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The Imperial Institute and the Development of Overseas Resources.

THE Imperial Economic Conference has approved a scheme whereby the Imperial Institute is to be reconstituted; a representative of the Department of Scientific and Industrial Research is to be one of a committee of three appointed to see that the Institute laboratories limit their work to preliminary inquiries, and the Galleries are to be closed, in spite of the protest of New Zealand, on the score of economy. The detailed account which has just been issued by the Imperial Institute (Bulletin of the Imperial Institute, vol. xxi., No. 1, pp. iv+289, price 3*s.* 6*d.*) of its work in recent years has been published at a very convenient time. The Institute was founded in 1887, but until 1903 the work for which it was established was subordinated to the effort to run it as a social club attached to a ballet. It was reorganised in 1903, and in that year it began the publication of its quarterly Bulletin, which now has a circulation of 3000 copies, and also issued the first report by its Mineral Surveys. Its efforts then to undertake the work for which it was founded were handicapped by restrictions, burdens, and prejudices inherited from the former regime. The Institute has, however, been steadily surmounting these difficulties and building up an organisation by which to help the utilisation of the varied materials still lying unused in the Empire Overseas. It works by three main branches. Its Department of Scientific and Technical Research investigates all kinds of raw materials and advises as to their profitable employment. Its Intelligence Department gives information and advice, and is aided by committees of commercial, technical, and scientific experts, which deal with raw materials, silk production, rubber research, timber, and the mineral resources of the Empire. The extensive museum attractively displays the chief raw materials and illustrates the geographical conditions under which they are produced and the processes by which they are utilised.

The work already achieved by the Institute is clearly of high value. The discovery of the Udi coalfield by one of its Mineral Surveys would alone repay all the expenditure on the Institute; for that coalfield, in the event of any serious war in north-west Africa, would be invaluable in the defence of our colonies there, and it will probably develop into a coaling station of high importance from its position on the tropical Atlantic. The discovery of the monazite sands of Ceylon has destroyed the former German monopoly based on Brazilian material. Several of the Mineral Surveys organised by the Institute have now passed away from it, as they have developed into independent geological surveys.

As to other natural products, investigations in the

Institute laboratories or carried on elsewhere have removed from Indian beeswax the suspicion of adulteration that had arisen owing to its varied natural composition. The Institute has helped to render tobacco one of the chief crops of Nyasaland. It has shown why Indian barley to be serviceable for malting must be shipped from Calcutta by May and from Bombay by June. It has further helped India and the medical world by destroying the former monopolies held by Russia in santonin and by Germany in thymol. It has shown that for many purposes the kapok of India can be used instead of that yielded by a different tree from Java. It has assisted British Africa and the tanning industry by showing the value of the sant seeds of the Sudan and by finding British markets for South African wattle. Its work on the commercial production of acetophenone in Western Australia promises useful results. It has shown, in spite of the general view to the contrary, that Indian opium often contains a sufficiently high proportion of morphine and codeine to replace the supplies of Turkey and Persia which failed during the War. It has aided tea and rubber cultivation in Ceylon, and the Sudan by recognition of the special qualities of its gums. It has helped to improve the cocoa of West Africa and develop its palm oil production. It has secured the offer to Palestine of higher prices for Eri silk than those paid for the material elsewhere. It has shown that the *Croton Elliottianus* of Kenya Colony yields a valuable drug, and that the Indian aconites include several medicinal reagents, the production of which would be profitable to India and useful in medical practice. It has given helpful advice in fibre and bean production in East Africa, in wood pulp manufacture in Canada, and in connexion with the minerals, timbers, and drug-producing materials of Australia and New Zealand.

The Institute has been helpful not only by encouraging production, but also by avoidance of waste and disappointment in premature attempts to utilise materials in areas which cannot at present compete with more favourably situated localities. Meanwhile it collects information as to the position of such materials, so that they can be reconsidered from time to time as the conditions alter.

The work in the Exhibition Galleries of the Institute is not the least important of its services. The Imperial Conference has directed attention to the need for improved geographical education as regards the Empire. We referred in an article (April 1, 1922, p. 403) to the Public Exhibition Galleries of the Institute as "without question the finest illustration of economic geography in the world." All the chief materials of the Empire are shown there with ingenious illustrations of the volume of output, their distribution throughout the Empire, and the geographical conditions under which they occur. Important geographical features are illustrated by models, such as those of the Victoria Falls and of important harbours; ethnographical factors by models of different races; the scenery of different regions by pictures and photographs; local handicrafts by collections of work; and Oriental artistic culture by decorated pavilions such as those of India and Ceylon. Statues of Cook and Raffles direct attention to great landmarks in historical geography.

In addition to the public galleries there are research collections for reference by industrial experts and commercial inquirers. The galleries are unique as the only centre at which may be seen the opportunities and resources of all parts of the Overseas Empire. Although closed on Sundays, the galleries have 100,000 visitors a year and 10,000 school children go in classes under the guidance of their teachers and the Institute's lecturer. The loss of these galleries would be educationally deplorable.

The organisation of the Institute has proved well suited to its work. It is managed by an executive council, including representatives of the contributing states and colonies, with the Under Secretary of State for the Colonies as the chairman. This arrangement secures widespread but voluntary association, and the Institute organisation may prove a useful model on which still greater experiments in Imperial co-operation may be made.

That the Institute supplies a widely-felt need is shown by the numerous inquiries sent to it from all parts of the Empire. In 1922 it returned in replies no less than 1334 reports. The chief subjects, in order of number, were tropical agriculture, minerals, fibres, oils and oil-seeds, food-stuffs and fodders, timbers, drugs, and paper-making materials. That the information given by the Institute is of use to our larger Dominions as well as the smaller colonies is indicated by the widespread origin of the inquiries. They included in 1922, 121 from India, 89 from Australia, 89 from South Africa, 52 from Kenya Colony, 45 from Nigeria, 37 each from Ceylon and the West Indies, 36 each from the Gold Coast and New Zealand, 35 from Canada, and a few from each of the smaller colonies and protectorates.

It may be hoped that the reconstitution of the Imperial Institute will extend its usefulness and enable it to carry to full success the main purpose for which it was founded. The development of the natural resources of the Empire would then be assisted by investigation into the economic biology, geology, and geography of the British Overseas Dominions through an institution worthy of the group of national scientific museums at South Kensington.

Field Natural History.

(1) *Hebridean Memories.* By Seton Gordon. Pp. xii + 180 + 65 plates. (London, New York, Toronto and Melbourne: Cassell and Co., Ltd., 1923.) 15*s.* net.

(2) *Shetland Pirates and other Wild Life Studies.* By Frances Pitt. Pp. 248 + 16 plates. (London: G. Allen and Unwin, Ltd., 1923.) 10*s.* 6*d.* net.

IT used to be said of leisured Englishmen that their first thought of a morning was—"What shall we kill to-day?" but in the present generation there is a steadily increasing number of men and women who prefer patiently to study wild animals in their haunts and to learn as much as possible about their character and habits. Instantaneous photography has added greatly to the interest and permanent value of this form of field sport, and both the books before me owe much to the camera.

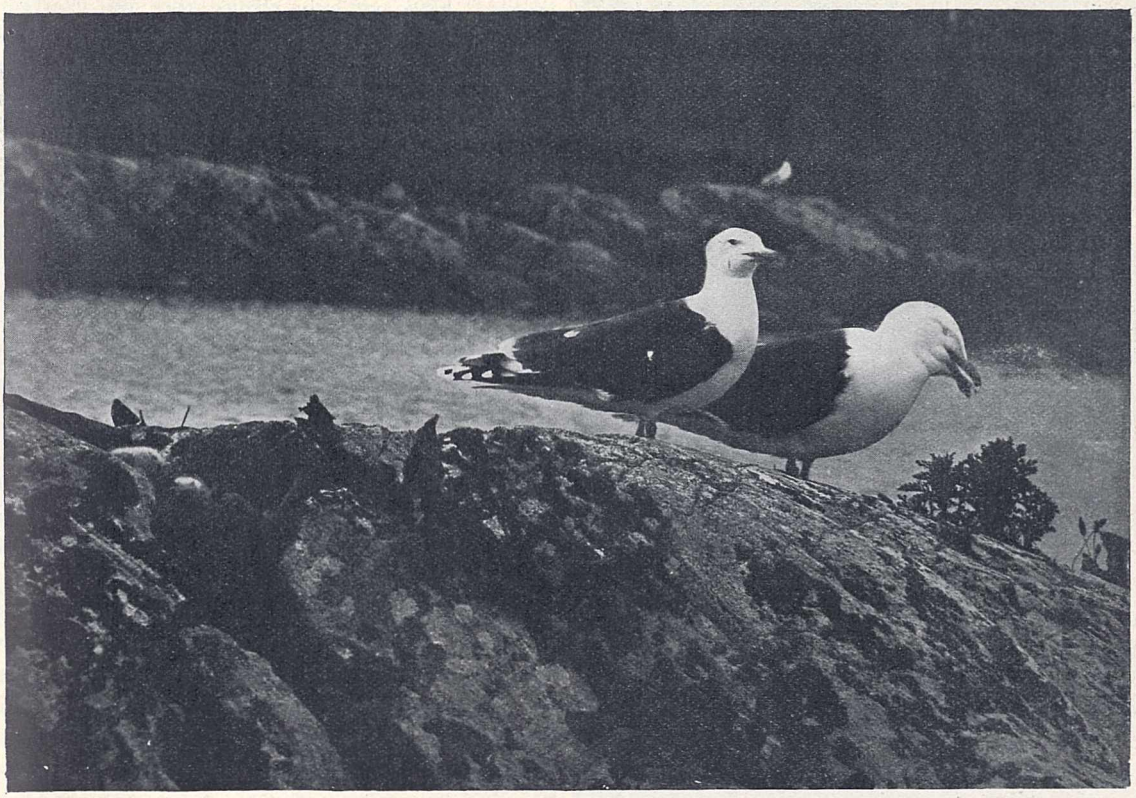

FIG. 1.—Cock and hen great black-backed gulls. The cock is the larger and is calling. From "Hebridean Memories."

