, child-labour exploitation, and preventable accidents; the waste of food arising from bad household management and lack of knowledge; waste due to adulteration; the waste of coal owing to our partial and imperfect attempts to treat the coal question scientifically; how indefensible is the sliding-scale contract system, and what is its effect on "public prices." He treats of fuel economies in the house, the smoke nuisance, electrical supply, and the creation of central power stations. He deals with what he styles the coming agricultural revolution, the home-grown food question, the technical education of the farmer, labour-saving machinery for the increase of tillage, demobilisation and farm work, the utilisation of waste land, intensive culture, reclamation schemes, waste due to the neglect of afforestation, the timber problem, etc.

In a special section of the work Prof. Spooner shows what has been done in the past to utilise waste substances, and how the waste of perishable things has been prevented. This portion, which he entitles "The Romance of Waste," is put together *pour encourager les autres*, and to prove that there is the potentiality of wealth in waste, as illustrated by the time-honoured examples of alpaca, shoddy, mungo, imitation sealskin, poplin, paraffin oil, linoleum, glycerin, etc. Another section is devoted to household wastes and economies, whilst a third deals with trade and industrial wastes, daylight saving, the waste due to derelict waterways, etc.

It will be seen, therefore, that the book covers a very large amount of ground. The author is certainly to be congratulated on the industry he has employed in its compilation and for the amount of information he has succeeded in compressing into a limited space. The work is simply and unaffectedly written, and appeals rather to the man in the street than to the expert. The author's knowledge of scientific facts is occasionally at fault, and his narratives of certain historical matters are now and again open to correction. "E. C. Stafford" (p. 267) should read "E. C. C. Stanford," and "carbon disulphite" (p. 87) should be changed to "carbon disulphide." The statement concerning dust in the vicinity of a Bunsen flame (p. 61) would seem to imply that the dust is a product of the flame, and the account of reclaimed rubber reads as if the process were something in the nature of adulteration, which is surely contrary to the lesson which it is the whole object of the book to enforce. Such a statement as "leather is frequently adulterated with glucose, soluble salts, and barytes, whilst treated tripe and compressed paper are known to be used as poor and fraudulent substitutes for leather" (p. 116), is calculated to convey an entirely false impression, and it is a gross exaggeration to say that "a great part of the wines of France and Germany has ceased to be the juice of the grape" (p. 112).

Lord Leverhulme, with a sense of humour, which is in strong contrast with the author's *ex parte* emphasis, makes the point that his foreword is "an apt illustration of that kind of 'waste' which is the saddest type of all wastes—a wasted opportunity." Here we join issue with his lordship. So far from neglecting it, he seizes the opportunity to state that in his opinion "the greatest wasters are those who concentrate their whole time on mere efforts for immediate and direct money-making." Such a preachment from so great a captain of industry serves to point a moral for which we share Prof. Spooner's gratitude.

MENTAL DISORDERS AND THEIR TREATMENT.

(1) *The Modern Treatment of Mental and Nervous Disorders.* A Lecture delivered at the University of Manchester, on March 25, 1918, by Dr. B. Hart. Pp. 28. (Manchester: At the University Press; London: Longmans, Green, and Co., 1918.) Price 1*s.* net.

(2) *The Re-education of the Adult: I. The Neurasthenic in War and Peace.* By Capt. A. J. Brock. (London: Headley Bros.) 6*d.*

(1) IN this lecture Dr. Hart discusses modern conceptions of the nature and treatment of mental and nervous disorders. He points out that, though the "physiological conception"—the belief that mental and nervous disorders are due to deranged bodily processes, and in particular to diseases of the brain—still holds its place, its sway is no longer undisputed, for there has now arisen the "psychological conception," which holds that some at least of these phenomena are due to mental causes, capable of determination by psychological investigation, and of removal by psychological methods of treatment. The conspicuous success of this latter treatment has been amply demonstrated in our military hospitals for "shell shock" and similar disorders. Dr. Hart insists upon the present imperative necessity of provision for civilian patients, both men and women, in those incipient phases of mental and nervous disorder when treatment promises the best results, and urges the desirability of institutions in which physiologist, chemist, and psychologist can attack, together and from every side, the many problems that await solution. In emphasising the necessity for the close association of treatment with organised investigation and with teaching, he points out that these three functions have their natural home in the universities and medical schools, and it is from them that we shall confidently expect the developments that are so urgently needed.

(2) This essay forms part of No. 4 of the second series of "Papers for the Present." Describing the "shell shock" hospital as "a microcosm of the modern world, showing the salient features of our society (and especially its weaknesses) intensified, and on a narrower stage," the author describes some of the re-educative methods which, having proved successful, may be commended to the attention of the educationist and those devoting themselves to the general problems of social reconstruction. Underlying all the symptoms of neurasthenia is found the element of separatism or dissociation—a significant fact for social psychology. Some of the current psychological methods of dealing with neurasthenia are placed by the writer into three groups, which, he says, are steps in a progressive series: (1) Psychoanalysis; (2) therapeutic conversations; (3) "ergotherapy." In methods belonging to the first group the mental condition is analysed, in the second the patient is "encouraged to look sensibly and squarely at things," while in the last he is "prompted to follow up his thoughts by action—by real functioning in relation to his environment."

INORGANIC CHEMISTRY FOR STUDENTS.

(1) *Introduction to Inorganic Chemistry.* By Prof. A. Smith. Third edition. Pp. xiv+925. (London: G. Bell and Sons, Ltd., 1918.) Price 8*s.* 6*d.* net.

(2) *Experimental Inorganic Chemistry.* By Prof. A. Smith. Sixth edition. Pp. vii+171. (London: G. Bell and Sons, Ltd., 1918.) Price 3*s.* 6*d.* net.

(3) *A Laboratory Outline of College Chemistry.* By Prof. A. Smith. Pp. v+206. (London: G. Bell and Sons, Ltd., 1918.) Price 3*s.* net.

(1) AMONG the text-books of inorganic chemistry of the newer type, in which the attempt is made to present the descriptive material so far as possible in connection with underlying theoretical principles, Prof. Alexander Smith's "Introduction to Inorganic Chemistry" is one the merits of which have gained wide recognition, and that a third edition of this work has become necessary will occasion no surprise.

A comparison of the present with the previous edition shows that some alterations have been made in the arrangement of the subject-matter and that a considerable amount of additional information has been inserted, corresponding with the advances of the past decade where these have come within the scope of an introductory textbook. Thus the account of the radio-active elements has been greatly extended, and there are new sections on colloidal solutions, the atomic numbers, and other subjects of a theoretical character. A number of paragraphs have also been inserted on some of the more recent technical applications of chemistry, such as the manufacture of nitric acid from the atmosphere, synthetical ammonia, the oxyacetylene flame, the application of tungsten, the use of permutite for water-softening, and so forth. By these additions the usefulness of the book is fully maintained, and it continues to give a scientific and attractive outline of the present state of chemical knowledge of a standard suitable for the highest forms of schools or for university students who are beginning the study of chemistry. There is, however, one passage in an introductory discussion of the transformations of energy which cannot be allowed to pass unnoticed. It is stated (p. 32): "So, with a conductor like the filament in the lamp, unless it offers resistance to the current *and destroys a sufficient amount of electricity*" (the italics are ours) "it gives out neither light nor heat." It is to be hoped that this will be amended in a later edition.

(2) "Experimental Inorganic Chemistry" is a laboratory companion to the text-book discussed above. It contains directions for carrying out a large number of experiments of various types, including illustrations of chemical laws, the preparation of substances and examination of their properties, some qualitative analyses, and simple experiments in physical chemistry. The instructions are very clear and precise and seem well designed to lead students to work thoughtfully. In a few cases, however, the methods given for carrying out the experiments appear a little crude for the class of students that would be capable of using the companion text-book intelligently.

(3) "Laboratory Outline of College Chemistry" is almost identical, word for word, with the last-mentioned work (2). There are, however, differences of arrangement, and in the order in which subjects are treated, which render it more suitable for use with the author's "General Chemistry for Colleges." It contains a short chapter, which is not included in "Experimental Inorganic Chemistry," on Bunsen's film and match tests. This is a welcome feature, for it is to be wished that these tests, on account of their elegance and of the training in manipulation which they afford, were taught more frequently than is at present the case.

W. H. M.

OUR BOOKSHELF.

Homeland: A Year of Country Days. By Percy W. D. Izzard. With illustrations by Florence L. Izzard and W. Gordon Mein. Pp. 383. (London: John Richmond, n.d.) Price 7*s.* 6*d.* net.

THIS book consists of a series of sketches—mostly impressionist—of the march of the seasons in the Eastern Counties of England. There is one for each day in the year, and the author shows his good sense by beginning with March 21 and ending with March 20. "So we set out in the thrill of the year's morning songs and climb with the sun to the high noon of summer; then go down the hill of autumn and traverse the valley of winter, and so arrive again before the portals of spring. Thus hope is with us first and last." And delight as well, we may say, for Mr. Izzard's pictures—many of them just vignettes—have a delicate touch, awakening old joys. On reading them we feel that the author is one who would sincerely say with Stevenson:—

> To make this earth our hermitage,
> A cheerful and a changeful page,
> God's bright and intricate device
> Of days and seasons doth suffice.

Let us mention a few titles: "Laggard Spring," "Snow and Kingfishers," "The Elms in Bloom," "Wine of Spring," "Bluebells," "The Top of the Morning," "The Honey Way," "Bees in the Broom," "A Yellow Wagtail," "A Summer Shower," "Scented Night," "Grass of the Dunes," "Ageing Leaves," "Spider-Craft," "Rain on the Wheat," "Autumn Colour," "A Pimpernel Morning," "Winter Sleeps." These are not informative essays, be it understood, but dainty bits of impressionism, pleasant to read for a few minutes in the morning, and rejoicing the heart. The book has some beautiful black-and-white illustrations by Florence L. Izzard and W. Gordon Mein, and it is very pleasantly printed with a page for each day. We recommend it heartily to those who have "a love of the country."

The Portal of Evolution: Being a Glance through the Open Portal of Evolution at Some of the Mysteries of Nature. By a Fellow of the Geological and Zoological Societies. Pp. 295 + ii. (London: Heath, Cranton, Ltd., 1918.) Price 16*s.* net.

THE author of this book begins chap. i. with the words: "My aim in writing this treatise has been to avoid making it in any way a scientific work." We are bound to say that he has succeeded. For what we opened with the eager hope of getting some fresh light on the factual problems of evolution turns out to be a sheer eccentricity. It is a serious but futile elaboration of extravagant hypotheses about the intermarrying of the diverse attributes of the Trinity. It is a preposterous attempt to illumine facts by fictions and to talk two languages at once. Of the author's scientific incompetence a glimpse is given in a statement in the first chapter: "Embryology has established beyond dispute that in the early stages of our conception within our mother's womb we again assume the types of worms, fishes, animals, and in some cases of plants that did their part in evolving our present existence." But a glimpse of something worse is given in the fundamental statement: "The intermarrying of the attributes of God's personalities has indeed placed in my hands a key that would, in time, with thought and study, enable mankind to unlock the door and enter the portal of Evolution, and ultimately to be able to understand divine revelations. . . ." We do not wish to be too hard upon a treatise so obviously serious and well-intentioned, especially as we are assured that "it is only during the last one hundred years that the property of understanding has dawned upon man," but we cannot help feeling that there has been a sad waste of paper here.

LETTERS TO THE EDITOR.

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

The Organisation of Scientific Workers.

THE Whitley Report on Industrial Councils raises several questions of peculiar interest to scientific workers. It is proposed that a predominant part of the control of any industry shall be based on the recommendations of industrial councils, bodies composed of representatives of the employers' associations and trade unions concerned. Among the subjects with which these bodies will deal are conditions of employment, technical education, and industrial research (para. 16), which are of special interest to the scientific staff. Owing, however, to the lack of organisation among scientific men, there is no method of obtaining their representation on these councils, and if this is not done these matters will be decided by the other bodies involved, without reference to those whom they particularly concern. The need for such organisation is urgent, for it is made clear (Appendix, question 3) that only trade unions and employers' associations are to be represented, and that any body formed later than the council can be admitted only with the approval of its predecessors. The interests of the scientific workers in any industry, therefore, demand that they should form themselves into trade unions.

This statement is not so alarming as it at first sight appears, for legally a trade union is merely any body among the objects of which is the regulation of conditions of employment; so that any organisation formed to represent its members on the councils would be automatically a trade union. Employers' associations are technically trade unions. The other methods of obtaining its aims are determined by itself, and, naturally, no course of action repugnant to the majority of scientific men could be taken by a body that they themselves govern.

For very similar reasons it seems desirable that workers in pure science should form a trade union among themselves. The Department of Scientific and Industrial Research is likely to extend its influence very much in the near future, and pure research will be aided by the establishment of many fellowships and studentships, the workers appointed being in the position of employees of the Department. Here, again, there is no machinery for ascertaining the opinion of the employee on matters that concern him; and it seems at least as desirable to consult the opinions of research workers in their own affairs as those of ordinary workmen, as will be done when the Whitley report is carried out. That the success of the scheme promoted by the Department depends largely on the satisfaction of the employees with their position is admitted repeatedly in its latest report (pp. 21, 43), and a means of expressing their views is needed; this can be afforded only by a general organisation of research workers on a democratic basis and working in close touch with the Department. At the same time such a body must deal with conditions of research in general, and would come within the legal definition of a trade union.