(1) Mr. Seton Gordon's field-studies have been conducted chiefly in the Highlands and Western Islands, where land and water retain much of their primitive aspect and still harbour creatures that have long been exiled from the low country. The hen-harrier—*Circus cyaneus*—for example, though practically extinct as a resident in the mainland, still rears its young in the Western Isles, although even there its survival is precarious. "It seems," says Mr. Gordon, "to be only a question of time before this handsome bird shares the fate of the kite and the white-tailed eagle, for even to its most inaccessible [least accessible?] nesting grounds collectors make their way every year, and to a collector a clutch of hen-harrier's eggs is a prize of the first order."

Happily Mr. Gordon has something to set against this gloomy forecast. Until three years ago, the whooper swan—*Cygnus musicus*—had not been known to nest in Great Britain since the end of the eighteenth century; but on a certain loch which must remain, like the clan Macgregor, "nameless by day," a pair of whoopers reared their young in 1918 and 1919, and in 1920 two pairs nested there. "One nest," says the author, "is still intact as I write; the other has been robbed by collectors." As Christians we are bidden to love our enemies, but as sinful mortals it is something far removed from a blessing that we invoke upon these nefarious thieves. Unless vigorous measures are taken to protect the nests, we shall lose this splendid bird once more, owing to the perverse curiosity of a few armchair naturalists who will give ten times the price for a British-laid egg of a whooper than he will pay for one laid in Iceland.

Mr. Gordon pitched his tent—an inconspicuous one, no doubt—about fifteen feet from the whooper's nest,

and succeeded in getting some excellent photographs. He always entered the hide accompanied by his wife, who presently left it, rowing away from the island.

"It is useless to enter any hiding-tent unless one is accompanied by a companion, and unless that companion departs as ostentatiously as possible. All birds

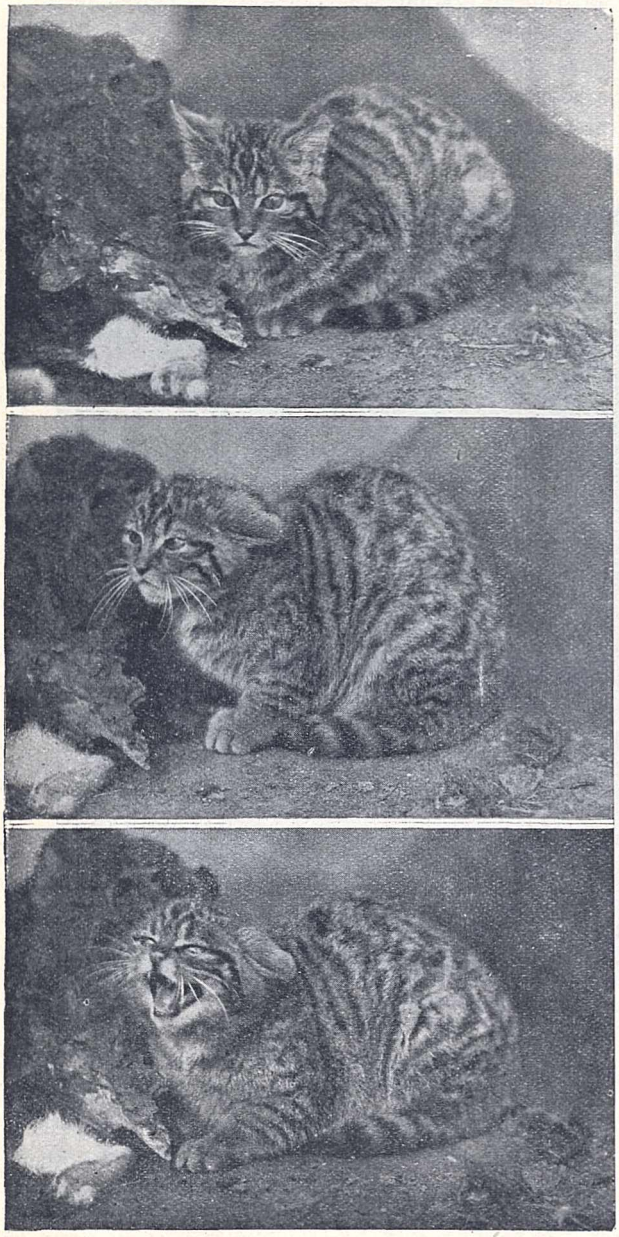

FIG. 2.—The wild cat—expressions of the emotions. 1. Sulky. 2. Angry. 3. Furious. From "Shetland Pirates and other Wild Life Studies.

can count *one*, but very few more than one; so a human figure leaving their nest stills their suspicions and causes them to return without delay, provided they have become accustomed to the presence of the hiding-tent, which should, if possible, be erected a few days previously."

Beasts as well as birds came under the author's scrutiny. The incident of a rabbit pursuing and driving away a stoat reminds me how, one summer evening, a large rat was driven close to my feet by a rabbit—presumably a doe protecting her young—was seized and severely shaken, and limped away squealing.

It surprises one that Mr. Gordon, who is at pains to defend the character of merlins, ravens and other birds of ravin, should repeat without comment what one would fain to be calumny against the dipper—*Cinclus aquaticus*. "It is said to do much harm when the sea-trout are spawning" (p. 51). We have the authority of the late Prof. Newton to the effect that "innumerable examinations of the contents of its stomach have not only proved that the charge [of devouring the ova of fishes] is baseless, but that the bird clears off many of the worst enemies of the precious product."

Mr. Gordon takes good note of the plants that grow in the waste places which he loves. The rose-root is recorded correctly as *Sedum rhodiola* on p. 21, and under the obsolete title *Rhodiola rosea* on p. 56. The illustrations throughout are admirable. The black-backed gulls, most ruthless of marauders, seem as harmless as doves in Fig. 1.

(2) The title of Miss Frances Pitt's volume "Shetland Pirates" is reminiscent of Magnus Troil and his daughters Minna and Brenda, but it is of feathered pirates only that she has to tell, namely, the great skua or bonxie—*Stercorarius skua*—and Richardson's skua or scootie—*S. parasiticus*. No doubt they live mainly by piracy, harrying gulls so cruelly that these have to disgorge their catch, and robbing the nests of other birds; but Miss Pitt charitably thinks that both species do occasionally fish honestly on their own account. These rapacious birds are described in the first chapter; each of the remaining chapters recording the author's observation of other birds and beasts, both in captivity and in the wild. She tells us how she used to declare that "there was no animal so wild that it could not be tamed by patience and kindness"; but her experience with a true wild cat—*Felis silvestris*—which she received as a kitten from Inverness-shire brought her to a different opinion, namely, that none of that species can be tamed or trained (Fig. 2).

One of Miss Pitt's most charming chapters deals with stoats and weasels; but I feel unable to share her doubts about the purpose of the white winter pelage assumed by both these little carnivores in northern regions, and by the stoat in parts of Great Britain. She cites the black tag on the stoat's tail as evidence against that purpose being protective coloration; but it is surely not more conspicuous than the white scut in the general protective colour of a rabbit. Miss Pitt's suggestion that a white coat better enables an animal to endure cold than a dark one receives no

support from the arctic fauna, for while the land mammals in polar regions are white in their snowy environment, the pelagic mammals — whales, seals, walrus, etc.—remain dark. The polar bear, hugest of Ursidæ, would encounter far more difficulty in stalking seals—his favourite food—were it not for his white mantle.

Miss Pitt has undertaken useful analysis of the barn owl's bill of fare. In twenty-eight pelts or castings taken at random from the roosting-place of a barn owl, she identified the remains of 112 small mammals and 3 small birds. "In less than a month that owl had eaten 66 mice and rats and 46 shrews, a record that I suspect few cats could equal." A cat, it may be noted, might kill the shrews, but would not eat them, therein showing a discrimination which it were well that gardeners and others would observe between the beneficent insectivore Sorex and the destructive rodents Mus and Evotomus.

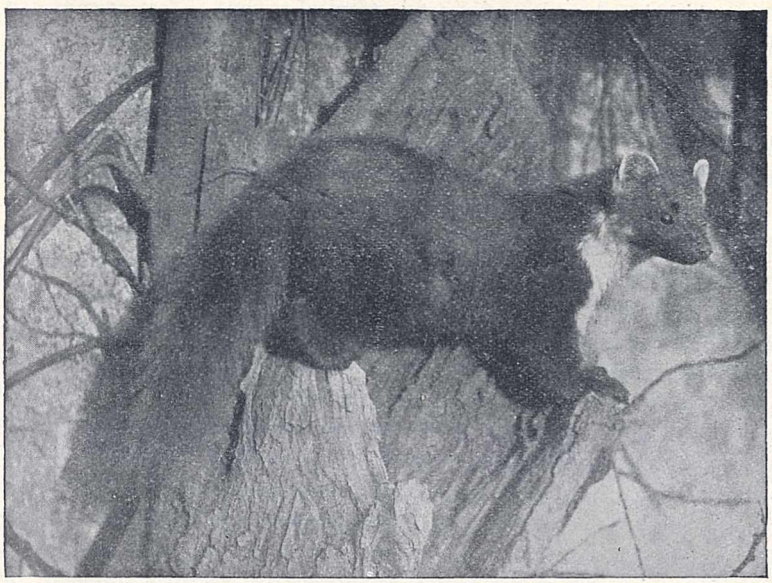

FIG. 3.—The British pine marten in full winter coat. From "Shetland Pirates and other Wild Life Studies."

Besides the experience gained through long hours of vigil in a hiding-tent, Miss Pitt has made still more intimate acquaintance with many wild animals, not as mere pets, but as free companions and messmates. Of these, the most intellectual were a pair of ravens, which spent much of their time "ragging" the cook alternately with her cat; the most docile was a merlin hawk, the most playful a pine marten (Fig. 3), which came as a "kitten" from the Cumberland Fells, and quite the most foolish and awkward was a brown hare. There is much entertainment, as well as sound information, in both these volumes.

HERBERT MAXWELL.

Earth and Sun.

Earth and Sun: an Hypothesis of Weather and Sunspots. By Ellsworth Huntington. With a Chapter by H. Helm Clayton. Pp. xxv+296. (New Haven: Yale University Press; London: Oxford University Press, 1923.) 23*s*. net.

FOR half a century or more, it has been known that the earth's magnetic condition varies in striking similarity with the state of activity on the sun's surface. Many attempts have been made to establish similar connexions between meteorological phenomena and the sunspot cycle, but only within recent years has it been possible to record indisputable success in such attempts. The element most clearly affected is, as might have been expected, the temperature. Köppen's work, supported by that of several other writers, demonstrates that at sunspot maximum the mean temperature of the atmosphere is slightly *less* than at sunspot minimum. The difference is small, being 0°·6 C. in the tropics, and falling to 0°·4 C. in temperate latitudes. It seems not unlikely that the diminution at sunspot maximum corresponds rather to increased terrestrial absorption—due to a greater amount of ozone in the upper atmosphere—than to diminished output of radiation from the sun. The sun sends out increased corpuscular emission, and almost certainly increased ultra-violet radiation, at times of sunspot maximum, so that it would be rather surprising were its total radiation to be diminished at such times. On the other hand, intensified short-wave radiation would probably produce more ozone, which would intercept a larger proportion of radiation on its way to the earth's surface.

Small as is this temperature variation, it may be expected to produce important effects upon other terrestrial phenomena. Such effects would show a connexion with the sunspot cycle, possibly almost as close as that shown by the temperature variation itself. Hence the fact that a meteorological phenomenon is strongly correlated with the solar activity does not necessarily imply that the connexion is direct and independent. It is doubtful whether any other independent solar meteorological effect has yet been established, though some remarkable secondary effects are known. For example, Mr. C. E. P. Brooks

has shown that the great African lakes, Victoria and Albert, show variations of level amounting to several feet, practically in synchronism with the sunspot curve, the maxima of the two curves occurring together. The rainfall in the drainage basins does not show a corresponding variation, and it seems probable that the high level at sunspot maximum is due to decreased evaporation owing to the lower air temperature. Again, Douglass has found several cases in which the growth of trees, as indicated by the thickness of their annual rings, has varied nearly in synchronism with the solar cycle; this is clearly an index of some more immediate solar meteorological effect, whether of thermal origin or not.

The question as to a possible influence of solar activity on the barometric pressure is one which has received considerable attention. In the case of this element the solar effects must necessarily be more complicated than in the case of temperature, where the variations are likely to be everywhere of the same sign at a given time, though with local differences of magnitude. The total atmospheric pressure upon the earth can scarcely be appreciably affected by the sun's changes, so that if the solar influence increases the pressure in one region, there must be a counterveiling change in other regions. The difficulty of detecting such effects is clearly much greater than that of demonstrating the temperature changes—itself an exacting task. Any such barometric changes which occur appear to be small, and must be obtained by averaging the results from a number of stations; if these happen to be distributed across the borders of oppositely-affected regions, the effect sought for may almost or quite cancel out; in any case it requires extremely detailed research to establish changes of particular sign in different regions, and to ascertain the limits of these regions.

Such investigations have of late years been prosecuted vigorously, and not without valuable results, by a number of American meteorologists—amongst others—and are recorded by Mr. Ellsworth Huntington in his new book. The sub-title of this work is "An hypothesis of weather and sunspots"; it is a companion volume to his recent book on "Climatic Changes," which dealt mainly with past relationships between the earth and sun, while the present work is concerned with existing connexions. The leading idea of both books is that terrestrial meteorology depends partly on purely terrestrial conditions, and partly on changes in the solar activity; the latter "are supposed to act chiefly through variations in barometric pressure and especially in the number, location, and intensity of cyclonic storms." It is also claimed that there is an important solar-activity effect on atmospheric electricity. The elucidation of such questions as these is obviously a matter of great interest and significance, and it is very convenient to have a summary of the present state of knowledge of the subject set out as is done in this book. The author has himself devoted enormous labour to this kind of investigation, and writes both with enthusiasm and with a wide acquaintance with the literature concerned. But to the reviewer it seems that much more evidence is required before it is safe to accept many of the conclusions which the author regards as established. In particular, the evidence for any regular effect of solar activity on barometric pressure and atmospheric electricity seems inadequate. There seems, however, to be a case for a connexion between sunspots and cyclones in certain tropical regions.

A considerable section of Mr. Huntington's book is devoted to the inverse problem of planetary influence upon solar activity. Mr. H. Helm Clayton contributes one of the four chapters in this section, and it is rather surprising to see in this chapter what seems to be an error elsewhere expressly pointed out by Mr. Huntington, namely, that the tidal influence of the planets on the sun is inversely proportional to the square of the distance of the planet from the sun. Many attempts have been made to relate the sunspot variations to planetary periods, but with doubtful success. The period of Jupiter (11·86 years) is not very different from the mean sunspot period (11·2 years), but the discrepancy is sufficient to render it very problematical whether any relationship between the two can be credited, even when allowance is made for the disturbing influence of the other planets. Mr. Huntington puts forward a hypothesis of electrical influence by the planets upon the solar atmosphere, but at present this is almost purely speculative. Such questions may be easier to decide when the nature of sunspots is better understood than now. At the moment it is at least a possible view that the main sunspot variation is due to some intrinsic solar period. S. C.

Biology and Sociology.

Essays of a Biologist. By Julian Huxley. Pp. xv + 306. (London: Chatto and Windus, 1923.) 7*s.* 6*d.* net.

THIS brilliant book, though somewhat disfigured by overlapping and repetition in certain parts, is one of the most suggestive and enlightening works for the popularisation of science which have appeared for a long time. It covers a wide field, and Mr. Huxley shows himself in it a man of wide interests, many parts, and an easy and attractive style of writing. He has two serious articles, covering much the same ground, on a new rationalistic conception of God; a sound

and careful survey of the relations of biology and sociology; a charming essay, full of careful observation, on the manifestation of emotion in birds; a light satirical discourse called "Philosophic Ants" on the relativity of our conceptions, two admirable discussions on sex psychology and on the biological approach to progress, and last, but not least, seven sonnets introductory to each chapter. They are quite good sonnets too.

It would be impossible in a short review to give any idea of the varied contents, and it would spoil the reader's enjoyment to pick out the plums too freely. But one may indicate the author's attitude on the more important topics of which he treats. The last two papers contain his attempted rationalistic reconstruction of the idea of God, being an analysis and elaboration of the statement that "the conception of God always represents man's idea of the powers operating in the universe." It will be noticed that the second of these papers, delivered at Woodbrooke at the sixth of the Unity History Schools, approaches more nearly, on the side of divine personality and of communal religion, to the ordinary attitude of the Churches.

It is not to be supposed that Mr. Huxley weakens anywhere in his allegiance to positive science. He tells us in the first paper that a "law of Nature is not something revealed as absolute, not something imposed on phenomena from without or from above; it is no more and no less than a summing-up, in generalised form, of our own observations of phenomena." He adopts, in fact, entirely in this matter the position which Dr. E. W. Hobson has been illustrating so fully in his recent Gifford Lectures. Students of Comte will note with interest that "the sciences are a hierarchy, the subject-matter of one constituting the foundation for the next in the series." The relation of biology to sociology is elaborated more than once in the book as an illustration of this. Sociology subsumes all the conclusions of the lower or earlier sciences, and adds to them various new considerations, or laws, of its own. With man in fact there has been a "radical change in evolutionary method" due to his power of transmitting the results of abstract reasoning by collective tradition.

Many readers will find the chapter on "Bird-Mind"—"Ils n'ont que de l'âme"—the most delightful thing in the book. The account of the egrets' honeymoon in Louisiana is almost too good to be true. Apparently they sit side by side for hours together with their long necks intertwined in a true-lovers' knot.

Mr. Huxley is right, after all, in giving the first place in the book to the essay on progress, which puts the doctrine so usefully and convincingly from the point of view of the biologist. It was certainly a serious omission, as he points out, to have had no chapter on this aspect of the subject in "Progress and History." We can see the human facts so much more clearly as they arise from the common biological evolution of universal life. From this point of view progress is seen to consist in "an increase in the control exerted by organisms over their environment, and in their independence with regard to it"; in an increase in the harmony of the parts of organisms; in an increase in the psychical powers of willing, of feeling, and of knowing. In short, progress is the growth, in power and harmony, of the soul; and man, being the crown of animate existence, embodies the principles of progress most completely. F. S. MARVIN.