The only body at present in process of formation that aims at attaining these objects is the National Union of Scientific Workers. Its inclusion of both pure and applied science within its scope corresponds with the policy of the Department of Scientific and Industrial Research, and seems highly desirable from the point of view of the co-ordination of science and industry.

C. SHEARER.
FRANKLIN KIDD.
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SCIENCE AND PARLIAMENTARY REPRESENTATION.

THE discussion which has followed the meeting of the medical profession held at Steinway Hall on October 1, "having for its object the securing of a more adequate representation of the medical profession in Parliament," has served to show that its restricted objective is hazardous and inadequate. But at least it made prominent one of the essential conditions of successful emergence from the earthquake of the world war, viz. the instant and judicious application of competent knowledge to every branch of national and provincial administration. Those who think this must accompany schemes of national development will thank the conveners of the recent meeting, recognise the value of the discussion it induced, and proceed to ponder how fitting use may be made of the opportunity described by Dr. Addison, the Minister of Reconstruction. It has been made clear that, in the opinion of many entrusted with the executive power of the State, the time has come when those who possess trained knowledge have special opportunities to which as patriots they ought to respond. These opportunities have not come to medicine alone; they have come to every branch of science and technology. It may be well, therefore, to review very briefly the circumstances in which the contributions of trained knowledge to national development may now be made continuously effective. Most of the factors of use or abuse are common to the professions, and if medicine is chiefly referred to in illustrating, it will be as a tribute to its splendid services to-day and to its Steinway Hall initiative.

Nothing can be satisfactorily attempted in Parliament or politics generally unless goals are so clearly stated that willing players of the game can see them. At the recent meeting, where one goal was assumed to be sought, two were set. There was, first, the goal of the "representation of the medical profession" in Parliament, to quote some of the speakers, the *Times* leading article, and some later letter-writers. There was, secondly, the goal of making possible to the community and Parliament "the considered experience and help of medical men as representative of the public interest and aiders of their constituencies" (Dr. Addison). Now the two may stand in the same field, but they are different. They may not be wholly incompatible, but they are diverse; twins, perhaps, but of very different temperaments. Despite some obscurities, Dr. Addison's address suggests that he prefers the second. In letters to the medical and general Press some powerful critics have made it clear that they agree with him. So do we. It is the more catholic, practical, and promising; and for this reason: whatever the professions apart from politics surmise, the political instincts of a politically matured people are not likely to err. It may be hoped, therefore, that these will promote, not the representation of particular interests in Parliament, but the selection of leading men from all spheres of intellectual and industrial activity to assist in the control of national affairs.

That knowledgeable candidates with expert capacity must first be citizens of a free country before they are expert consultant members of its Parliament is essential to the future of knowledge as a political instrument and to the success of those who thus use it. This is especially true to-day from causes that are not yet sufficiently realised. In many departments of commercial, professional, and class effort class interests have had to be emphasised beyond prudence to get any type of organisation accepted by disunited individual units. Much organisation of a roughly hewn type has been accepted, therefore, and in industry, as in war, generalship has had to be improvised, with like disastrous results sometimes. The price which has inevitably to be paid for inefficient organisation, for organisation, that is, which permits the machine to run the man, is troubling the counsels of parties and groups, and threatening grave evil to the country—in its executive action itself a bad culprit.

It is to inadequate knowledge at the top of professional and class organisations that most of the prevalent functional disorders are due. The tool is not just now esteemed. It is highly probable that the good sense of the community, dimly conscious of class dangers, will assert itself on suitable occasions against class demands and all extensions of class representation. Moreover, the future is not with this method, as trade-unions and capitalistic organisations are finding out. That way lies death. A virile race uses organisations, but is not mastered by them or dictated to by them. Surely it will be most unfortunate, futile as well as unfortunate, for the as yet unmobilised scouts of knowledge to handicap themselves by following an example seen to be reactionary and dangerous. Theirs the better prospect of appealing directly to the happier instincts of a free and growing race, of demonstrating that in seeking to serve their country in the hour of its greatest need they wish to place its interests before any other interest, personal, professional, or, for that matter, partisan. They stand as citizens to serve as citizens: that is the path of honour and of leadership. It is the path also of success.

The work to be done has to be done in Parliament, we are told, and through Parliament. This implies ability to understand and to participate in the general work of Parliament, whence all their opportunities will arise. Important as is the physician's experience and mental equipment in diagnosis, when he has his patient before him the prime factors are the patient himself and his potential response to any treatment. So, if the professional man, the expert, is to hold his own in a Chamber sufficiently filled with the representatives of commerce and labour, however true to his own professional responsibilities he may be, he must first look at the work to be done from the point of view of the national interest so far as his special gift can further it, in order that the object of the Bill which takes time may be worthy of Time. He must be able to establish and to maintain touch with his parliamentary colleagues, to adjust that which he knows to the medium in which it has to be applied—no light task—and thus to make effective the special contribution he has to bring. His most valuable aid may sometimes consist in preventing gross mistakes being perpetrated in ignorance, but to pull up any machine in full motion demands exact knowledge of its mechanism. No Member of Parliament who knows his own special business, his business as a legislator, and the routine of the House, would fail to get a hearing; what a power he might become! He cannot understand his business as a legislator unless he makes that his first and chief object.

If this is true of the House of Commons, how much more true is it in the constituencies. The closest contact of knowledgeable candidates with the electorate is necessary to-day if electors are to learn their duty, choose and support educated and efficient administrators, and discountenance inefficient administrators. Can the electorate be adequately served if selected constituencies are to be offered eminent experts in science and technology with specialist limitations, whose presence in Parliament is desired that they may attend the consulting-rooms of State Departments, sit on Special Committees, or voice, occasionally, some sectional interest? Surely these services can be commanded at any time without imposing a preliminary qualification which would in itself then be but a pretence. And what of the influence of such practice on the men themselves and on the repute of the intellectual ministry for which they stand? It may well be that some of the most useful men of one category would also be available in another; as was said, the two goals are not wholly incompatible. The consultant might be the man who, before his constituents, could interest them in knowledge, reveal the folly of some section in a contested Bill, or, later, show how a clause, vital to the success of a new Act, might at once be made locally operative. If so, both needs would be met in the same man. But even then it is on the citizen plane that true representation has to be sought. Both in the Commons and in the constituencies this is the type of service which is alive: it grows.

Knowledge is not static; it is dynamic. It perfects itself in practice amid ever-changing atmospheres, and owes most of its efficacy at any time to perceptions and extensions gained in performance of function. In free nations the demands of each parliamentary session will give professional counsel its chance and chiefly determine its usefulness. The limitations of Parliament as a patient are gross and grave. But it is the only patient here on view. Knowledge has its work therewith, and knowledge must do it: it can only be done on the basis of approved citizenship. The nation should get nothing meaner.

To sum up. The coming General Election will make a special demand on the men best equipped to serve the country, and in many respects that demand has never been easier to meet. During no previous epoch has the country depended more for its preservation on competent and ascertained knowledge, and never have we had with us a larger number of available men skilled in some branch of knowledge and already familiar with the administrative and functional routine through which that can best be applied to national work. Men of affairs, themselves prominent in the ranks of men of science, are neither few in number nor unknown to constituencies. Something has been said in medicine about the exact constitution and responsibilities of the committee which should select suitable candidates for whom seats could be found. It does not matter very much what method of selection is taken so that the right goal is clearly set up, and there are those ready to be true to the test of the time. A very small sum of money—small as sums go to-day—in the hands of a few administrators acquainted with the problems and with the *personnel* of the scientific world would permit them at once to consult the party Whips and arrange for the candidature of an experimental group such as competent State chiefs would gladly welcome to the House and constituencies live to be thankful they ever sent there. J. J. ROBINSON.

EPIDEMIC INFLUENZA.

THE name "influenza" is of Italian origin, and is derived from the Latin *influxio*, which signifies a humour or catarrh. Creighton[1] gives the following account of its introduction into the English language:—

"It was in 1743 that the Italian name 'influenza' first came to England, the rumour of a great epidemic, so called, at Rome and elsewhere in Italy having reached London a month or two before the disease itself. The epidemic of 1743 was soon over, and the Italian name forgotten, so that when the same malady became common in 1762 someone with a good memory or a turn for history remarked that it resembled 'the disease called influenza' nearly twenty years before. After the epidemic of 1782 the Italian name came into more general use, and from the beginning of the present century [*i.e.* 1801] it became at once popular and vague. The great epidemics of it in 1833 and 1847 fixed its associations so closely with catarrh that an 'influenza cold' became an admitted synonym for coryza or any common cold attended with sharp fever." The last-named usage has lingered in common parlance to the present day, and such "running" colds are frequently contagious. The series of epidemics from 1889 to 1893 effectually dispelled the idea of the necessary association of epidemic influenza with catarrh.

It has also been customary since 1893 to term "influenza" any brief febrile affection associated with more or less headache and muscular pain. The nature of such attacks is little known, but the majority are certainly not true influenza. Epidemic influenza is a malady which has probably existed from the earliest times. Creighton traces allusions to it in the medieval Latin writers, and in the sixteenth and seventeenth centuries strange epidemics are recorded from time to time under such names as "new disease," "hot ague," "sweating sickness," and others which seem undoubtedly to have been manifestations of it, and the disease has recurred again and again with an interval of a few years. In the nineteenth century, after an outbreak in 1855, more than a generation passed with little or no mention of epidemic influenza in this country, when in the early weeks of the winter of 1889 reports began to be published on the reappearance of influenza in Moscow, Petrograd, Berlin, and other foreign capitals. This epidemic wave, like many that preceded it, had an obvious course from Asiatic and European Russia towards Western Europe, and eventually reached London, and in January, 1890, had a decided effect upon the bills of mortality of the city. It spread all over England, Scotland, and Ireland, but by the spring of that year had almost disappeared.

The features of the disease at this time were a sharp and sudden attack of fever, accompanied with headache, pain at the back of the eyes, pains in the limbs, and severe back-ache, with prostration and a general feeling of misery. Catarrhal symptoms were by no means prominent, but in the elderly the disease was frequently complicated by bronchitis, pneumonia, and heart failure, and convalescence was often prolonged. The pronounced back-ache and absence of catarrh at first suggested that the malady might be dengue fever, but it was soon recognised that the epidemic was one of genuine influenza. The disease recurred in 1891, 1891–92, and 1893–94, and then waned and almost disappeared. The worst period was in January, 1891; in the week ending January 23 the death-rate in London rose to 46 per 1000 living (a month previously it had been 21·9), and 506 deaths from influenza were registered, as well as a very high mortality from bronchitis and pneumonia.

After a period of quiescence lasting for three-and-twenty years, influenza in epidemic form once more made its appearance towards the middle of the present year. In May and June it ravaged Madrid and other parts of Spain, afterwards attacking the British and German forces on the Western front, and travelling to this country, Holland, and Scandinavia. London experienced a sharp attack in July, and some 1600 deaths are attributed to it. On the whole, however, this outbreak was a mild one, except among the debilitated and the aged. The usual course pursued by the disease was a sudden onset of sharp fever lasting about three days, with headache and muscular pain, but little catarrh, followed by rapid convalescence. By the end of August the epidemic was practically at an end. During the present month another outbreak has occurred and is in progress, and this time the disease is assuming a more serious character, and many deaths from pneumonia and bronchitis complicating it have been reported, particularly

[1] "History of Epidemics in Britain," vol ii., p. 304.

among young and presumably strong and healthy adults. South Africa and Tangier are also experiencing severe epidemics.

While in previous epidemics the general progress of influenza has been westwards from Asiatic and European Russia, the epidemic this year was first reported in Spain and travelled northward. It is to be noted, however, that the war has fundamentally changed the general direction of European traffic—that from East to West being suspended, while the North and South traffic has been greatly augmented. It has to be remembered, too, that Chinese and other Eastern coolies have furnished Labour battalions behind the lines on the Western front, and it may be quite likely, therefore, that the disease has been imported from the East in this manner.

With regard to the nature of epidemic influenza, it is undoubtedly a fever of a highly infectious or contagious character, and, therefore, caused by some micro-organism. In the epidemic of the 'nineties Pfeiffer discovered a minute bacillus, difficult to grow except on certain specially prepared culture media, and even then yielding only very delicate growths, and unstained by the Gram method of staining. This is the influenza bacillus which has ever since been regarded as the causative microbe of epidemic influenza. In the epidemic of this year, however, Spanish, British, and German investigators have failed to find the influenza bacillus except in quite a minority of cases. The principal bacteriological findings reported are microbes belonging to the coccus class, either Gram-negative or Gram-positive cocci, and in some of the fatal cases streptococci have been present in the blood.

The difference in the bacteriological findings between the 'ninety and the present epidemics suggests that epidemic influenza, so-called, is not a single disease. We have a parallel to this in the case of typhoid and paratyphoid fevers, which in symptoms closely resemble each other, but which are due to distinct microbial agents. There are also certain differences in the symptoms present in different influenza epidemics which point to the same conclusion.

The principal factor influencing the spread of influenza seems to be close aggregation of individuals. It is the crowded office, workshop, barrack, or camp that suffers most from the ravages of influenza. Dilution with plenty of air mitigates the infectious properties, and free ventilation is therefore important. In the July outbreak favourable reports were given of the value of systematic spraying of the air of offices and workshops with an atomiser spray, using some volatile disinfectant, such as bacterol, in largely preventing the spread of infection. Fatigue and debility are always conducing factors to infection, and the young and the old are generally more prone to contract the disease. Whether any drug has really any power to prevent infection is questionable, but in the 'ninety epidemics there was a general impression that systematic daily doses of quinine were of some use.

R. T. Hewlett.

THE SALTERS' INSTITUTE OF INDUSTRIAL CHEMISTRY.

The Salters' Company has during many years given evidence of its interest in the promotion of scientific education and research by the provision of fellowships tenable by post-graduate workers. It has now taken a further very important step in announcing a scheme for the establishment of an institute to be called "The Salters' Institute of Industrial Chemistry." The offices of the institute will be for the present at the Salters' Hall, and the scheme will be administered by a director, who will be selected on the ground of qualifications based on a distinguished academic career in chemistry coupled with extensive technical experience. An Advisory Board composed of representatives of the Salters' Company, the universities, and the Association of British Chemical Manufacturers is also under consideration.

The Company proposes to establish two types of fellowship, for which post-graduate students of British nationality will be eligible whether graduates of a British university or of a university in the United States or elsewhere. There are to be (1) fellowships to enable post-graduate students to continue their studies at an approved university or other institution under the general supervision of the director of the institute, and (2) industrial fellowships to enable suitably equipped chemists to carry on research for any manufacturer under an agreement entered into jointly by the institute, the manufacturer, and the fellow.

It will be observed that the Company does not at present contemplate the erection of any building or the equipment of any laboratory. Its aim is, therefore, somewhat different from that of the founders of such establishments as the Davy-Faraday Laboratory attached to the Royal Institution in London, or the Kaiser Wilhelm Institute opened in 1912 near Berlin. The intention is to add to the number of first-rate chemical technologists available for the service of industry in this country, a class of men which at present scarcely exists and is sorely needed. It is hoped to offer such attractions to some of the best students that on completing their university course they will seek to apply their knowledge to manufacture and industry generally, and that employers will recognise promptly the necessity for such assistance so that openings for such men with suitable remuneration will be provided concurrently with the supply. Hitherto almost the only career available for the honours graduate in chemistry has been in connection with the teaching profession. Probably in future such men will be divided into two classes according to their personal predilections, some going to the works, while others will prefer teaching. In both directions the opportunities provided have been insufficient in number and inadequate in remuneration, so that many cases have occurred in which a man with distinct scientific gifts has been forced by circumstances to seek employment in other directions, and science has been consequently the poorer.

The fundamental idea which has inspired the Salters' Company may be illustrated by one or two examples. Suppose a man to have taken his degree with distinction in chemistry, and in physiology as a second subject. Elected to a Salters' fellowship, he may undertake a research on some subject of a biochemical nature. This may be carried on at his own university or at any other possessing a special school for this class of work in England or some other country. In due time arrangements may be made by the director for the fellow to take a course of chemical engineering, perhaps in America, and afterwards to obtain technical and industrial experience. In a very short time a man so trained and experienced will be in a position to demand, and will certainly be worth, a very high salary. It would be easy to provide a similar course with the necessary modifications adapted to the case of a man whose original bent is in the direction of physical chemistry or pure organic or metallurgical chemistry. The printed scheme issued by the Salters' Company gives no information as to the pecuniary value of the proposed fellowships. In estimating the annual amount which should be assigned to each fellowship, it must be remembered that the holder, while required to live simply and carefully, must be free from difficulties about books, travelling expenses, and laboratory outlay. Probably 300*l*. a year under present conditions and for some time to come will not be found too much, though perhaps expenses will depend to some extent on whether the student remains at home or is required to reside at a foreign university or centre. When operations are to commence at the institute will depend on the discovery of the right man for the office of director, and doubtless he will have a good deal to say about working details.

The two classes of fellowship referred to in the scheme have been in principle anticipated. For the former, which provides for post-graduate study without at first direct reference to technical applications, the Ramsay Memorial, which has been before the public for the greater part of the last two years, has adopted essentially the same plan, and is only waiting for funds to carry it into effect.

With regard to the institution of industrial fellowships, nothing of the kind has yet been attempted in this country. But the Kennedy Duncan scheme in connection with the Universities of Kansas and Pittsburgh has been in operation for some few years, and is reported to have been satisfactory and successful. Mention of these facts, however, is not intended to disparage in any way the wise forethought and liberal intentions of the Salters' Company, which, by the action now contemplated, is rendering a very important service to national interests, both by the example thus set and by the generous application of its funds.

One other point may here be mentioned. The scheme under consideration seems to avoid the difficulty which has always been associated with other schemes for the encouragement of post-graduate work—namely, that the career of the student after the first few years was indeterminate, and often ended in disappointment. The scheme, once talked of, for providing valuable fellowships with the object of tempting a few specially endowed researchers to devote the rest of their lives to research seems to have been lost sight of, or, after consideration, to have been given up.

It is, however, to be hoped that nothing in the plans proposed for associating science with industry will result in discouragement to scientific genius. Researches undertaken with specific objects, especially with a view to improvements in manufacturing processes or to the invention of new ones, and in the investigation of properties of materials and products, will probably not lead to the discovery of new fundamental principles. In the past these have almost always been the fruit of labours undertaken under the stimulus of that kind of curiosity concerning Nature, her laws, purposes, and operations, which is sufficient to satisfy the ambition of a Davy or a Faraday. Whatever Ramsay might have done had he devoted his working life to researches designed to assist industry, the results of his studies concerning the source and properties of the inert gases, themselves of no use in human affairs, are of greater permanent interest and importance by reason of the new light thrown on the nature of the elements and the constitution of matter. After all, a knowledge of the materials and powers in which life is immersed, and of which it is a part, is in the long run more useful than the applications which may be made to the purposes of mankind. The student of Nature is concerned only about the means of carrying on his work without anxiety as to the future of himself or his family. His discoveries cannot immediately become the subjects of sale or pecuniary reward, and as a rule he does not look for anything of the sort. It will, however, not be forgotten that for the few there are the Nobel prizes.

THE RECONSTRUCTION OF THE FISHING INDUSTRY.

It is no secret that a most vigorous propaganda for the reconstruction of the entire fabric of fishery control is now being carried on by those engaged in the industry, and that this movement gathers force as the end of the war appears to come nearer. The English propaganda takes the form of proposals for the unification of fishery control by the creation of a Ministry having all the powers now exercised by branches of several Public Departments and by the local Fishery Committees. Its suggestions relate mainly to administrative and regulative reforms, to problems of marketing, transport, distribution, exploitation, and technical education. The Scottish proposals,[1] which have just become public, devote but slight attention to administrative changes, but

[1] Memorandum on the Reconstruction of the Fishing Industry after the War. Prepared by the Scottish Steam Drifters' Association, Aberdeen, at the *Daily Journal* Office, September, 1918.

emphasise in the strongest manner the necessity for the organisation on a large scale of *scientific research and education.* Proposals for the reform of the Fishery Authority consist of the suggestion that the existing Fishery Board should cease to exist, or, rather, that it should be "assimilated in form to that of other Public Departments," being "completely manned by Civil Servants and with a permanent head," and coming into relation with the industry through a Consultative Board.

The Memorandum before us gives a short account of the pre-war yield of North European sea-fisheries. In the year 1912 Europe took about 7000*l.* per 100,000 inhabitants, Norway 128,000*l.*, Germany 3000*l.*, Great Britain 29,000*l.*, and Scotland 73,000*l.* This position of Great Britain it is our duty to maintain.

The scheme for the organisation of scientific research and fishery education exhibits a degree of insight into the conditions of the industry and a familiarity with the problems involved such as no previous recommendations have disclosed. The whole situation has materially changed since pre-war days. Ought our participation in international schemes of fishery investigation to terminate? Should any scheme of scientific research aim at the co-ordination of the English, Scottish, and Irish Authorities? The Memorandum says "Yes" to both questions. British interests in North European fisheries are so outstanding that they call for adequate attention; some other nations may not be prepared to go on with the work of the International Council, and if they do the Continent will again become the centre of gravity of the organisation, while in the industry itself Great Britain will remain the predominant partner; and, finally, the expense of time and money entailed by the frequent conferences under the old scheme was unattended by proportionate results. But all this need not imply isolation in matters of investigation—only formal withdrawal from the existing scheme.

In place of the three national Fishery Departments and some of the local Fishery Committees, which before the war instigated scientific research, the Memorandum suggests a single central council having the control of the funds voted by Imperial Parliament. The Council ought to contain representatives of each national Department, of the Meteorological Office, of the fishing-vessel owners, and of the industrial concerns dealing with curing, preserving, by-products, transport, and refrigeration. Recognising the movement in the public mind towards devolution of authority and administration, the "vital importance of combining scientific research with industry," and the necessity for close co-operation between the expert and the *entrepreneur*, the drafters of the Memorandum regard centralisation in London as detrimental. "It could not be accepted." The Council, the head of which ought to be a chairman and director, a man conversant with fishery matters, "and not appointed for political reasons," would expend, direct and allocate the administration of funds, publish reports, memoirs, and results of research, advise on supporting scientific work carried on in unofficial laboratories, devise schemes of investigation and systems of statistical collection, conduct propaganda, appoint agents abroad, publish intelligence, and conduct a fishery journal.

But the Central Council would not establish laboratories or actually conduct scientific investigation. That would be the work of the English, Scottish, and Irish Fishery Departments, and of the Marine Biological Association of the United Kingdom (for "in respect that pure science is the fountain from which applied science draws its life and force, the Marine Biological Association should receive a generous grant yearly out of the funds received by the Central Council"). Each of these four organisations would establish and maintain laboratories, and conduct research in accordance with the schemes submitted to them and the funds allocated. They would also organise schemes of fishery education and co-operate with educational authorities for that purpose.

Some matters dealt with apply specially to Scotland. The Department should seek to develop the new Education Act, which appears to provide for continuation and technical instruction, but not for higher fishery education. For the latter purpose a college of fisheries at Aberdeen is suggested, similar in scope to the Scottish College of Agriculture. This would provide for the education—"that is now a clamant necessity"—of those holding responsible positions in industry in all subjects that are relevant. It would provide for training in research, conduct bureaux of scientific and economic information, maintain a museum, and carry on a sub-department for co-operating with local schools and "encouraging pupils of ability."

Here we have the real grip of essentials. "The future of the industry depends on knowledge"; "Nothing will so surely secure this as opportunities for scientific knowledge." If the outlined schemes for education and scientific research are carried out, "the Scottish fishing industry will continue to hold its high place among the nations of Europe."

NOTES.

The inauguration of the first boring for petroleum in this country, which took place at Hardstoft, near Chesterfield, on October 15, was an event of more than economic interest by reason of the confirmation it may afford of the speculations of competent oil-field geologists of the existence of oil in this country. Forty American drillers are engaged on the first boring, but provision of the necessary plant for drilling ten wells has been made; seven of these drillings are to be made in the vicinity of Chesterfield. Each of the wells will be fully equipped for a maximum depth of 4000 ft., and the principal occurrence of oil is expected to lie between 2000 ft. and this maximum. Lord Cowdray, to whom the nation is so much indebted for the assistance he has rendered in this pioneer work, claimed that although in America such experimental drilling would be known as "wild-catting," yet it was more than justified by to-day's knowledge, but was not a case for exaggerated hopes. Such a word of caution was very necessary, for it is so customary to think of oil-wells as yielding prodigious quantities that the low average of some five tons a day per well throughout the world is not realised. Last year the importation of oil into this country was valued at more than 36,000,000*l*. Even if all the ten wells yielded the above average, the contribution to our national requirements would be very little, and the present enterprise must be regarded more as exploratory than as likely to furnish any adequate proportion of our requirements.

PROF. W. J. POPE, in giving the first Streatfeild memorial lecture at the City and Guilds Technical College, Finsbury, on October 17, selected for his subject "The Future of Chemistry." He reviewed the past and present states of chemical science and industry, and referred to the good work accomplished by men like Meldola, Armstrong, Streatfeild, and others in training the men who during the last four years have been instrumental in establishing a chemical industry on a sound basis, and have enabled us as a nation to produce all those materials necessary for the successful prosecution of the war, many of which, prior to 1914, were to be obtained only from enemy countries. These results were rendered possible by the existence of a small but efficient company of chemists, many of whom were formerly students at the City and Guilds Technical College, Finsbury. The lecturer, in referring to the splendid prospects which the future held for chemical industry, reminded the present students that it rested with them how far this rich heritage of possibilities handed down by the labours of two generations of chemists was explored and developed. Sir Edward Busk, in moving a vote of thanks to the lecturer, referred to the indifference which existed prior to the war regarding applied chemistry, an indifference connected, no doubt, with the immense accumulation of wealth and the general prosperity which had favoured us as a nation. We had been sharply roused from our apathy, and no doubt by this time we all had a just appreciation of the importance of chemical science to national security and prosperity.

WE announce with much regret the death on October 18, in the ninety-first year of his age, of the Rt. Hon. Sir Edward Fry, G.C.B., F.R.S., late Lord Justice of Appeal.

MR. D'ARCY POWER will take "Cancer of the Tongue" as the subject of his Bradshaw lecture at the Royal College of Surgeons of England on Thursday, November 14, at 5 o'clock.

AN address on "Past and Future of the Fight against Tuberculosis" will be given by Sir Malcolm Morris at the Royal Society of Medicine, Wimpole Street, at 8 o'clock on Monday, October 28, the occasion being the opening of the winter session of the Tuberculosis Society.