The Petroleum Industry.

A Handbook of the Petroleum Industry. By Dr. D. T. Day, Editor-in-Chief. In 2 vols. Vol. 1. Pp. x+964. Vol. 2. Pp. vi+1006. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1922.) 2 vols. 3*l.* 15*s.* net.

THIS work, which might aptly be termed the "Redwood" of American petroleum literature, has been written with a very definite purpose in view, namely, as an aid to the best utilisation of oil and the development of new resources to offset the impending shortage of supply in the United States. In a striking preface the editor-in-chief, Dr. Day, discusses dispassionately the truth of a situation which many people, both in Great Britain and in America, seek to gloss over, usually from self-interested motives. Briefly the situation is this: there exist less than twenty years' resources of petroleum in the United States at the present rate of supply and demand. To this we may add that one-fifth of the total oil requirements of that country latterly has been derived from Mexico; but in Mexico also there has been a startling decline in output noticeable recently, due principally to salt-water encroachment in some of the most productive wells. Small wonder, then, that serious-minded Americans (and Europeans too, for that matter) are apprehensive of the future, and that the several specialists responsible for this handbook are actuated by a common motive, that of contributing "their special knowledge to this volume, in the hope that more oil may be found and better utilisation be given it."

Written expressly for the public, the work makes a more direct appeal to the engineers who produce and refine oil, and it may be said at once that the sections concerned with these aspects of the industry are by far the best. From the point of view of the general public, the enormity of detail, the size of the work (nearly 2000 pages of comparatively small type), and the impression

it conveys at first glance of being a highly technical treatise, will probably prove rather overwhelming, though it is to be hoped that these factors will not be detrimental to a wide circulation and thus defeat the main objects of its production.

The work is much more than a mere compilation. Fifteen specialists in different branches of the industry have contributed to its undertaking, and as a standard book of reference it thus stands alone. No one man, be he a Heaven-sent genius, can comprehend adequately the intricate ramifications of the oil-industry of to-day; no written work, the product of a single human brain, can possibly do justice to a subject the rapid evolution of which depends on progress along so many highly specialised branches of natural science.

Yet, like all things material, there are obvious disadvantages in the co-ordinated essays forming the substance of this work. Not the least of these is the strong American bias noted throughout; also the apparent lack of appreciation of problems which beset others than those engaged in the American petroleum industry. After all, though we readily admit United States supremacy if measured in terms of annual oil production, the Old World may surely claim a modest share in the research and invention which have contributed to the wonderful progress of petroleum technology within the last half-century. American industrial problems are not necessarily Eurasian, nor are American solutions to those problems necessarily final to foreign operators. Hence without for one moment casting any reflections on the high merit of the work, it seems to us that a far wider purpose (thus a correspondingly greater value) would have been served had the book been planned on a more broad-minded, international basis, with something more than passing mention of oil affairs external to the United States.

This international element, had it existed, would have balanced the detailed description of the stratigraphy, structures and oil occurrences of North America with something more than a few cursory paragraphs of similar Eurasian criteria, as given by Mr. F. G. Clapp, responsible for the first section on "The Occurrence of Petroleum." Mr. F. H. Lahee, in the second section on "Field Methods in Petroleum Geology," would have been compelled to demand (with great advantage to the section) more space to deal with methods applicable to other than simple phases of geological surveying. Mr. R. G. Smith would likewise have included some description of the impregnated sediments well-known in European industries in his section on "Asphalt," while Mr. D. E. Day's section on "Oil Shale" would have profited by some account of European occurrences and methods. Perhaps these, and similar omissions, will be remedied in future editions of the work; at all events most of the other sections are so good that it would be a pity if this were not done, thus making Day's "Petroleum Industry" a standard work in every sense of the word.

H. B. MILNER.

Our Bookshelf.

Friction. By Dr. T. E. Stanton. Pp. xiv+183. (London: Longmans, Green and Co., Ltd., 1923.) 12*s.* 6*d.* net.

IN recent years considerable advances have been made in our knowledge of lubrication, static friction, and the resistance exerted by fluids on bodies moving through them. The importance which this knowledge has for engineers can scarcely be overestimated, and it is fortunate that the man who has had the greatest share in making these advances has been able to find time to write a complete account of the whole subject.

In the term "friction," Dr. Stanton includes all the agencies by which the moving parts of a machine are retarded and their energy dissipated. First of these in importance comes fluid resistance, and the first chapter is devoted to viscosity, the physical property on which all fluid friction depends. The second chapter, on the "External Friction of Fluids," opens with an account of the application of Newton's principle of dynamical similarity to fluid friction, and the results of a wide range of experiments on the flow of fluids through pipes are discussed from this point of view. The remarkably wide scope of the discussion of the surface friction of fluids may be judged from the fact that the friction may be estimated from experiments on the flow of liquids or gases in pipes, from direct experiments, with sheets of metal exposed edgewise in the wind, from meteorological observations, from tidal data, and from observations of the velocity of the wind close to the surface of a flat plate. All these methods lead to nearly identical results.

Chapter iii. is devoted to the hydrodynamical theory of lubrication; recent work is summarised, and an interesting account is given of the mathematical considerations which led to the discovery of Mitchell's method of lubricating the thrust blocks of a steamer's propeller shaft.

It is perhaps to be regretted that the description of Hardy and Doubleday's recent researches on boundary lubrication has been compressed into one paragraph. The application of this work to engineering has not yet gone very far, but it seems probable that developments in that direction may be expected in the near future. The remaining chapters, on "Rolling Friction" and on "Friction and Heat Transmission," introduce problems about which little is known, but perhaps for that very reason they are as stimulating as any in the book.

The engineer will find useful information in every chapter, but it is to the physicist that the book makes its strongest appeal. It would be difficult to pick out from the whole range of physics a better example than the subject of friction affords of the interdependence of mathematical and experimental methods. The logical way in which the matter is arranged serves to emphasise this point of view.

G. I. T.

Real Mathematics: Intended Mainly for Practical Engineers, as an Aid to the Study and Comprehension of Mathematics. By E. G. Beck. (Oxford Technical Publications.) Pp. ix+306. (London: Henry Frowde and Hodder and Stoughton, 1922.) 15*s.* net.

ARE engineers as bad as they pretend to be, or, at any rate, as Mr. Beck wishes us to believe? His desire is "to bring about a change of attitude towards mathematics," "to show the thing as an actual, tangible reality, instead of as a collection of rigid and unrelated rules and formulæ." He asserts that "the physical realities of mathematics have become swathed about with wrappings of mystery and suggestions of the supernatural." No doubt there is still room for improvement in mathematical text-books; but Mr. Beck must be singularly ignorant of modern text-books if he imagines that these sentences are anything but a libel on them.

In any case, if modern mathematical text-books are at fault, their improvement will not be secured by Mr. Beck's methods. At bottom there seems to be nothing in his explanations that is not contained in most of the decent school books—only Mr. Beck talks a lot. In addition he says some absurd things. The most striking example is perhaps the discovery that $\sqrt{-25}=-5$.

Mr. Beck's views on mathematical teaching are best understood from the following self-revelation: "The ability to solve a differential equation is, of itself, not worth five seconds of effort to acquire; but if such ability enable a man to design machines or structures more economically, or if it serve him as a key to the recorded experience of others, its value would clearly be so enormous as to lie beyond the scope of ordinary means for estimation." In other words, the only justification of mathematics is the creation of dividends!

The Social and Political Ideas of some Great Mediæval Thinkers: a Series of Lectures delivered at King's College, University of London. Edited by Prof. F. J. C. Hearnshaw. Pp. 223. (London, Calcutta and Sydney: G. G. Harrap and Co., Ltd., 1923.) 12*s.* 6*d.* net.

THIS volume contains eight studies of political thought in the Middle Ages which, with two exceptions, appear substantially in the form in which they were delivered as a course of public lectures in King's College, London, during the autumn of 1922. Seven of the lectures deal with individual thinkers, beginning with "Saint Augustine and the City of God," a composite production by the Rev. A. J. Carlyle and the editor, and one of the exceptions mentioned above, and ending with "John Wycliffe and Divine Dominion," also by the editor. It will be noted the term "Middle Ages" is, chronologically, if not theoretically, liberally interpreted. The remaining lectures deal with John of Salisbury (E. F. Jacob), St. Thomas Aquinas (Rev. F. Aveling), Dante (E. Sharwood Smith), Pierre Du Bois (Eileen E. Power), and Marsilio of Padua (J. W. Allen). The Principal of King's College contributes the introductory lecture, in which he draws an illuminating distinction between political theory and political thought, and fully justifies the claim for the interest of the subject to the modern reader who is not specially concerned with medievalism as a whole. The lectures cover the development of the idea of a national state out of the theory of an international organisation, spiritual or temporal, and are therefore not without bearing upon political theory of the present day.

Hunters of the Great North. By Vilhjalmur Stefansson. Pp. 288+16 plates+2 maps. (London, Calcutta and Sydney: G. G. Harrap and Co., Ltd., 1923.) 7*s.* 6*d.* net.