THE engineering gold medal of the North-East Coast Institution of Engineers and Shipbuilders has been awarded to Mr. Harry R. Ricardo for his paper entitled "High-speed Internal-combustion Engines," which was read before the institution on April 30 last.

THE death is announced, at fifty-one years of age, of Prof. Maxime Bôcher, professor of mathematics in Harvard University since 1904. Prof. Bôcher was president of the American Mathematical Society in 1909–10, and the author of several works on the theory of linear differential equations and related subjects.

MR. LEONARD C. HARVEY has returned from the United States after having carried out for the Director of Fuel Research a full investigation into the progress made in recent years in the application of pulverised coal for metallurgical and general industrial purposes for steam-raising in land and marine boilers and in locomotives on railways. His report will be issued as a Government publication by the Department of Scientific and Industrial Research at an early date.

THE third lecture of the series arranged by the Industrial Reconstruction Council will be held in the Saddlers' Hall, Cheapside, E.C.2, on Wednesday, October 30. The chair will be taken at 4.30 by Sir Wilfrid Stokes, K.B.E., president of the council, and an address on "The Functions of the Government in Relation to Industry" will be given by Mr. W. L. Hichens, managing director of Messrs. Cammell, Laird, and Co. Applications for tickets should be made to the Secretary, I.R.C., 2 and 4 Tudor Street, E.C.4.

THE United States, like our own country, is already feeling the loss of its scientific men through the undiscriminating and brutal hand of war. Prof. J. F. Kemp records in *Science* (September 13) the death of Capt. John Duer Irving, of the 11th U.S. Engineers, editor of *Economic Geology*, and professor of that subject in the Sheffield Scientific School of Yale University. Prof. Irving followed his father, the late R. D. Irving, in paying special attention to deposits of metallic ores and useful minerals. The father was, perhaps, more drawn towards petrology, and his work for the U.S. Geological Survey may be better known than that of the younger man, who died from pneumonia in Flanders at the age of forty-four. It is part of the tragedy that the finest investigations of Prof. Irving will now be published posthumously. A bulletin by him and Dr. S. F. Emmons on the Downtown district of Leadville, Colorado, was issued in 1907. Dr. Emmons's death left the junior author in charge of the revision of the great monograph on Leadville, and the edition now in hand, recording a large number of new observations, will remain for scientific men as Prof. Irving's monument.

THE Wilberforce Museum, controlled by the Corporation of Hull, has recently received a promise of a valuable addition to its collections in a large series of Stuart relics presented by the Rev. W. C. Piercy. It consists of a large number of prints and oil paintings connected with the Stuart period, a miniature of Henrietta Maria, and a memorial ring of Charles I., with a tapestry, said to be of Gobelin manufacture, from the Bardo Palace at Turin, representing Charles I., Queen Henrietta Maria, and Charles II. as a boy. Besides these objects, there is a considerable collection of books relating to the Stuarts. These collections will revert to the museum after the death of Mr. Piercy and his wife.

IN the Journal of the Royal Anthropological Institute (vol. xlviii., part i.) Mr. H. Ling Roth concludes his elaborate monograph on primitive looms. In its earliest stages the loom is so apparently simple that it is very difficult to decide whether it was due to independent invention, inheritance from ancestors in a distant region, or transmitted from one race to another. Origin or invention must precede distribution or copying, and is consequently more remote and obscure than distribution, which in most cases is so obvious that it tends to increase the obscurity of origin. On the whole, Mr. Roth comes to the conclusion that some looms are of independent invention, while others are an inheritance or have been transmitted from one race to another.

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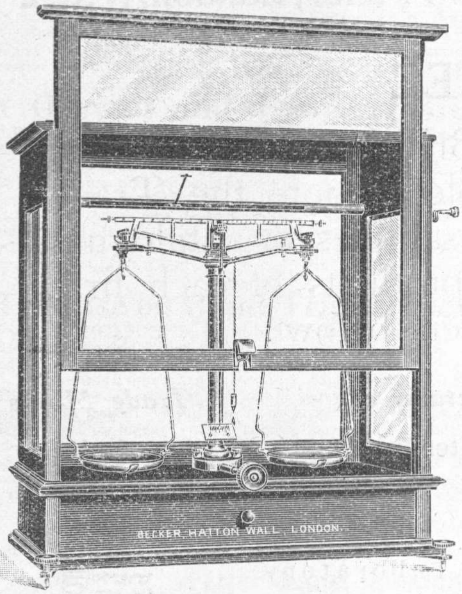

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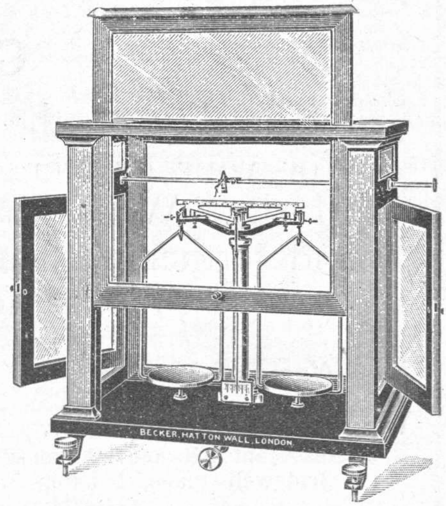

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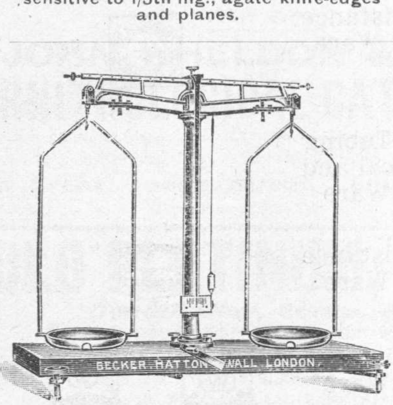

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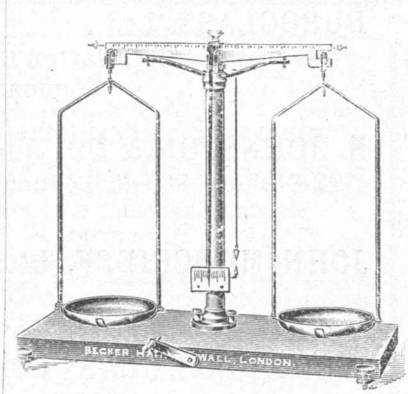

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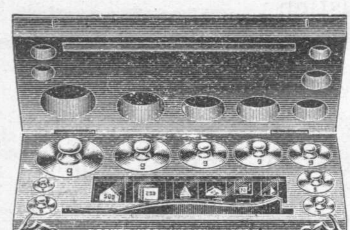

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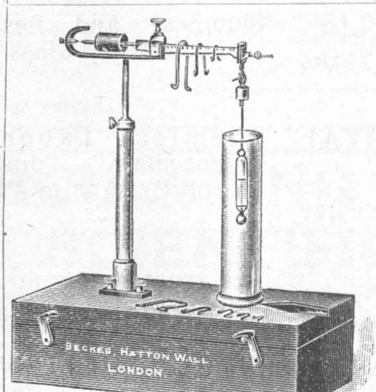

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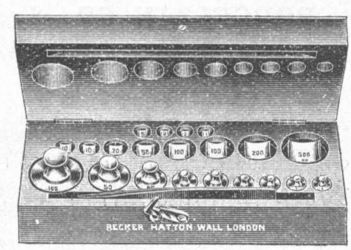

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SOME new light on the proto-ethnology of the Malay Peninsula is thrown by excavations in caves at Lenggong, Upper Perak, conducted by Mr. I. H. N. Evans, the results of which are published in the Journal of the Federated Malay States Museums (vol. vii., part iv., June, 1918). Amongst other objects, some stone implements were discovered. Whether these had been subjected to a rubbing-down process still remains a matter of doubt. If we are to regard the specimens as being roughly blocked out and unfinished specimens of the Neolithic period, it is difficult to see into what peninsular type or types they are to be included. It is possible that the earliest occupants of these caves did not possess any pottery, but a little may have been in use in the period represented by these implements.

IN *Man* for October Miss M. Murray discusses the question of the so-called "devil's mark," familiar to all students of European witchcraft. After a review of the evidence, the writer draws the conclusion that the mark was coloured, permanent, caused by the pricking or tearing of the skin; that the operator passed his hands or fingers over the place, and that the pain was severe and might last a considerable time. These facts suggest tattooing. Another form of the "devil's mark" was the "little teat." The description points to its being a natural phenomenon, the supernumerary nipple. Cases of polymastia or supernumerary breasts, and polythelia or supernumerary nipples, are constantly observed by modern scholars, and their occurrence is more common than is generally believed, and in many cases is unnoticed, unless well-marked in men or causing discomfort by functioning when in women.

IN the *Eugenics Review* for October (vol. x., No. 3) Prof. J. A. Lindsay discusses the eugenic and social influence of the war. He concludes that "when we come to count up the gains and losses of the war, there can be little doubt to which side the balance will incline. The nation will have lost heavily in man-power, in brain-power, in capital, and in industrial resources. But there will be some not inconsiderable compensations. The nation will, we may hope, emerge from the great ordeal purged of some of its defects. Luxury will diminish, thrift will increase. Food production at home will have received a great stimulus. Education will be on a sounder basis. We shall be more teachable, less self-satisfied, readier to profit by example and by experience."

THERE is a general belief that it is a relatively easy problem to estimate a person's intelligence by looking at him; and teachers, physicians, and employers are often compelled to make judgments as to the intelligence of a given person with no more data than can be obtained from a rapid survey of his appearance; hence such phrases as "he looks bright" or "he looks stupid." Even in the law courts rough estimations of intelligence are sometimes required. In the *Psychological Review* (vol. xxv., No. 4) Mr. R. Pinter gives the results of an investigation he made for the purpose of testing the trustworthiness of these judgments. The author chose twelve photographs of children varying in intelligence from proved feeble-mindedness to unusually great ability, and asked groups of people to arrange the photographs in order of merit for intelligence. His groups consisted of physicians, psychologists, teachers, and miscellaneous people. He found that the group of psychologists was the most nearly correct, but that on the judgment of no one group or of no one person could any reliance be placed. Several observers were consciously influenced by children of their acquaintance whom a photograph happened to resemble, and irrelevant trivialities quite frequently biased the observer's judgment. The author concludes that, although perhaps a living person would be easier to judge than a photograph, nevertheless these haphazard judgments are too untrustworthy to be of practical value; and that, whether the observer be a teacher, physician, or employer, it would be better to use objective standards, and he recommends that the use of mental tests should be considerably extended.

THE fourth and fifth parts of the Report of the Danish Oceanographical Expedition of 1908–10 to the Mediterranean and adjacent seas have just been published (Copenhagen, 1918). No. 4 deals entirely with several groups of the fishes collected—the shore fishes, the Stomiatidæ, Argentinidæ, Microstomidæ, Opisthoproctidæ, Mediterranean Odontostomidæ, Bramidæ, and Trichiuridæ. No. 5 is also biological, and describes the Mediterranean Scopelidæ; one group of Crustacea, the Hyperiidæ-Amphipoda; the sea-grasses; and the Algæ (except the calcareous species). The reports are wholly systematic, and particular attention is paid to larval and post-larval forms. Schmidt's biometric methods are applied in the descriptions of fishes, and very clearly drawn and printed tables and distributional charts are included. The report is a model of careful editing and admirable printing.

THE Bulletin of the Madras Fisheries Department (No. 11, Government Press, Madras, 1918, edited by Mr. James Hornell) contains a very interesting paper by Sir F. Nicholson, Honorary Director of Madras Fisheries, on carp cultivation in Bavaria. There are thousands of ponds in the kingdom, and they are regarded as more profitable than the same area of good land. As a rule, they are natural hollows, which nearly empty in the winter. About once in ten years they are cropped with oats or some other cereal. They receive drainage from the surrounding area of cultivated land, and the liquid part of the farm drainage is deliberately led into them. Shade is undesirable, and a high water temperature very favourable. The ordinary pond vegetation exists, with a very abundant plankton. The fish are actually cultivated, like trout for stocking purposes in this country. They are fed artificially by cereals, seeds of lupins, maize-cake, fish-meal, bad potatoes, oil-cake, vegetables unfit for the table, etc. In one farm, not the best, the output in one year from a pond of 88 acres was 11,000 lb. of fish. The methods are strongly recommended for adoption in India.

THE vital relation of economic ornithology to agriculture and horticulture is sufficiently obvious to warrant a more extensive and more scientific study than it has yet received. The subject is an intricate one, and much harm has been done by hasty generalisations based upon very inadequate and imperfectly collected data. Few workers have contributed more usefully to the subject than Dr. W. E. Collinge, and the report on his recent investigations, which is published in the September issue of the *Journal of the Board of Agriculture*, is deserving of wide notice. In most previous work the numerical or gravimetric system of estimating the food contents of birds' stomachs has been followed, but Dr. Collinge roundly condemns this in favour of the volumetric method or percentage valuation by bulk. As the result of examinations of 3670 adult birds and 595 nestlings, embracing nine species of wild birds, he draws the conclusion that only two of these species, viz. the house-sparrow and the wood-pigeon, are distinctly injurious, and should be subjected to strong repressive measures. Two others, viz. the rook and the sparrowhawk, are too numerous, and consequently injurious over wide areas, whilst the missel-thrush is too numerous in certain localities; these species could be adequately reduced by a temporary withdrawal of protection. The remaining four species, viz. the skylark, green woodpecker, kestrel, and lapwing, are highly beneficial, and should receive every protection.