IN this volume Mr. Stefansson recounts some of his early experiences in the Arctic when he was a member of the Leffingwell expedition in 1906–7. He tells of his travels with the Eskimo, how they taught him to hunt, to accept their diet and mode of life, to build snow houses and generally to live in comfort in a region which people will persist in regarding as inhospitable in the extreme. It is a volume of the lore of the Arctic full of vivid descriptions and personal incidents. The chapters on hunting contain a great deal of the natural history of the caribou, polar bear and seal, and there is of course much of interest regarding the Eskimo. Mr. Stefansson has given us no book of polar travel of greater interest than this volume. It should help to dispel some of the current fallacies regarding the Arctic climate and conditions of life in the far north. The call of the north is in its pages, which will awaken memories among those who know the ice, and stir others with a longing to go and see. R. N. R. B.

Mirrors, Prisms, and Lenses: a Text-book of Geometrical Optics. By Prof. James P. C. Southall. Enlarged and revised edition. Pp. xx+657. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1923.)

THE revised edition of Prof. Southall's text-book of geometrical optics, in addition to a number of new problems scattered throughout the book, contains an important new chapter at the end of the volume. The historical notes dealing with the rectilinear propagation of light, and optics in the seventeenth century are of considerable interest. It is usually stated that Newton was the first to distinguish seven colours in the prismatic spectrum, but Maurolycus (1575) in the explanation which he gave of the circular arc of the rainbow directs attention to the four principal colours, together with three other colours which he regarded as transitions. Reflection prisms are discussed at some length, and new and approved schemes of optical calculation, partly due to Mr. T. Smith, are described. A word of praise must be given to the diagrams.

Introduction to Practical Mathematics. By V. Seymour Bryant. Pp. 95. (Oxford: Clarendon Press; London: Oxford University Press, 1923.) 2*s.* 6*d.* net.

MR. BRYANT'S little book is intended to supply the needs of classes preparing pupils for the entrance scholarship examinations in science in Public Schools, and is based upon a syllabus issued by the Science Masters' Association at the request of the Joint Standing Committee of the Head Masters' Conference. The course suggested in the book is very suitable and interesting, and the explanations offered should prove of value to the pupils. S. B.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor 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 Relation between Solar Activity and Atmospheric Electricity.

DR. CHREE in his reply (NATURE, September 8, p. 361) to my communication on solar activity and atmospheric electricity (NATURE, August 11, p. 203) first makes reference to the status of the question as to the effect of sun-spot activity on the secular change of the earth's magnetism. Those who have investigated this question have reached apparently contrary conclusions according to the phenomenon examined, the data used, and the method employed by the individual investigator. It would require too much space to enter into detail as to the reasons for the discordant results. Let it suffice here to state that Dr. Chree and I have investigated different phenomena. Thus Dr. Chree, on the basis of the Kew data alone, concluded, contrary to Leyst, that the secular change of the *magnetic declination* did not vary markedly, if at all, with sun-spottedness.

Such a restricted investigation could, of course, not be accepted as settling the broad question as to whether any appreciable change in the *direction of magnetisation* of the earth may be related to solar activity changes during a sun-spot cycle. I, on the other hand, confined my investigation solely to the question whether there was an appreciable change in the earth's *intensity of magnetisation* which might be associated with change in solar activity during the sun-spot cycle. Instead of relying upon the data from one station alone, I used the intensity data from eight stations distributed around the globe, namely: Kew, Potsdam, Pola, Bombay (Colaba and Alibag), Honolulu, Sitka, Cheltenham (Maryland), and Porto Rico. Regarding the various questions which must be considered in investigations of this character, the interested reader may be referred to my paper on the subject,[1] at the conclusion of which the intention was stated of making a still more comprehensive examination, as soon as additional data were available.

With regard to the difference in the method or formula used by Dr. Chree and myself when investigating a possible relationship between solar activity and atmospheric electricity, let me state briefly the assumptions involved. Dr. Chree in his paper[2] adopts a formula which assumes that there is strict synchronism between the phenomena of sun-spottedness and atmospheric electricity, and that for the same sun-spot number, during the first and second halves of the cycle, for example, the atmospheric-electric element investigated should have precisely the same value. In my formula (NATURE, August 11, p. 203) I introduced a term, provisionally called a time- or cycle-term, which was intended to take into account, approximately, a possible a-cyclic effect in atmospheric electricity during a sun-spot cycle such that the atmospheric-electric element considered, barring other disturbing causes, would not have precisely the same value for the same sun-spottedness. With the aid of this additional assumption, which does not appear unreasonable in view of similar effects in other geophysical and cosmical phenomena, an improved mathematical representation was obtained and higher values of the correlation coefficient were derived than those which Dr. Chree had found. No futile attempt was made to get an *exact* representation by unduly multiplying the number of unknowns to be determined by the method of least squares. The desire was merely to obtain, in accordance with the best practice, a sufficiently satisfactory representation of the observed facts with the *fewest* possible unknowns; the general concordance in the derived unknowns from widely separated stations would appear to be ample justification of the formula employed.

It must be realised that no method of applying an a-cyclic correction, due to an undiscovered cause, can be made perfect; however, when more extensive data for several sun-spot cycles are available, no doubt improvements may be made. In this connexion it may be remarked that Dr. Chree's method of applying a-cyclic corrections to the observed magnetic and electric diurnal variations has not yet been generally adopted. However, no great refinement in mathematical method is requisite to show, even for the data at present available, that a definite relationship between solar activity and atmospheric electricity is sufficiently plausible to merit careful attention. Some of the evidences have already been cited in my previous communication and reference has been made to a later and more complete paper.[3]

Dr. Chree directs attention to some low values of the atmospheric potential-gradient at the Ebro Observatory; by reference to the observatory bulletins it will be found that recent low values, especially during the period June-October 1922, were not unnoticed by the Observatory, and that possible artificial disturbing causes were investigated, as the result of which some changes have been made. The Observatory will doubtless make such additional tests and redetermination of reduction factor as may be requisite in the circumstances. This later information from the Ebro Observatory had not been received at the time of my previous communication, in which data only to 1921 inclusive were utilised. (The date for No. 11 in Table 2 of my previous communication should be 1921·5, instead of 1921·1.)

I am glad that Dr. Chree is helping to keep alive an interest in the highly important question as to possible variations in atmospheric electricity which may have to be associated with changes in solar activity. We may rest assured that until this question is definitely settled no complete theory of the origin and maintenance of the earth's electric charge can be definitely formulated. My main purpose appears to have been accomplished, namely, to bring back into the literature a question for reinvestigation which was actively discussed more than a half-century ago and then dropped for want of sufficiently accurate data of the requisite extent. It is hoped that the renewed discussion will contribute towards the multiplication of atmospheric-electric stations where every possible care will be taken to ensure continuity of strictly comparable data for as long a period as possible. Among other precautionary measures, more frequent and more extensive controls, than is at times the case, of the factor for reducing observed potential-gradients to an infinite plane, are requisite.

LOUIS A. BAUER.

Department of Terrestrial Magnetism,
Carnegie Institution of Washington,
October 5.

[1] *Terr. Mag. and Atmos. Elect.*, vol. 23 (1918), pp. 1-22 and 61-68.
[2] Proc. Phys. Soc., London, vol. 35, part 3, April 15, 1923, p. 132.
[3] It is expected that this paper may appear in the December, 1923, issue of *Terrestrial Magnetism and Atmospheric Electricity*, when it is hoped that, in addition to other data, those for 1922 at Kew and Eskdalemuir will be available.

Long-range Particles from Radium-active Deposit.

IN a letter to NATURE of September 22, p. 435, under this heading, L. F. Bates and J. Stanley Rogers suggest that the H-particles found by us (NATURE, September 15, p. 394) to become expelled from the atoms of Be, Mg, and Si, probably also of Li, by α-particles, are really identical with the long-range α-particles which these authors have obtained from radium C deposited on a brass disc. Highly interesting as their communication is, it does not, however, seem to have any direct bearing on our results.

The difference in brightness between the scintillations from α-particles and from H-particles viewed under identical conditions is so conspicuous, that no mistake is possible. Comparing the former to stars of the first magnitude, the latter would be of about the third magnitude; that is, a ratio in luminosity of about 6 to 1. By way of emphasising this difference we have, in the same scintilloscope, demonstrated the scintillations due to the H-particles from aluminium foil inside a glass capillary charged with emanation, together with the scintillations from polonium α-particles, before the physical section of Skandinaviska Naturforskaremötet, held in Gothenburg this summer. With due precautions the same experiment can also be carried out with a thin-walled silica capillary containing a few millicuries of emanation, so as to demonstrate the H-particles from silicon. Although there is very little doubt that the scintillations we have observed are really due to H-particles, an *experimentum crucis* can, of course, be made only by measuring their magnetic and electric deflection.

As was stated in our first communication, our final experiments were carried out with a minute emanation vessel divided into several communicating compartments of equal length, in which thin layers of different substances were spread over the bottom, made from thinnest copper foil. Control countings of the particles expelled from the naked copper foil of an empty compartment proved the number of these to be only a fraction of those expelled from the compartments charged with other substances. As the absorption curve for the "copper"-particles agreed with a theoretical absorption curve calculated for natural H-particles from hydrogen supposed to be occluded in the copper, there seems to be no reason for assuming them to be expelled directly from disintegrating atoms of radium C. But even if that were granted, there is no reason for ascribing that origin to the much more numerous particles of relatively short range expelled from the Be, Mg, and Si compartments of the same vessel, considering that the amount of emanation and its products present within each compartment was practically the same.