THE first annual report of the official seed-testing station of the Board of Agriculture, which is issued in the Board's *Journal* for September, affords abundant justification for the creation of the station in November last. In the eight and a half months of the station's existence up to July 31 no fewer than 7744 samples were dealt with, of which 5676 were sent by seedsmen and 1553 by growers. In course of time the proportion of the latter class will doubtless steadily increase as the facilities provided become more widely known amongst farmers and allotment-holders. More than forty species of seeds were tested, the most numerous being cereals, grasses, clovers, turnips, mangolds, and onions. The report clearly indicates that much worthless seed is liable to get into the hands of farmers, about 1 per cent. of the samples showing a germination of 5 per cent. or less. The quality of a few kinds of seed would seem to have been decidedly below the average of recent years, *e.g.* vetches, English red clovers, trefoil, meadow fescue, timothy, scarlet runner and French beans. Dodder was very prevalent in red clovers, especially in those of Chilian origin, and its presence in samples of other leguminous species is evidence that sufficient attention is not yet paid to the elimination of this parasite. The general significance of the results as outlined in the report merits the most careful consideration of both seedsmen and growers.

WE have received a copy of the register of earthquakes felt or recorded in the Philippine Islands during the year 1917 (U.S. Weather Bureau for December, 1917). The number of earthquakes catalogued is 146; most of them were of moderate intensity. Only two were strong enough to damage buildings slightly, yet, though their epicentres were situated within or close to the Philippine Islands, both were registered at seismological stations all over the world.

IN a paper on the atmospheric scattering of light, which constitutes Publication No. 2495 of the Smithsonian Miscellaneous Collections, Mr. F. E. Fowle, of the Astrophysical Observatory of the Smithsonian Institution, gives the results of an examination of the data collected at Mount Wilson between 1910 and 1916. If the fraction of the light of given wavelength incident at the outer limits of the atmosphere which penetrates to the earth's surface be called the transmission coefficient, this coefficient is found to vary for dry air from about 0·6 at the blue to about 0·9 at the red end of the visible spectrum, its value varying with the inverse fourth power of the wavelength. In addition, there is a slight haziness which reduces the coefficient by 0·5 to 3 per cent. in normal years. The coefficient for dry air is entirely accounted for by the gas molecules according to the theory given by Rayleigh. The coefficients for water-vapour vary from 0·9 to 0·98 over the same range, and follow the same law of variation with wave-length. The absorption is, however, fifty times that to be expected on Rayleigh's theory. The haziness due to the vapour reduces the transmission about 2 per cent. in all parts of the spectrum.

THE Central Argentine Railway has a present mileage of 3300, and serves the northern portion of the Argentine. It has the distinction of being the first of the great railway lines in the Argentine to adopt the modern method of dealing with suburban traffic, and this fact lends interest to a series of illustrated articles in *Engineering* descriptive of the electric traction system employed. Messrs. Merz and McLellan have acted as engineers in conjunction with Messrs. Livesey, Son, and Henderson, and the whole of the apparatus used in connection with the electrification was manufactured in Great Britain. The complete electrification works for the suburban system include a power station of 15,000-kw. capacity, 57 miles of high-tension transmission cables, four traction substations with 14,000 kw. of converting plant, and the electrical equipment of 100 miles of single track. Power is produced in the generating station as three-phase current at 20,000 volts, with a periodicity of 25 cycles, transmitted to the sub-stations, converted to direct current at 800 volts, and supplied to the trains through a third rail. The power plant includes six Babcock and Wilcox water-tube boilers with underfeed stokers, four horizontal reaction turbines with high- and low-pressure cylinders by Messrs. C. A. Parsons and Co., Ltd., together with alternators, transformers, and motors by the same firm.

Engineering for October 18 contains an account of an interesting process for producing wheels and discs by rolling which is in operation at the works of the Cambria Steel Co., Pa. The method, which is due to Mr. E. E. Slick, consists in cutting "cheeses" off 11-in. to 20-in. rolled bars, and then converting these blanks into wheels or discs by a special form of rolling mill, of which drawings are included in the article. The blanks are cut from the hot bar by eccentric shears having cutters with cam-shaped edges, which approach and recede from each other as the cutters rotate. It is this approach of the two edges during a rotation which effects the cut by shearing on a bar placed between the two. The blanks are then reheated and punched so as to leave a hole nearly half-way through them, into which a loose pin is fitted, which serves to centre the blank in the subsequent rolling operation. The rolling mill consists of two shafts set at a slight angle to each other. At adjacent ends each shaft carries a die corresponding with the wheel-form required, and between these dies the blank is placed. One die is fixed axially, and the other can be traversed axially by hydraulic rams. The total thrust exerted by these rams is about 3,000,000 lb. It is claimed that the wheels produced by this process are of uniform texture, and that any piping which may have existed in the centre of the round bar remains in the centre of the punched wheel, and is ultimately removed when the wheel is pierced to take the axle.

WE regret that a reference in a note in our issue of October 10, p. 111, conveyed the impression that the Institute of Chemistry had failed in its efforts to increase its activities. Mr. R. B. Pilcher, registrar and secretary of the institute, informs us that more than one hundred new fellows and more than 650 new associates have been elected since October of last year. All that the writer of our paragraph intended to suggest was that the institute, by opening its doors more widely, would obviate the necessity for the formation of new organisations in the chemical profession; indeed, events are already beginning to show the undesirability of having several organisations representing the profession. We are glad to take this opportunity of congratulating the institute on the success of its progressive policy.

MESSRS. LONGMANS AND CO.'s new announcement list contains the following books relating to science:—"Life of Frederick Courtenay Selous, D.S.O.," J. G.

Millais, with sixteen full-page illustrations; "Ships' Boats: Their Qualities, Construction, Equipment, and Launching Appliances," E. W. Blocksidge; and a new and revised edition of "Recent Advances in Physical and Inorganic Chemistry," Dr. A. W. Stewart, with an introduction by the late Sir William Ramsay, K.C.B., F.R.S., illustrated.

MR. F. EDWARDS, of 83 High Street, Marylebone, has just issued Catalogue No. 384 of books dealing with a variety of subjects, but mainly architecture, printing and bibliography, and bookbinding. The sections appealing more especially to readers of NATURE are those relating to archæology, gardens, and the proceedings of many provincial scientific societies.

MESSRS. J. M. DENT AND SONS, LTD., have received a licence from the Controller of Patents to publish a translation of "The Biology of War," by Prof. G. F. Nicholai, the former holder of the chair of physiology in Berlin University, who, after imprisonment in Germany for his opinions, escaped to Denmark by aeroplane.

OUR ASTRONOMICAL COLUMN.

BORRELLY'S COMET.—L. v. Tolnay gives the following elements of this comet in *Astr. Nach.* (No. 4961); he has computed planetary perturbations, including those of Mars, to which the comet made a near approach at the beginning of 1912:—

$$T = 1918 \text{ Nov. } 16{\cdot}6818 \text{ G.M.T.}$$

$$\left.\begin{aligned} \omega &= 352^\circ\ 23'\ 0{\cdot}73'' \\ \Omega &= 77^\circ\ 1'\ 47{\cdot}71'' \\ i &= 30^\circ\ 29'\ 29{\cdot}01'' \end{aligned}\right\} 1925{\cdot}0$$

$$\phi = 37^\circ\ 57'\ 20{\cdot}77''$$

$$\mu = 513{\cdot}90816''$$

The following ephemeris is from a Marseilles Circular (for Greenwich midnight):—

	R.A. h. m. s.	N. Decl.	Log r	Log Δ
Nov. 2	6 33 30	2 20	0·1478	9·7978
6	6 38 58	4 52	0·1463	9·7766
10	6 44 1	7 44	0·1454	9·7561
14	6 48 35	10 57	0·1449	9·7367
18	6 52 37	14 30	0·1449	9·7190
22	6 56 3	18 24	0·1453	9·7035
26	6 58 49	22 36	0·1462	9·6910
30	7 0 49	27 2	0·1476	9·6822

Harvard Bulletin (No. 669) gives the following observations made at the Yerkes Observatory by Mr. Van Biesbroeck:—

G.M.T.	R.A. h. m. s.	S. Decl. ° ′ ″
Aug. 31·89146	4 39 19·15	14 1 50·0
Sept. 5·91563	4 45 18·78	13 29 47·4

The comet had a diffused elongated nucleus in P.A. 95°, a tail 40″ long in the same direction; its magnitude was 13; it may rise to the 9th magnitude in November, being fairly near the earth.

WOLF'S COMET.—The following is a continuation of M. Kamensky's ephemeris for Greenwich midnight:—

	R.A. h. m. s.	Decl. ° ′	Log r	Log Δ
Nov. 2	21 4 59	2 50 N.	0·2138	0·0608
6	21 13 52	1 48	0·2112	0·0677
10	21 23 8	0 51 N.	0·2088	0·0749
14	21 32 46	0 1 S.	0·2066	0·0824
18	21 42 42	0 49	0·2048	0·0904
22	21 52 56	1 31	0·2032	0·0986
26	22 3 24	2 8	0·2018	0·1072
30	22 14 3	2 40 S.	0·2008	0·1159

The comet is likely to be of the 10th or 11th magnitude.

SOLAR-LINE DISPLACEMENTS AND RELATIVITY.—A further contribution to the study of solar-line displacements in connection with Einstein's theory of relativity has been made by Mr. J. Evershed (*The Observatory*, vol. xli., p. 371). Thirty of the lines composing the cyanogen band λ 388 were carefully selected for observation, and their displacements determined by comparison with the corresponding lines in the carbon arc. The provisional mean values for the shifts are +0·004 A at the centre of the disc, and +0·006 A at the polar limbs. There appears to be a curious systematic difference in the results for the north and south polar limbs, the former agreeing approximately with the centre of the disc, while the latter consistently showed the much larger displacement of +0·008 A. The displacements as a whole are larger than those found by Dr. St. John, but they are still, on the average, not much more than half the predicted gravitational effect, whilst for iron lines the shifts are in many cases twice as great at the limb as is required on the relativity hypothesis. In explanation of the limb displacements Mr. Evershed suggests that the effect may possibly be due to the unsymmetrical shading towards the red of the majority of the Fraunhofer lines, which would be emphasised at the limb in consequence of the longer path of the photospheric light through the absorbing vapours. A large proportion of iron lines have, in fact, been found to be very slightly shaded towards the red in the laboratory spectrum. In agreement with Dr. St. John, Mr. Evershed considers his results unfavourable to the theory of relativity.

SCIENTIFIC AND PRACTICAL METRIC UNITS.

WE have received a communication from Dr. John Satterley, of the University of Toronto, with reference to Sir Napier Shaw's article on "Units and Unity" in NATURE for June 27, in which he complains of "the bewildering array of powers of ten" that hamper the C.G.S. system of electro-magnetic units and the practical units of electricity. Dr. Satterley makes the same complaint of other measures based on the metric system, which he admits is admirable for purposes of scientific measurement, but not for everyday use until it is simplified and the names of its units are shortened. He cites the milliwatt as representing a complication so intricate that nobody but a professional metricist knows what it is.

The communication represents the impossible position which some teachers of science practically take up consciously or unconsciously. The introduction of C.G.S. units into scientific measurement is an accomplished fact; and if scientific measurement is to be the headlight of practical life, it is absurd for the ordinary sensible man to be kept in ignorance of the units with which scientific men work. It has been remarked in some quarters that Sir Napier Shaw's article should have been addressed to the uninformed and unconverted: that readers of NATURE were all agreed upon the question. But if the agreement is only with the reservation that the organised system of physical units as it exists is reserved for the inner circles of scientific society, while the inch and the English system are good enough for the ordinary dealings of everyday life, it is obvious that the practical applications of science in this country must continue to be crippled as heretofore.

The beginning of Dr. Satterley's complaint is that "metricists are continually inventing new units—practical units (so-called) which are multiples of the centimetre, the gram, and the dyne." Who are the delinquents in that case we do not know. Dr. Satterley professes his ignorance of the millibar. He may not have seen Prof. V. Bjerknes's work published in Washington, or the discussions that have taken place upon it in meteorological publications. He should not, however, complain if those whose scientific lives depend absolutely upon measures of the pressure of the atmosphere feel necessities which he does not share. If he himself is unaware of the literature of the subject, he can get the information which he seeks very simply by asking his colleague who is charged with the duty of expounding the important subject of dynamical meteorology in the University of Toronto just as he would ask a mathematical colleague if he came across an equation which he could not solve. No doubt the powers of ten are awkward, and those that are superfluous will pass away with practical use, but not before.

The general question of the reform of our system of weights and measures is raised again by the Ministry of Reconstruction in the report of Lord Selborne's Sub-Committee appointed to consider the methods of increasing home-grown food supplies in the interest of national security. One difficulty in the way of home-grown supplies to which the report directs attention is the chaos of different units and the divergence of standards of measurement for agricultural produce. The Sub-Committee proposes, therefore, that a uniform standard of weight should be laid down on which alone sales and purchases of agricultural produce, other than liquids and certain market-garden produce, should be legal; with standard measures also for liquids and of number for market-garden produce habitually sold in that way. Now that the sale of produce is no longer between the local grower and the local shopkeeper, but is so organised that narcissus grown in Scilly may be sold as cut-flowers in Aberdeen, the old conventional methods of sale by the habit of local pottle or basket are certainly out of date.

There is no doubt that selling by weight is the scientific mode of procedure, and for dealing with shiploads the only practicable method. Also for the final distribution of the stock to small purchasers weighing is the only satisfactory basis of a modern bargain. For the intermediate stage between the large producer and the small buyer the measure of capacity that is based upon convenient packing for transport is very serviceable. When produce must be put into sacks, or pots, or flats in order to get it to market it is in so handy a form for sale and so badly arranged for weighing that some scale of equivalents must come into vogue either by agreement or by law, and it should be the object of legislation to make that easy and not difficult; just as wherever beer is sold it must be sold by the barrel, whether the barrel contains 36 gallons or 163 litres.

The really debatable point, however, about a revised scheme of selling produce by weight is what the standard of weight shall be. Here the ton and the pound are the rivals, just as the pound (in another sense) and the penny are rivals in decimal coinage. There is such a convenient bridge to the metric system through the ton that an English name for the kilogram would be the best solution. If anyone can produce a monosyllable that would be generally adopted as a designation of a weight of about 2·2 lb., the rest might be comparatively easy. "Kilo" is neither sufficiently euphonious nor sufficiently exclusive.

Sale by number is another matter with a great history of its own, depending upon the art of bargaining. When we have got rid of long hundreds, and bakers' or booksellers' dozens, and scores which are not twenties, we might then agree that an immense amount of bookkeeping would be saved if net prices could be protected against the inroads of discounts for prompt cash, but that is probably as deep down in human nature as giving back a shilling for good luck when one sells a pig.

FRUIT INVESTIGATIONS AT LONG ASHTON.[1]

THE report of the Agricultural and Horticultural Research Station of the National Fruit and Cider Institute, Long Ashton, near Bristol, gives a record of the work done during the year and the changes in organisation brought about as the result of the war. Fortunately, the investigations still continue, though much of the time of the staff is devoted to the work of the Food Production Department; and, still more fortunately, arrangements are in progress whereby the station will be able further to develop after the war. On its establishment in 1903 the station had to be content with 15 acres of land; since that date the area has gradually expanded until at the beginning of this year it was 28½ acres. Most of the land, however, is now planted up with fruit or covered with buildings, and no new experimental work requiring land could be undertaken at the station itself. An opportunity for increasing the area of available land has recently occurred, and arrangements have been made whereby this is to be extended to 53 acres, while an option has been secured that will enable another 200 acres to be taken over if necessary. The director is to be congratulated on having made these arrangements for future developments.

The report consists of a series of papers by the director, Mr. B. T. P. Barker, and the staff, Messrs. Otto Grove, G. T. Spinks, A. H. Lees, and C. T. Gimingham. The subjects are varied; there are several pathological papers dealing with diseases or pests of fruit-trees, one on apple stocks, and another on cider-apple jelly. The production of jelly from apples involves many interesting problems, the chemistry of which is not fully understood. Cider apples and perry pears are not normally used for food in this country except in times of scarcity, when certain varieties are taken by the jam-makers, and to a less extent for dessert and cooking purposes. In the case of apples only the "sours" are used in this way, the "sweets" and "bitter-sweets" being exclusively reserved for cider. The "sours" contain a good deal of malic acid, the amount exceeding 0·45 per cent. in the juice; they yield a jelly without difficulty. The "sweets" and "bitter-sweets" have hitherto proved unsuitable for jelly-making, but Mr. Barker has now fortunately discovered the proper conditions for manufacture. The juice is first extracted, and is then concentrated in a Kestner evaporator until the malic acid constitutes between 1 and 1·5 per cent. of the whole; then sugar is added until the total quantity present amounts to 65 per cent. In practice a certain amount of blending of juices is desirable, so as to ensure that the proper concentration of malic acid shall be readily obtained. It is, of course, possible to obviate any addition of sugar by carrying the evaporation far enough; in this case it would have to go to one-seventh of the original value of the juice, the average sugar content of which is about 10 per cent. On the whole, it is found cheaper to add the sugar.

A prolonged investigation is being made into the various "stocks"—the seedling trees on which grafts are grown. Of these "stocks" there are great

[1] Annual Report of the Agricultural and Horticultural Research Station National Fruit and Cider Institute, Long Ashton, Bristol, 1917.

numbers, but Mr. Barker proposes to treat them as a series of hybrid varieties produced by much natural inter-crossing, in the first instance between the botanical species from which the ordinary cultivated apple has arisen, and, later, between the varieties resulting from the earlier hybridisation. The main problem is to determine the nature of the influence of the stock on the resulting fruit-tree, and, in particular, whether it is simply mechanical in nature and regulated by the morphology of the root system, or whether there is a definite physiological influence, the nature of which is determined by the character of the seedling. If the latter is a factor, the problem is, of course, extraordinarily complicated, but there are opened up possibilities of striking developments in the culture of fruit. Further work on this important subject will be awaited with interest.

A NEW GRAPHIC METHOD IN NAUTICAL ASTRONOMY.

A NEW departure of some little interest has been recently taken in America in the publication by the United States Hydrographic Department of a new chart, or diagram, for finding readily by a simple graphic process hour angle or azimuth at sea. So far as azimuth is concerned, a diagram of this nature, known as Weir's Azimuth Diagram, has been in use for many years, but in that case the hour angle is made use of as a datum, whereas in the new diagram the altitude takes the place of hour angle as argument; and, as an altitude can be observed at sea with much less trouble than hour angle can be deduced from chronometer time, some labour is saved by its substitution.

The construction of the diagram, which is due to the inventive genius of Mr. G. W. Littlehales, of the U.S. Hydrographic Department, is based upon a function of the angle very generally employed by navigators, but not much known outside nautical circles, called the haversine. A formula very generally employed in spherical trigonometry for finding an angle of a triangle from three sides given is

$$\sin^2 \frac{A}{2} = \frac{\sin (s-b) \sin (s-c)}{\sin b \sin c}.$$

The practical application of this formula was very much simplified about a century ago by the introduction into the nautical text-books of a new table which gave the value of the logarithm of the square of the sine of one-half the angle, and was therefore called the "sine square" table. A little later, since

$$\sin^2 \frac{A}{2} = \tfrac{1}{2}(1 - \cos A) = \tfrac{1}{2} \text{ vers } A,$$

the name of haversine, or half versine, suggested itself for the new function of the angle, and as such it is generally known to-day.

The particular formula on which the diagram is based was proposed about ten years since, and is as follows:

$$\text{hav}\,(a) = \text{hav}\,(b \sim c) + \{\text{hav}\,(b+c) - \text{hav}\,(b \sim c)\}\ \text{hav A}.$$

If the sides b, c be regarded as constants, a, A being variables, this expression takes the form

$$y = mx + c$$

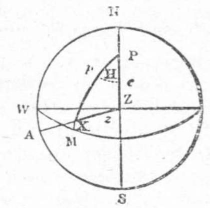
—that is, of the equation to a straight line.

This formula suggested to the inventor the notion of a square chart, with sides graduated according to the values of a series of natural haversines, by means of which, having given the altitude and declination of a body and the latitude of place, hour angle and azimuth might be found by simple inspection. Upon such a chart, by drawing a straight line through two points readily determined, a connection would be established, in one case between the hour angle and zenith distance, in the other between azimuth and polar distance, so that, one of a pair being given, the value of the other could be taken approximately from the chart.

The Triangle of Position in Nautical Astronomy.

The diagram which follows exhibits on the plane of the horizon what is known as the "triangle of position," in which

PZ, the co-latitude $= 90° -$ lat. or c.
PX, the polar distance $= 90° \pm$ dec. or p.
ZX, the zenith distance $= 90° -$ alt. or z.
ZPX, the hour angle $=$ H.
PZX, the azimuth $=$ Z.

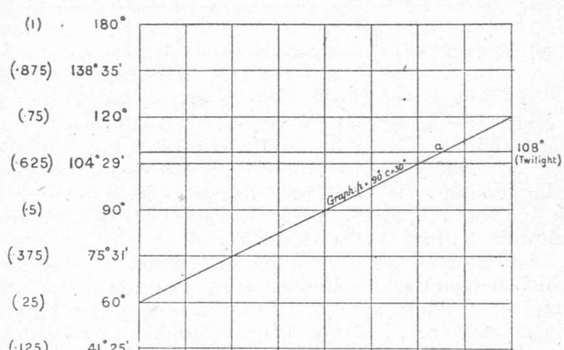


The general formula adapted to this triangle gives for hour angle

$$\text{hav } z - \text{hav}\,(p \sim c) = \{\text{hav}\,(p+c) - \text{hav}\,(p \sim c)\}\ \text{hav H},$$

the polar distance (p) and co-latitude (c) being considered as constants.

The small diagram given below will perhaps serve to explain the process adopted. The side is only 3 in. in length, compared with 2 ft. in that issued for practical use. In the actual chart, again, a system of "grillage," by means of lines drawn at short intervals parallel to the sides of the chart, enables the value of an angle to be read off to the fraction of a degree at sight, whereas in the small diagram the graduations of the sides are equal, and the points marked indicate the angles corresponding with successive values of the haversines at intervals of 0·125.



Hour Angle and Zenith Distance.

Example 1.—At a place in lat. 60°, when the sun is on the equator, find zenith distance at 4h. P.M., hour angle at setting, and at the end of twilight.

Rule.—On left-hand margin mark the point corresponding with $(p \sim c)$, *i.e.* of meridian zenith distance at upper transit, and on right-hand margin the point for $(p+c)$, or meridian zenith distance at lower transit. The line joining these points is the graph required, hour angle for any position being read off at foot of chart, and zenith distance on margin.

Here polar distance $(p)=90^\circ$, co-latitude $(c)=(90^\circ-60^\circ)=30^\circ$.

Therefore $(p-c)$ for left margin $=90^\circ-30^\circ=60^\circ$.
" $(p+c)$ " right " $=90^\circ+30^\circ=120^\circ$.

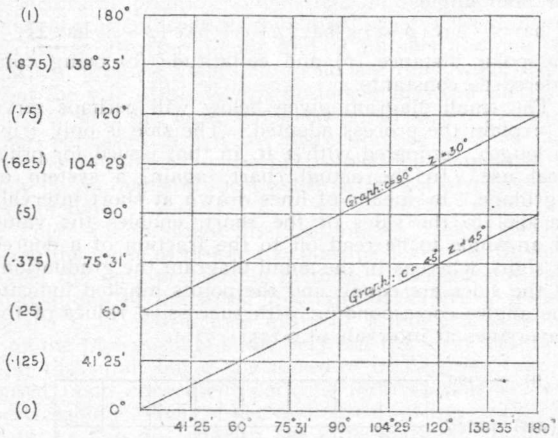
The graph being drawn accordingly, at 4h., or 60°, read off at foot of chart, we have zenith distance 73° 31′ on margin. When the sun is setting the zenith distance is 90°, and the hour angle is also 90°, or 6 hours. To find the hour angle at the end of twilight —that is, when the sun has a depression of 18°—we have to draw the parallel for $90^\circ+18^\circ$, or 108°. The graph intersects this in the point (a), which would be found on measurement to correspond approximately with 8h. 33m. P.M.

Azimuth and Polar Distance.

Interchanging polar distance (p) and zenith distance (z), the procedure will be very much as before.

Example 2.—At a place on the equator find the azimuth of bodies of declination 14° 29′ N., 0°, 14° 29′ S., the altitude in each case being 60°.

Rule.—On left-hand margin mark $(z\sim c)$, and on right-hand margin $(z+c)$. Join these points, and azimuth for any position is read off on base, and polar distance on margin.



Here $(c-z)=90^\circ-30^\circ=60^\circ$, $(c+z)=90^\circ+30^\circ=120^\circ$. For declination 14° 29′ N., we have polar distance 75° 31′, and azimuth N. 60° W.; for declination 0°, polar distance is 90°, and azimuth N. 90° W.; for declination 14° 29′ S., polar distance is 104° 29′, and azimuth N. 120° W. or S. 60° W.

The following is an example of the converse case in which declination is obtained from azimuth:—In latitude 45° N. find the declination of a body which passes the prime vertical at an altitude equal to the latitude of place. For $(z-c)$ we have the value zero, so that the graph passes through the origin, while $(z+c)=90^\circ$. If the bearing is 90°, we have polar distance 60°, so that declination is 30° N. If the azimuth is 60°, it is also evident from the diagram that polar distance is 41° 25′, and declination 48° 35′ N.

The deduction of declination from observed altitude and approximate azimuth is of value at sea to identify an unknown star.

The most obvious use of the diagram is to supply an exceedingly simple graphic method for azimuth. In theory the diagram can be used with equal facility for hour angle. But in the latter problem much greater accuracy is required than in the other, and the diagram necessary would have to be upon too large a scale to be available for ordinary use at sea. It is quite possible, however, that another kind of navigation may become a matter of daily experience ere long, viz. the long-distance navigation of the air, and that in this form of navigation, which will undoubtedly possess many features peculiar to itself, the diagram may serve generally not only for azimuth purposes, but also for those of hour angle.

In the words of the inventor of the diagram:—"The feasibility thus disclosed of framing a nautical astronomy in which all requirements will be subserved by a single trigonometrical table, like the table of haversines, No. 45 in the *American Practical Navigator*, invested the subject with interest from the point of view of aerial navigation, because this formula, if successfully represented in graphical form, might provide the aerial navigator with the equivalent of a volume on nautical astronomy in a form simple enough to fulfil the instant needs of flight." H. B. G.