As a matter of fact a small number of scintillations of α-type was generally observed in our experiments, beside the much fainter H-scintillations, especially at the lowest values of absorption, when they were relatively numerous. We have so far not had occasion to examine these particles or their origin but have for the time being assumed them to be identical with the particles found by Sir Ernest Rutherford to be expelled from oxygen (*Phil. Mag.* vol. xxxvii. p. 562) which have in succession been taken for oxygen atoms carrying a single charge, double charged X nuclei, and now, apparently, α-particles of abnormally long range.

In conclusion, we may say that, judging from the experimental data at present available to us, we cannot see any other way of explaining the origin of the particles we have observed than by upholding our former view, namely that they are H-particles expelled at an artificial disintegration of the beryllium-, the magnesium-, and the silicum- (probably also the lithium-) atoms and not any long-range particles from radium-active deposit as the title given by the Editor to our first letter would seem to suggest. In that letter, in addition to the corrections pointed out in NATURE of October 13, p. 540, the word "neutral" should have been printed "natural."

GERHARD KIRSCH.
HANS PETTERSSON.

October 13.

Colour Vision and Colour Vision Theories.

WHETHER Prof. Peddie's explanations are adequate is a matter for the reader to decide. Let us take one of a fact which is conclusive evidence against the trichromatic theory. If the terminal portion of the red end of the spectrum be isolated in my spectrometer it will appear as a faint red upon a black background. If the eye be fatigued with red light, even by looking through a red glass held against a light for one second, the red will not be visible for some considerable time, but the eye may be fatigued for twenty minutes with yellow light without interfering with the visibility of the red light.

Prof. Peddie's explanation is as follows: "That there is no shortening at the red end of the spectrum after fatigue with yellow light follows at once if both the red and the green sensations are fatigued by the yellow light, while all three sensations, red, green, and blue, are present to some extent at all visible wave-lengths." But this explanation, which is inconsistent with the work of König, Abney, and others, does not explain why there is considerable shortening after slight fatigue with the red glass. Prof. Peddie does not explain Shelford Bidwell's crucial experiment, namely, that his red borders are not seen with spectral yellow light but are seen with a mixed yellow made up of red and green matching it.

As with other departments of science, the minutest accuracy is required in experiments on colour vision. Many results are due to impure colours and stray light. A chemist would not do Marsh's test for arsenic when he had bought his zinc at an ironmonger's and his sulphuric acid at an oil shop, both being contaminated with arsenic, but many workers are satisfied to use coloured papers for work on colour vision.

If the positive after-image of a spectrum be viewed it will be seen to disappear from the red to the violet end, and on the trichromatic theory it is stated that the positive effect of the red sensation disappears before that of the green; but in an absolutely dark room, if pure spectral yellow light be thrown on a white screen and a flicker apparatus rotated slowly in front of it, the yellow will not change its hue; on the trichromatic theory it should become green. The results are quite different when stray light is allowed to fall on the screen as well.

F. W. EDRIDGE-GREEN.

London, October 27.

Sex Chromosomes in Plants.

I HAVE recently been investigating the cytology of a number of diœcious plants with the intention, if possible, of throwing light on the matter of sex chromosomes in plants. Incidentally, I took up the genus Lychnis, one species of which, *Melandryum rubrum*, Garcke (*L. dioica*, L.), has been examined previously by Strasburger. In detailing his observations he states that, in both sexes, there are twelve pairs

of chromosomes present in the somatic cells. In the heterotype division he found one pair of bivalents much larger than the others, but the individual members of this pair were of equal size; thus no signs of the disparity indicating the possibility of two types of microspore were revealed.

I have examined its close ally, *Lychnis alba*, Mill., and find similarly twenty-four somatic chromosomes, of which two are larger than the rest. In the female plant at the reduction division these two appear similar; thus the daughter nuclei are alike. In the male, however, the two large chromosomes differ from one another both in size and shape; the larger one is bent, somewhat in the shape of a hockey stick, with the curved end pointing outwards from the spindle, whilst the smaller somewhat pear-shaped one is not more than two-thirds its size (Fig. 1). The shape is quite constant and the appearance is the more striking in that this pair of chromosomes takes the stain much more strongly than the others.

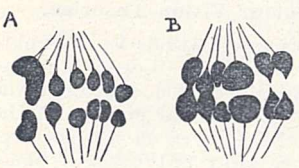

FIG. 1.—Heterotype division in *Lychnis alba*, Mill. A: male; B: female.

Since *L. alba* is so closely related to *L. dioica*, in which Shull has demonstrated sex-linked characters with the male heterozygous for sex, it seems more than probable that we have here a definite case of an XY pair of chromosomes in the male with a corresponding XX in the female. This is the first definite record of sex chromosomes in a Dicotyledon.

A full account of this and other species of Lychnis and their hybrids will be published shortly.

KATHLEEN BEVER BLACKBURN.
Botanical Department, Armstrong College,
Newcastle-upon-Tyne.

Powers of Perception of Birds.

MY attention has been directed to a note in NATURE of November 18, 1922 (vol. 110, p. 677), containing references to an article on "The Sense of Smell in Birds" (NATURE, June 17, 1922, p. 783), and to Dr. H. H. Beck's paper on "The Occult Senses in Birds" (*Auk*, 1920, xxxvii. 55). As your note intimates, there is evidence that neither by "occult sense" nor by smell do turkey vultures find their food. They certainly depend largely upon a very keen sense of sight, as is shown by the following incident.

A toy rabbit consisting of white plush and excelsior packing was given to our little girl a number of years ago. It proved to be a favourite toy. One night she forgot it and left it lying in the yard. As we sat at breakfast the next morning we were greatly surprised to see a turkey vulture strutting in a circle about the toy rabbit as it lay on the ground, and eyeing it with head turned to one side. Here was something new to his experience. It was certainly the form, but not the substance of a dead rabbit. If the turkey vulture has an "occult sense," in this case at least he did not depend upon it, or, doing so, was completely deceived.

The position of the writer of the note in NATURE is one to which we can subscribe when he says: "It is surely more reasonable to attribute these [powers of perception] to greater acuteness of the known senses than to imagine new senses for which no physiological basis can be suggested."

CHAS. W. PALMER.
Northeast High School, Philadelphia, Pa.,
October 15.

Population and Unemployment.

IN the résumé in NATURE of October 13 of the presidential address by Sir William Beveridge to the Economics Section of the British Association, the point which raised so much discussion in Liverpool is indicated by this sentence:—"Increased birth control is not required by anything in the condition of Europe before the War, and is irrelevant to our present troubles." As this idea has already been hailed by many, may I point out that Sir William entirely ignored the *unemployables*. Those who are unemployable through organic disease, feeble-mindedness, general debility, and various other characteristics of a "C 3" and physiologically inferior population do not appear in the ordinary list of unemployed, but they are, nevertheless, a huge financial burden on the community. Both a financial strain and a physiological danger to the race, they not only breed and reproduce their like if left without birth control; but they are brought into existence in otherwise healthy stocks whenever mothers under hard conditions reproduce too rapidly. Only by means of constructive birth control can women space their children so as to ensure the likelihood of reasonable health to those they bear under the modern and unnaturally hard conditions of slum life.

While Sir William Beveridge may play at ninepins with the primitive "Malthusian theory," it is most dangerous that, misled by his phrases, uncritical persons who confuse Malthusianism with constructive physiological birth control should be given such inopportune encouragement. Statistics confirm our common-sense observation that intelligent members of the better stocks are widely using birth control; hence, unless we do have an increase of birth control so that the inferior stocks also use it, we shall continue racially to deteriorate at an ever-accelerating speed.

MARIE C. STOPES,
President of the Society for Constructive Birth Control and Racial Progress.
7 John Street, Adelphi,
London, W.C.2.

A Possible Cure for Cancer.

WHILST reading Prof. Johnstone's remarks (Lancs. Sea-Fish. Lab. Report for 1922 (1923), p. 19) on malignant (cancerous) growths in fishes, I was struck by and seized upon the statement that "wen" is an example of a controlled growth.

So long ago as 1908 I remember Prof. Farmer suggesting in his lectures on "The Cell" that "cancer" might be due to lack of control of the individual as a whole over certain tissues, and this view has gained force ever since that time; but now arrives a statement that "wen" is a controlled growth. Let it be assumed that both statements are correct; then the individual with a wen contains or has contained in its system somewhere a controlling influence which—from many analogies—may not improbably exist in the blood. Now if wens occur in other suitable animals than man it would be an easy matter to extract plasma or other components of the blood for injection into other individuals of the same species having uncontrolled (cancerous) growths in order to test whether the controlling influence exists there and can be passed on to another individual.

If the suspicion were confirmed, a cure for cancer would be obtained, as the application of a similar process to man would no doubt follow very swiftly.

Or again, assuming that individuals with wens have an obvious control of a tendency to cancerous

growths, the suggestion is provoked that all normal mature individuals contain a factor—probably biochemical—which controls a tendency to abnormal growth. Why not then try simply the injection of blood-plasma or other constituents of the blood from normal mature individuals into cancerous subjects ?