EXPERIMENTAL STUDIES OF THE MECHANICAL PROPERTIES OF MATERIALS.[1]

THE general purpose of experiment on materials is to distinguish between the fit and unfit, the suitable and unsuitable materials for the various requirements of the structural and mechanical work of the world. The special object of the engineer in testing materials is to obtain a rational basis for proportioning structures and machines so that they may sustain the straining actions to which they are subjected without fracture or prejudicial deformation, and at the same time without waste of material. Nor is there any finality in such testing, for new alloys, new heat treatments, new conditions of use are always making fresh investigation necessary. In the next place, the mechanical properties of materials desired and assumed in designing are embodied in specifications. Thence arises a second occasion for experiment. Tests of reception or inspection tests are necessary to determine whether material supplied reaches the required standard. With the widening of the sources of supply, an engineer can no longer depend merely on the reputation of the seller, but must make his own tests.

Early Researches.

There are two methods, said Roger Bacon in the thirteenth century, by which we acquire knowledge—argument and experiment; and he proved the fertility of the method of experiment in contrast with the barren dialectics of his time. But it was some centuries later before anything was done to ascertain by experiment the data required by the engineer in using materials of construction. Yet there is no subject of greater importance to engineers, or of more intellectual interest, than the study of the mechanical properties of materials which fit them for use in construction. Nor is there one which more deeply concerns the general public who depend on the product of machinery and travel on railways.

The earliest known experiments on the strength of materials were made by Galileo[2] in 1638, and not long after Muschenbroek,[3] of Leyden, made many tests on a small scale, some of which are quoted in Barlow's "Strength of Materials." Galileo knew nothing of elasticity, but he determined the tenacity of copper and started an inquiry into the strength of beams, giving a solution partly right, partly wrong.

1 From the Thomas Hawksley Lecture delivered before the Institution of Mechanical Engineers on October 4 by Dr. W. Cawthorne Unwin, F.R.S.
2 Fontenelle, "Histoire de l'Académie des Sciences," 1702.
3 "Introductio ad cohaerentiam corporum firmorum," 1729; Barlow, "Strength of Materials," 1867, p. 3.

A step of the highest importance practically and theoretically was the publication in 1678, by Robert Hooke, "an Englishman of great genius but unpleasant temperament," of the empirical law that stress is proportional to strain.[4] Then in 1680 Mariotte, who independently discovered Hooke's law, indicated that the resistance of a beam is due to tension on one part and thrust on the other part of a section. Coulomb,[5] later, more scientifically obtained the equation of equilibrium by resolving horizontally the forces at a cross-section and equating the moment to that of the external forces on either side of the section.

In 1807 Thomas Young[6] defined the coefficient of elasticity or Young's modulus—an epoch-making advance because of the clearness it introduced into elastic reasoning. Arthur Schuster says that Young was probably, next to Leonardo da Vinci, the most versatile genius in history, and Helmholtz said that he was one of the most clear-sighted men that ever lived.

Early Practical Testing.

In the latter half of the eighteenth century a group of distinguished engineers and architects concerned in constructing a bridge over the Seine and the Pantheon or Church of St. Geneviève at Paris, finding the need for information, built testing machines of 20 to 100 tons capacity. Among them were Perronet,[7] Rondelet,[8] Gauthey,[9] and Girard.[10]

In 1817 Peter Barlow published an essay on the strength of timber and other materials founded on tests made at Woolwich. In 1825 Navier,[11] charged with the construction of a suspension bridge at Paris, required all the members to be subjected to a proof load of 10 tons per sq. in., and about 4000 pieces were tested with loads up to 70 tons. Navier had also made a great advance in theory in first investigating the general equations of equilibrium of an elastic solid.

It will be already clear that knowledge of materials was progressing along two independent lines—that of experiment and that of analysis. In the latter half of the eighteenth century mathematicians of the highest rank were applying themselves to the problems presented by the resistance and deformation of solid bodies. But mathematics is a kind of mill the product of which depends on the data with which it is fed. While experimental data were wanting, there were errors and misunderstandings in the theoretical investigation of elasticity. Prof. Love[12] says that in 1820 "the fruit of all the ingenuity expended by mathematicians on elastic problems might be summed up as—an inadequate theory of flexure, an erroneous theory of torsion, an improved theory of the vibrations of bars, and the definition of Young's modulus." But practical engineers had at this time accumulated considerable empirical knowledge of the resistance of materials. No one can overrate the importance to the engineer of theoretical researches in applied mechanics, but that branch of science is outside the purpose of this lecture.

Considerable advances in knowledge of strength of materials were made by Eaton Hodgkinson, who, though largely self-taught, had considerable mathematical ability and skill in observation. The precise position of the neutral axis of the cross-section of a beam seems to have been first demonstrated in a paper on transverse strain and strength of materials in 1822.[13] Between 1847 and 1853 he was professor of engineering at University College, London. In 1830[14] he carried out the well-known experiments on the most economical form of cast-iron beams, and in 1840 and 1857[15] he published researches on the strength of columns which form the basis of practical rules still in use. Though Hodgkinson's apparatus was rough, he so designed his tests that the results were accurate to a small limit of error.

The Conway and Menai Bridges.[16]

A great advance arose out of the circumstances attending the construction of the Menai and Conway tubular bridges. A railway had to be carried over spans not before accomplished for such work. Robert Stephenson imagined a suspension bridge with platform stiffened by wrought-iron girders, and there still exist in the piers of the Menai Bridge arrangements for supporting chains. Early, however, Sir William Fairbairn, from experience with ships, formed the opinion that girders would support themselves without chains. Much knowledge was found to be wanting, and very extensive experiments on a large scale were carried out in 1845–48, in which Fairbairn, Hodgkinson, and Edwin Clark assisted, and many scientific authorities were consulted. There was a great clearing-up of ideas as to the laws of transverse strength, especially in the case of built-up structures, and as to provision against buckling of members in compression—a fundamental question, as we have learned in the case of the Quebec Bridge.

The most novel expedient was the testing of a model of the Menai Bridge, one-sixth of full size. The model was of 75-ft. span and 4½ ft. deep. It was broken six times by dead weight, being repaired where weakest after each fracture. In this way its strength was increased from 35·5 to 86·1 tons, or, including its own weight, from 38 to 89 tons. Hence was deduced a law for geometrically similar tubes, namely, that the strength increased only as the square of the linear dimensions, but the weight as the cube. It follows that there is a limit of increase of dimensions for a girder of any given type and material at which the stresses due to the weight of the structure become equal to the safe working stress on the material—a limit approached in some modern bridges.

The Britannia and Conway bridges were successfully completed, and gave rise to the types of girder bridges which have prevailed from that time. But it is interesting that Eaton Hodgkinson almost to the last considered that suspension chains would be necessary, and Edwin Clark states that with few exceptions scientific men either remained neutral or ominously shook their heads and hoped for the best.[17]

Effect of the Introduction of Steel.

Wrought-iron was a material of tolerably uniform quality, but steel varies in its properties through a wide range, and in the early days was sometimes treacherous. Hence came about the demand for much more general and systematic testing. In 1858 Messrs. Robert Napier and Sons proposed to use steel in some high-pressure boilers. Doubtful as to the quality of the so-called homogeneous metal and puddled steel then manufactured, they employed Mr. David Kirkaldy to make tests which, it is believed under the advice of

4 "De potentia restitutiva." (London, 1678.)
5 "Essai sur une application des règles de maximis et minimis," Mém. par divers savans, 1776.
6 "Lectures on Natural Philosophy and the Mechanical Arts." Lecture III., 1807.
7 Lesage, "2nd Recueil de Mémoires des Ponts et Chaussées," 1808, p. 151.
8 "Traité de l'art de bâtir," 6th ed., 1830.
9 "Œuvres de Gauthey," 1909, p. 269; *Journal de Physique*, de l'Abbé Rozier, 1774, p. 402.
10 "Traité analytique de la résistance des solides," 1798.
11 "Notice sur le pont des Invalides," p. 284.
12 "Treatise on the Theory of Elasticity," 1892, p. 5.

13 Memoirs of Manchester Philosophical Society, vol. iv.
14 *Ibid.*, vol. v.
15 Phil. Trans.
16 "Britannia and Conway Bridges," Edwin Clark, 1850.
17 *Loc. cit.*, vol. i., p. 298.

Rankine, covered a wide range. The results were published in 1862.[18] The testing machine was a single-lever machine, with no adequate means of taking up the strain during loading. The investigation led to the construction by Mr. Kirkaldy in London of a large machine of about 400 tons capacity, and the establishment of the first testing laboratory where tests were carried out for anyone requiring them. No doubt Mr. Kirkaldy's research had much to do with the adoption of the tensile test as the usual test of reception for iron and steel. From general considerations it might be argued that a torsion test or a shear test would have answered equally well.

Combined Stresses.

A branch of the subject on which our experimental knowledge is still imperfect is the resistance to combined stresses; for instance, the case of combined bending and torsion, or combined hoop and longitudinal stress. The most important investigation is that of Guest in 1900,[19] in which the yield-point was determined in cases of thin tubes subjected to combinations of tension, torsion, and internal fluid pressure. The result has been the general adoption in calculating crank-shafts of the theoretical formula for the equivalent bending moment M_e, due to a bending moment M and twisting moment T,

$$M_e = \sqrt{(M^2 + T^2)},$$

which is usually termed Guest's law. No tests of varying or alternating combined stresses have been made, and there is here an important field for future research.

In this review of experimental work it is not possible to pass over the researches of a remarkable man, Johann Bauschinger (1832–93), the son of an artisan at Nuremberg, thrown on his own resources at the age of fourteen. Taught in the technical school, he became professor of physics and mathematics at Augsburg and Fürth, and afterwards of mechanics at Munich. He made one of the earliest researches on locomotives, in which indicator diagrams were taken when running. He established the first public laboratory, supported by Government, for testing materials, and introduced methods of accuracy not previously attempted, measuring extensions, for instance, to 1/250,000 of an inch. He first indicated the similarity of deformation in geometrically similar test-bars, and investigated the variation of the position of the elastic limit in overstrained bars. The "Mittheilungen," published under his direction, are a collection of extremely valuable and diversified researches.

It was due to Bauschinger's influence that an international association was formed in 1884 to discuss and standardise methods of testing.

Public Testing Laboratories.

In Germany, Austria, and Switzerland there are public laboratories, partly supported by the State, attached to technical high schools which are also Government institutions. Their function is to execute commissions for public departments or private persons. It was early recognised there that such laboratories can further industry and commerce, provided they meet the requirements of manufacturers, and at the same time are accepted as independent and impartial, and maintain a high standard of intelligence, accuracy, and skill. It is desirable that State institutions should carry out purely scientific investigations free of charge, but it is expected that private persons who use them should pay enough to cover outlay on special appliances or labour, while the cost of site, plant, and administration is borne by the State. It is possible for such institutions to follow out investigations suggested in the course of ordinary work which could not be attacked by private persons. In some cases industries have combined to have extensive researches, extending over years, made in these laboratories. The public make so much use of them that they are scarcely available any more for purposes of instruction. Thus in the engineering laboratory at Gross Lichterfelde there is a staff of 230 persons, of whom seventy-five have received high academic training, and thirty-eight others training in technical schools. The annual income from tests amounted in 1913 to 20,000*l.* and the expenditure to 32,000*l.*

The Bureau of Standards at Washington is a Government institution of the same type. It has four large laboratory buildings and four or five smaller buildings, which together cost 200,000*l.*, and the equipment about 70,000*l.* The annual cost of maintenance is about 120,000*l.* There is also an auxiliary laboratory at Pittsburgh. Of six departments one is devoted to tests of materials and structures. A great deal of work is carried out for public departments, and the Bureau settles the specifications of materials supplied to them, as well as inspects and tests them. I understood when at Washington that the testing of the immense quantity of cement used on the Panama Canal was confided to the Bureau, but much work has also been done for manufacturers' associations and scientific societies.

The National Physical Laboratory is very similar to the Bureau of Standards, and has accomplished for this country similar work. It has now become a Government institution, and the continuance of its very valuable work is assured.

[The remainder of the lecture was concerned with testing machines and tests carried out with them.]

18 "Experimental Inquiry into the Tensile Strength and other Properties of Wrought-iron and Steel," by D. Kirkaldy, 1862.

19 J. J. Guest, "Strength of Ductile Materials under Combined Stress," Proc. Physical Soc., vol. xvii.; Scoble, *Phil. Mag.*, 1906, vol. xii.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

WE learn from *Science* that at a meeting of the General Municipal Council and the Chamber of Commerce at Bordeaux on September 10 a proposal was unanimously adopted to establish, in honour of the President of the United States, a Franco-American University of applied sciences, commerce, and industry.

THE regulations for the current academic year for technical schools and other forms of provision for higher education in England and Wales have now been issued by the Board of Education (Cd. 9152). Substantially the regulations are the same as those in force since August 1, 1915. It is satisfactory to find that the Board is prepared to increase its grants in any cases in which it is satisfied that, as a result of general increases since the financial year 1913–14 in the rates of salary or fees paid to teachers, the grant so determined has become an inadequate contribution towards the cost of the schools or classes concerned.