It is of course possible that the factor inhibiting abnormal growth may lie dormant in the healthy individual or only occur at a particular phase of life—one of which may be at about the end of the growth period—and may not therefore be transmissible in blood constituents at all stages of the mature life-history, even supposing that the blood is the locus of the factor when it is active. A further possibility may be that only certain apparently normal individuals possess constantly an *active* growth-restricting factor and that these individuals remain to be identified. Whatever the importance of the above surmises may be, it would seem clear that the economy of individuals with " wens " must be regarded at present as of great importance in the study of cancerous growths. It is realised that there is a great deal of speculation in the remarks made above, but the importance of the subject is regarded as sufficient excuse. J. H. ORTON.

Marine Biological Laboratory, Plymouth,
October 25.

Science and the State.

LORD SALISBURY has noticed with great pleasure your appreciative article (October 27, p. 609) on the co-operation of the different parts of the Empire in scientific research dealt with in his recent speech to the Imperial Economic Conference. He would like, however, to assure you and your readers that when he spoke of the willingness of scientific men to place their services at the disposal of the Government and the community for " far less than the true remuneration of their great talents," he was referring not to the scientific staff of the Department, but to the distinguished men who serve on the Advisory Council and other Committees and Boards of the Department, most of them entirely gratuitously. The members of the Advisory Council are offered a modest honorarium, but it is not always accepted.

PHILIP FARRER,
Private Secretary.

Privy Council Office, Whitehall,
October 30.

A Representative Scientific Council.

THE proposal made in the leading article in NATURE of October 13, page 529, seems of the utmost importance, and is therefore likely to be discussed by abler pens than mine. I venture, however, to touch on some considerations not yet covered by your opening statement.

In a world of disillusion, with Church and State both in discredit if not in disgrace, there is a widespread and keenly felt need for wiser guidance. Here is the opportunity. Some of us would say that in an age of revolutions, it is not a further enforcement of authority by the method of violence that is needed. To substitute the dictature of " Science " for the dictature of the proletariat is only to demonstrate that the real enemy is the bourgeois and the bureaucrat. Here is our temptation.

We have no recognised definition of scientific " truth " as distinct say from war truth, newspaper truth, or Quaker truth. Do we mean that our conclusions are always " contradictoire," open to challenge, verification, or correction ? If so, there is obviously no case for enforcing them on an ignorant but reluctant populace.

There is already some distrust of the learning of the medical profession. They are wise enough to be content to advise their patients, but not to enforce their advice. The Ministry of Agriculture is wise enough to issue advice. From the Board of Education we should welcome rather more advice and rather less administration. Just consider how much mischief might be done in the present state of our knowledge of eugenics by a new tyranny of good intentions and ignorance.

On the other hand, there is a very strong case for some public body of scientific experts which might advise and report on all matters affecting the public welfare ; for example, on the children of Russia, the reafforestation of Greece, the rebuilding of Tokyo, the finances of Germany, the frontiers of France. If some scientific (not political) body meeting in Geneva could find the right answers to these questions, some of us would be content to sacrifice all other sorts of authority vested in the League of Nations in favour of the authority that might ultimately accrue to an oracle which confined itself to good advice.

For the word " democracy " we might substitute " scientific initiative and democratic veto." We need both. Almost all that can be done by mass movements, like trades unions and armies, is to veto, to stop other things being done by other people. Initiative, doing new things, is generally the work of individuals, not of mobs. The case for a scientific advisory body is far stronger than any existing political system recognises. The House of Lords may be earmarked for the future development of Trades Unionism, but the Privy Council is an existing institution which could be developed into an acting advisory council, with no authority to enforce its advice.

It may be difficult to draw the line of representation among the claims of metaphysics, theology, theosophy, anthroposophy, anthropology, psychical research, and experimental psychology. An excluded minority of Christian Scientists might be hostile, as you say. Hence the virtue of Prof. Oppenheim's maxim :— " There will be voting and the majority will indeed decide, but that decision will only bind that majority. In matters of ' scientific ' opinion are we not justified in saying that no majority however great should seek to enforce its decisions on any minority no matter how small ? "

On the other hand, consider the immense power that might be wielded by an advisory organisation that merely advised its members to " withhold support " from an existing political institution which seemed to be going astray. Imagine, for example, that during some recent wars the General Medical Council had advised its members to refuse service in all ambulance units or a Chemical Society disowning members engaged in manufacturing explosives, or a Trades Union refusing to make munitions or to accept Treasury notes in payment !

There is a little difficulty about registration. Is a university degree in science enough, or is research work necessary ? Or might the standard be lowered to the Preliminary Scientific Examination ; and what about people of quite obviously exploring habits of mind who have never had the chance of a university education ? The analogy of the Teachers' Registration Council a little suggests that registration might be the only aim which would be achieved.

The great thing is to maintain an offer of the best scientific advice available for the widest possible community. HUGH RICHARDSON.

Wheelbirks, Stocksfield-on-Tyne,
October 23.

Radio Direction Finding by Reception.

THERE are in use to-day three principal systems of direction finding by which the apparent direction of arrival of a train of electromagnetic waves can be observed and, under suitable conditions, the direction of a radio transmitting station determined. These are usually described as the Bellini-Tosi system, the single frame system, and the Robinson system. The Bellini-Tosi system has been very fully developed by the Marconi Company for use on land and on board ship as an aid to navigation, and is the system most usually employed in this country for that purpose. The coil frame system has received most attention in the United States, and has there been the subject of a great amount of research work. The Robinson system, for reasons which will appear later, is specially suitable for use in connexion with direction finding in the air and has mainly been developed with that end in view. All three systems have been for the most part the subject of independent development and their several merits have been the subject of considerable controversy.

In general, however, all the systems operate upon the principle that the magnitude of the electromotive force induced in a vertical loop or coil of wire by an electromagnetic wave depends upon the angle between the plane of the loop and the wave front of the arriving wave. An electromagnetic wave can be considered as consisting of electric and magnetic forces which are at right angles to each other and to the direction of travel of the wave. These two force vectors are in phase with each other and each varies rapidly in a periodic manner. The effect on a wire placed in the field due to such a wave can be deduced from consideration of the effect of either the electric or the magnetic fields in the wave front. In the case of a single coil vertical loop of wire it can be shown that the periodic magnetic field due to an electromagnetic wave the wave front of which is plane, though not necessarily vertical, introduces in the loop an alternating electromotive force the maximum value of which is given by the following expression :—

$$E_m = \omega H_m A \cos \alpha$$

where ω is the periodicity of the wave, H_m the maximum value of the horizontal component of the magnetic field in the wave front, A the area of the loop, and $90° - \alpha$ the angle between the plane of the loop and the horizontal component of the magnetic field. The effect of the vertical component of the magnetic field may be disregarded since the plane of the loop is vertical and therefore cannot be linked by this component. If the loop is rotated so that the electromotive force becomes zero the plane of the loop is then parallel to the horizontal component of the magnetic field, and the direction whence the waves are travelling is thus at right angles to the plane of the loop. The direction of arrival of the waves can therefore be determined with an ambiguity of 180°. It can be shown that, in general particulars, the underlying principles of all the three systems in use to-day are the same—and that the systems are in their action essentially equivalent to the single rotating loop.

The single coil system most closely approximates to the simple theoretical case. A tuning condenser is, however, usually introduced in series with the coil across which the amplifying and detecting apparatus is connected; but it can be shown that the potential difference across this condenser depends on the orientation of the frame in the same manner as the electromotive force induced in the frame. The single coil, as used in practice, consists, as a rule, of several turns of wire instead of a single turn. These turns are usually spaced in a series of equally dimensioned loops in nearly parallel planes (box type coil), or are wound spirally in the same plane (pancake type coil). In the case of a pancake coil the quantity A in the expression given above is replaced by the effective or mean area of the coil. In the case of box type coil, since the winding of the coil is, of necessity, slightly askew to the axis of the coil, there is the possibility of an effective turn of wire being introduced the plane of which is practically at right angles to the main turns of the coil; the effect due to such a turn, however, introduces an error not exceeding 0·1°, which is negligible for all ordinary purposes.

The connexion of the tuning condenser and receiving apparatus to the coil introduces certain disturbing effects. First the electromotive force picked up by the leads and the whole circuit, although small compared with the maximum value of the potential difference across the tuning condenser, may be sufficiently strong to give an audible signal when the coil is orientated so as to make this potential difference zero (*i.e.* $\cos \alpha = 0$). In this way an ill-defined minimum may be produced, and accurate determination of the bearing made more difficult. Secondly, a bad zero may be produced by what is known as "vertical" or "antenna" effect. One side of the tuning condenser is connected to the grid of the first receiving valve, while the other side is connected to the filaments of the valves, to which in turn are connected the filament and anode batteries. The capacity to earth of the two sides of the coil joined to the tuning condenser will, therefore, in general be unequal, and a potential difference will be produced across this condenser even when there is no circulating current in the coil. One result is a blurring of the minimum, and another is that the two minimum positions are found on rotating the coil not to be exactly 180° apart, owing to the fact that the superimposed potentials due to the antenna action of the coil are nondirectional. These effects can be eliminated, however, by the introduction of a small variable balancing condenser between the grid of the first valve and the tuning condenser.

In the Bellini-Tosi system two large rectangular or triangular loops each of a single turn are erected with their planes at right angles. To each of these a small field coil is connected in series. These small coils are again mounted with their planes at right angles and between them is pivoted a small search coil, attached to which is a pointer which moves across a horizontal circular scale divided into degrees from which the observed bearings are read off.