AT a recent meeting of the governors of the Royal Technical College, Glasgow, it was announced that 2368*l.* has been added to the New Endowment (Research) Fund, making the total to July 31 last 21,245*l.* Since then the college has received a donation of 1000*l.* from Sir William Rowan Thomson, and a similar sum from Mr. James Templeton, so that the fund now nearly approaches 25,000*l.*, the sum in view when it was instituted. Mr. Francis Henderson has handed to the college a National War Bond for 1000*l.* as a donation to the fund. Sir George Beilby was re-appointed chairman of the governors, and Dr. Mackenzie vice-chairman. Lord Weir was elected to the vacancy in the board caused by the death of Dr. Dyer.

THE October issue of the *Scientific Monthly* contains some interesting particulars of the arrangements made in the United States to train students in colleges and universities for the Army. Since October 1 a students' corps has been in training in more than four hundred such institutions. At eight institutions in New York City about 20,000 men are in training, and if there are half as many in other institutions throughout the States, there must be 500,000 recruits from whom will be selected candidates for commissions and technical posts in the U.S. Army. The student-soldiers will be given military instruction under Army officers, and will be kept under observation and test to determine their qualifications as officer-candidates, and technical experts such as engineers, chemists, and doctors. After a certain period each man will be selected according to his performance and assigned to military duty. It cannot at present be stated definitely how long a particular student will remain at college, for this will depend on the requirements of the mobilisation and the age-group to which he belongs. The colleges are asked to devote the whole energy and educational power of the institution to the training desired by the Government.

IN moving the second reading of the School Teachers (Superannuation) Bill on Monday, Mr. Fisher, President of the Board of Education, said that the Government has come to the conclusion that it is essential at the earliest possible moment to bring under one State pension scheme all qualified teachers of aided schools of all kinds below those of university rank. The scheme of superannuation will be non-contributory. The terms upon which the benefits have been calculated closely resemble those of the Civil Service pension system. A teacher with an average salary of 400*l.* a year during the last five years of teaching service will, upon retirement at the age of sixty, receive a superannuation allowance of 200*l.* a year, and in addition a lump sum of 533*l.* No system of pensions for teachers can be regarded as satisfactory unless it provides for the free passage of teachers from one type of grant-aided school to another. The Bill places no obstacle in the way of such migration. Under the Bill no service in future will be pensionable except that which is rendered in grant-aided schools, with an exception in favour of those schools which come upon the grant list within the next five years. At present the pension scheme differentiates as against women, but in future the benefits to both men and women will be proportionate to their salaries. Mr. Fisher is confident that the Bill will achieve three objects of great educational importance: it will promote the unity of the teaching profession; it will improve the quality of the instruction given in the schools; and it will secure from the great developments which are bound to come under the operation of the new Education Act an army of men and women teachers who will be attracted to their calling, not merely by the material benefits which the measure will confer, but also by the knowledge that for the first time the State has given adequate recognition to the teaching profession. The cost additional to that of the present pensions scheme will be, in ten years' time, 2,000,000*l.* per annum, but the total cost will be about 2,428,000*l.*

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, September 23.—M. P. Painlevé in the chair.—A. **Lacroix**: A note by Dolomieu on the Lisbon basalts, addressed in 1779 to the Royal Academy of Sciences.—E. **Fournier**: Criterion of the forms of hulls favourable to the highest velocities.—P. **Vuillemin**: The principles of botanical classification.—G. **Scorza**: Ahelion functions with three independent variables.—G. **Sizes**: The tempered scale and its transformation into the modern chromatic scale.—L. **Daniel**: Action of a marine climate on the inflorescence of *Asphodelus luteus*. Cultivation of this plant on the sea-coast resulted in marked differences in behaviour of the flowers as compared with those grown inland.—L. **Léger** and G. **Mouriquand**: Anopheles and ancient malarial foci in the Alps.—J. **Bouchon**: Lymphatic bleeding as a means of disinfection of war-wounds. An account of a practical method for carrying out the lymphatic bleeding suggested in a recent note by Prof. Yves Delage.

September 30.—M. Léon Guignard in the chair.—P. **Appell**: An ordinary differential equation connected with certain systems of linear and homogeneous partial differential equations.—H. **Le Chatelier** and B. **Bogitch**: The heterogeneity of steel. Remarks on the macrographic as opposed to the micrographic study of steel structure. Six illustrations of the structures induced by melting electrolytic iron under varying conditions are given. The experiments show that the macrographic heterogeneity of steel is due to the presence of oxygen in solid solution in the iron.—P. **Vuillemin**: Classification of the dicotyledons.—E. **Cartan**: The varieties of Beltrami of three dimensions.—E. **Bauer**, P. **Weiss**, and A. **Picard**: The magnetisation coefficients of oxygen and nitric oxide and the theory of the magneton. Exact measurements of the magnetisation coefficients of oxygen and nitric oxide lead to results which are not in agreement with the magneton theory. Possible causes of the divergences are discussed.—H. **Pécheux**: The thermo-electricity of tungsten. Details of the change of resistance with temperature and thermo-electric power (against copper) of three drawn tungsten wires of unequal purity.—M. **de Chardonnet**: Sections of artificial silks. In the case of collodion silks it is possible from the section to distinguish between fibres formed by projecting the liquid into air or into water. In the latter case an estimate of the concentration of the liquid collodion employed is possible from the study of the section.—P. **Gaubert**: Isomorphous mixtures.—F. **Grandjean**: The interference fringes developed by friction and electricity in certain anisotropic liquids.—A. **Guébhard**: Remarks on the protosphere or primitive scoria shell of H. Douvillé.—H. **Béclère**: Anthropometric radiography of the thumb.—A. **Vernes**: Syphilimetric indices. Colorimetric determination of the deviations of stability.—MM. **Defressine** and H. **Violle**: The prophylaxy and treatment of influenza. Vaccination with an antipneumococcic serum is advocated, and, in the case of persons unavoidably exposed to infection, the use of a gauze mask.

October 7.—M. P. Painlevé in the chair.—J. **Boussinesq**: The theory of punching and the flow of plastic blocks: the elastic phase of these phenomena.—P. **Vuillemin**: The classification of dicotyledons.—G. A. **Boulenger**: The place of the Chelonians in classification.—J. K. **de Fériet**: Systems of partial differential equations verified by hyperspherical polynomials.—P. **Humbert**: Partial differential equations verified by Hermite polynomials, deduced from an exponential.—C. **Camichel**: Great velocities of water in pipes. The high pressures in current use in the hydraulic industry may give the water velocities of the order of 100 metres per second, but the experimental study of water velocities has not been taken above velocities of 10 metres per second. In the experiments described the velocities range from 80 to 0·09 metres per second. For velocities above 2·5 metres per second the relation $\log J = 1{\cdot}93 \log U - 0{\cdot}36$ was found to hold, where $J = \partial p/\partial x$ and U = the mean velocity.—A. **Véronnet**: The limit and extent of an atmosphere. Application to the planets.—M. **Portevin**: Internal strains developed in metals and alloys by rapid cooling.—H. **Béclère**: The construction of plans in stereoscopic radiography.—G. F. **Dollfus** and P. **Marty**: The discovery of a fossil-bearing layer in the Cantal.—P. **Georgevitch**: Asexual generation of *Padina pavonia*.—P. **Lesne**: The sub-fossil entomological fauna of the submarine peats of Belle Isle.

MELBOURNE.

Royal Society of Victoria, August 8.—Mr. F. Wisewould, vice-president, in the chair.—Miss N. C. B. **Allen** and Prof. T. H. **Laby**: The sensitiveness of photographic plates to X-rays. This work was performed in order to find the speed, inertia, contrast, and fog-density of various plates for exposures to X-rays, and the physical basis upon which these qualities depend. It was found that the density of a plate depends, within the range of wave-lengths investigated, not on the wave-length, but only on the energy of the X-rays.—F. **Chapman**: New or little-known Victorian fossils in the National Museum. Part xxii.: Some Palæozoic worms, with evidence of their soft parts. Trachyderma, one of the commonest fossils from the Silurian of the Melbourne area, has until lately been known only by sub-chitinous tubes penetrating the mudstone obliquely or vertically to the stratification. Recently discovered fossil remains, together with others collected many years ago, prove to be remarkably well perserved gill-plumes (prostomial appendages) of Trachyderma, which was a Chætopod having affinities with the Cryptocephala. Traces of eye-spots and dorsal appendices can be seen on some of the best-preserved examples. The tube of *Cornulites youngi*, a new species from the Lower Ordovician of the Moorabool River, is described. This is probably the oldest known species of the genus. The evidence of the present species points to an affinity with the worms, and by its blunt and impressed base was most likely attached to foreign bodies.

BOOKS RECEIVED.

All Alive O! A Vade Mecum for Breeders and Feeders of Horses, etc. By J. G. Lyall. Pp. 86. (Lincoln: Lyall and Sons.) 2*s*. 6*d*.

Société Française de Physique. Collection de Mémoires Relatifs à la Physique. Deuxième série. Les Progrès de la Physique Moléculaire. By Mme. P. Curie and others. Pp. 242+11 plates. (Paris: Gauthier-Villars et Cie.) 12 francs.

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

Fungi and Disease in Plants. By E. J. Butler. Pp. vi+547. (Calcutta and Simla: Thacker, Spink, and Co.)

Staple Trades and Industries. Edited by G. D. Knox. Vol. i. Wool. By F. Ormerod. Pp. xii+218. (London: Constable and Co., Ltd.) 6*s*. 6*d*. net.

I Fenomeni Elettro-Atomici sotto l'Azione del Magnetismo. By Prof. A. Righi. Pp. xvi+435. (Bologna: N. Zanichelli.) 17.50 lire.

A Junior Course of Practical Zoology. By the late Prof. A. Milnes Marshall and Dr. C. H. Hurst. Eighth edition, revised by Prof. F. W. Gamble. Pp. xxxvi+515. (London: J. Murray.) 12*s*. net.

Numerical Trigonometry. By P. Abbott. Pp. x+163+mathematical tables pp. iii+33. (London: Longmans and Co.) 5*s*. net.

Mathematical Tables and Formulæ. By P. Abbott. Pp. iv+58. (London: Longmans and Co.) 2*s*.

The Future Citizen and his Mother. By Dr. C. Porter. Pp. xvi+144. (London: Constable and Co., Ltd.) 3*s*. 6*d*. net.

DIARY OF SOCIETIES.

FRIDAY, OCTOBER 25.

PHYSICAL SOCIETY, at 5.—*Discussion*: The Case for a Ring Electron.

MONDAY, OCTOBER 28.

ROYAL SOCIETY OF ARTS, at 3.—Consideration of a Scheme for the Promotion of Industrial Art.

TUESDAY, OCTOBER 29.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 5.—Reginald A. Smith: (1) Stone Implements and "Tortoise-cores" Collected by Resident Magistrate F. J. Jansen at Victoria West, Cape of Good Hope; (2) Implements of Neolithic Types from Narkaru Bauchi Plateau, Nigeria, Exhibited by G. W. Lamplugh, F.G.S.; (3) Specimens of a Series of Stone Implements Collected by Capt. C. W. Cunnington, near Siwa, Libyan Desert.

TUESDAY, NOVEMBER 5.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—Sir John A. F. Aspinall: Inaugural Address, and Presentation of the Medals recently Awarded by the Council.

WEDNESDAY, NOVEMBER 6.

SOCIETY OF PUBLIC ANALYSTS, at 5.—H. Droop Richmond: Note on the Graduation of Gerber Butyrometers.—B. G. McLellan and A. W. Knapp: The Estimation of Cacao Shell.

THURSDAY, NOVEMBER 7.

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

FRIDAY, NOVEMBER 8.

ROYAL ASTRONOMICAL SOCIETY, at 5.

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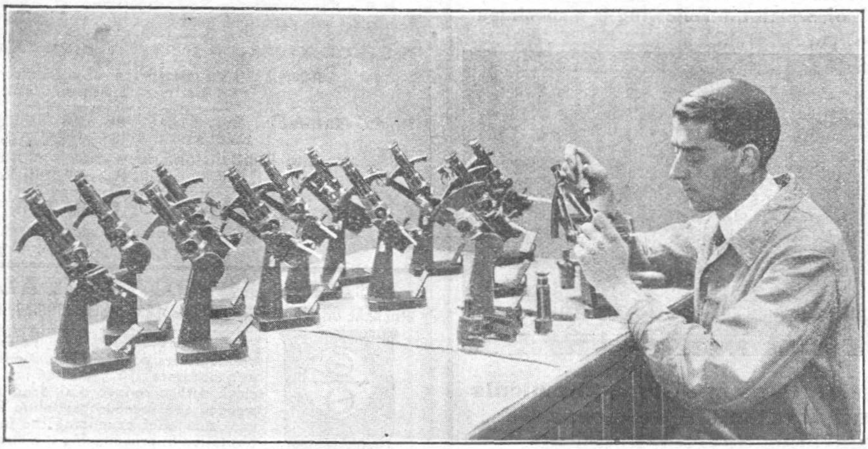

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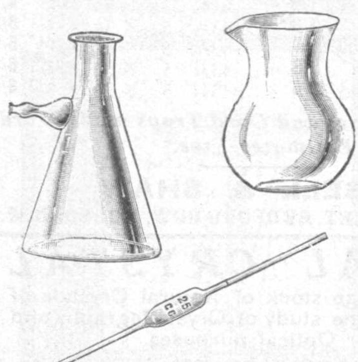

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