The two field coils reproduce in miniature the field in which the main coils are placed, and the search coil turning within the small field coils is equivalent to

a single rotating coil directly receiving the energy of the waves. Thus the Bellini-Tosi system is in theory exactly equivalent to the ideal single turn rotating loop. The system, as in case of the single frame coil, is liable to a certain amount of "antenna" effect. It is also necessary in erection for care to be taken that the similarity of the two loops and their circuits is ensured, and that the planes of the loops are accurately at right angles.

In the Robinson system two coils, which differ as regards their area-turns, are fixed rigidly at right angles and pivoted about a vertical axis. The coils are connected in series and so arranged that the direction of winding of one of the coils can be reversed with regard to the other by means of a switch. In this way the electromotive force induced in the former coil can be added to or subtracted from that induced in the latter. When the coil with the larger area-turns is placed in the minimum position for signals induced by the arriving waves, the smaller coil is in the maximum position. In this position, on throwing over the switch from one position to another, no change of signal strength will be heard in the telephones attached to the receiving circuit, and the larger coil will be perpendicular to the direction of travel of the waves. Consideration of the theory of this system shows that the operation of the reversing switch is really equivalent to swinging a single frame, or the search coil in a Bellini-Tosi installation, through an angle on either side of the minimum position. The amount of this equivalent angle of swing depends on the ratio of the area-turns of the two coils of the Robinson system. This ratio is usually arranged so that for good sensitivity this equivalent angle is 20° to 30°.

Since, in using the system, the equivalent coil is swung to positions 20° to 30° on either side of the minimum by the action of the switch, the received signals are not reduced to zero intensity. The system is therefore suitable for use where the finding of the zero position is difficult through extraneous noises or interference, and it is, accordingly specially adaptable for use in aircraft.

All the three systems of direction finding are liable under certain conditions to errors which may be classed under three heads: (*a*) variable errors arising from causes influencing the direction of travel of the waves during their propagation through space, (*b*) errors due to the effect of the local surroundings of the receiving station, (*c*) instrumental errors.

A discussion of the three systems of direction finding as regards their basic principles and as regards their liability to the above three classes of errors has recently been published as Special Report [1] No. 1 of the Radio Research Board under the Department of Scientific and Industrial Research. The conclusion reached in this report based on a large number of careful observations is that each system is liable to errors of the same order of magnitude. The errors due to the location of the directional finder can be avoided, however, by careful selection of the site of the station, while instrumental errors can be reduced to practically negligible amounts by suitable design and arrangement of the apparatus. Until recently it appears to have been generally held that observations with undamped waves were more liable to error than those with damped waves. Experiment has shown, however, that the errors observed were occasioned by the heterodyne method of reception of undamped waves, and that they may be eliminated almost entirely by careful screening and arrangement of the heterodyne with regard to the receiving apparatus and aerial system.

The variable errors, falling under class (*a*), however, present much greater difficulty and so far no means of eliminating them have been found. Since they are introduced by changes in the direction of travel of the wave front during propagation the explanation of the factors which give rise to them is to be sought in the study of the propagation of waves. The fact that all the systems of direction finding are in their essentials equivalent to rotating the single turn rotating loop, is of great importance in this respect because in considering the effect of different wave fronts it is only necessary to consider the behaviour of the simplest type of aerial (*i.e.* the single coil type). The results of experiments carried out on one system then can safely be considered as applicable to the other two.

By any of the three methods discussed the direction of the horizontal component of the resultant magnetic field in the wave front can be determined. In practice, however, it is the direction of the horizontal component of the line of motion of the waves which is actually required. Should neither the direction of travel of the waves nor their resultant magnetic field be horizontal, then the setting of a coil in the minimum position for signal strength will have no necessary relation to the direction of arrival of the waves, and errors will be recorded by all three systems. On the other hand, provided the resultant magnetic field remains horizontal, the wave front may be inclined at any angle; or again, provided the wave front remains vertical, the resultant magnetic field may have any angle therein, without causing errors to occur in the observation of the direction. The variable errors are far greater by night than by day. The variation produced may arise very suddenly and the observed bearing may change at the rate of several degrees a minute, or the deviation in the bearing may remain steady for a considerable period. The magnitude of night variations, which are far greater than those due to location or to instrumental errors, may be judged from the following observations recorded in the Special Report of the Radio Research Board already referred to. In one series of experiments where observations were carried out with a Standard Robinson set and a portable type Bellini-Tosi set, erected in the same field at Slough, on various fixed transmitting stations employing waves between 2000 and 5000 metres, the maximum variation for Karlsburg observed with the Robinson set was 27·1° and with the Bellini-Tosi set 28°, for Moscow 9·9°, 9·2°, for Coltano 10·8° and 7·2° respectively. In another series of experiments, on waves of 2000 to 9000 metres, carried out at Orfordness with a permanent Bellini-Tosi apparatus and a standard Robinson set, the total variations at night ranged on various occasions from 5·0° to 54° for the Bellini-Tosi set and 5·2° to 51·3° for the Robinson set.

It should be remarked, however, that these large

[1] A discussion of the practical systems of Direction Finding by Reception, Dr. R. L. Smith Rose, and R. H. Barfield (Radio Research Board Special Report No. 1), published by H.M. Stationery Office. Price 9*d.* net.

variations occurred in cases where the distance between the transmitting and receiving station was great—being rarely less than 100 miles and in some cases as great as 1500 miles. Also the waves had travelled for considerable distances over land. These facts probably account for the changes in the apparent direction of travel of the wave front necessary to produce the large variations observed. Fortunately in the application of radio direction finding to navigation such conditions as a rule do not occur. Ships usually require their positions or bearings to be given when they are nearing land, and there is a considerable amount of evidence to show that, in the case of the shorter waves, as used by ships, passing entirely over sea for distances of the order of 50 to 80 miles, individual bearings very rarely show a maximum error of more than 5°, while simultaneous observations carried out on the same waves after passing over land frequently show variations of the order of 40°.

From the experimental evidence available it would seem that with a suitably situated shore direction finding station a ship at a distance of the order of 50 miles can be given a bearing, under normal conditions, with an accuracy to 1° to 2°. A single direction finding station can only give a ship her bearing from the receiving station, but if a second direction finding station suitably placed with respect to the first is available, two bearings can be given and the position of the ship can be fixed by their intersection. Experience has shown that such an intersection is usually sufficiently correct to enable a ship's position to be given with all the accuracy necessary for safe navigation. O. F. B.

The Education of the People.[1]

By Prof. T. PERCY NUNN.

IN education, as in all the great fields of practice, there are, and must constantly arise, problems that can be solved only by patient application of the methods of science, but however far the scope of educational science may extend, the critical educational issues will always lie beyond it. For in its origin education is a biological process which does not wait for deliberation to call it into existence or for science to guide it, but has the inevitability of behaviour rooted in instinct.

What is it, then, that determines the general character of the educational process at a given point in the history of a human society? The answer is that the same *élan vital* which brought the society to that point urges it so to train its young that they may maintain its tradition and ways of life. It follows that the education a nation gives its children is, perhaps, the clearest expression of its *ethos* and the best epitome of its scheme of life. Thus the ideas of too many of our Georgian forefathers upon the education of the masses corresponded faithfully with their belief in the great principle of subordination about which Johnson and Boswell talked so often and agreed so satisfactorily. One remembers, for example, how hotly Miss Hannah More denied the scandalous rumour that she was teaching the poor of Cheddar to write! Similarly, the liberal curriculum of our elementary schools reflects the prevalence to-day of a widely different view of the nature and purpose of society. In brief, it is an expression of the steadily growing belief, first, that every member of society has an equal title to the privileges of citizenship; and, secondly, that the corporate strength of society should be exerted to secure for him actual as well as theoretical possession of his title.

How the movement based upon that belief will ultimately affect the happiness of our people no one can with certainty foresee; nevertheless, I am bound to record my opinion that in its main tendency it ought wholeheartedly to be accepted. I think this chiefly because it seems to be inspired by the Christian principle of the immense value of the individual life, or, if you prefer to put it so, by the Kantian principle that no man ought to be treated merely as a means but always also as an end in himself. But if the movement is accepted, public education must correspondingly assume a character which would follow neither from the principle of subordination nor from the principle of *laissez faire*. The view I submit is that the education of the people should aim at enabling every man to realise the greatest fullness of life of which he is by nature capable—"fullness" being, I add, measured in terms of quality rather than of quantity, by perfection of form rather than by amount of content. That view is the basis of all I have to say.

During the last century we learnt, following Darwin, to look upon all biological phenomena as incidents in a perpetual struggle wherein the prizes to be won or lost were the survival of the individual and the continuance of his species. From this point of view there could be only one object of life, one *causa vivendi*, namely, to continue living, and the means by which it was to be attained were adaptations to environment achieved by an individual, and perhaps handed on to its offspring, fortunate germinal variations, or lucky throws of the Mendelian dice. It was natural, if not logically necessary, that the doctrine should fuse with the view, as old as Descartes, that life is but an intricate complex of physico-chemical reactions. Upon that view, even to speak of a struggle for existence, is to use a metaphor admissible only on account of its picturesque vigour; when we study the forms, processes, and evolution of living beings we are spectators merely of the operation of physical and chemical laws in peculiar forms of matter.

These ideas, in either their more moderate or their more drastic form, affected the attitude of men towards matters lying far outside the special province of biology. National policies have been powerfully influenced by them, and it has been widely held that the education of children should be shaped mainly, if not solely, with the view of "efficiency" in the struggle for existence. It is, therefore, relevant to point out what tremendous difficulties are involved in their thorough-going

[1] From the presidential address delivered to Section L (Educational Science) of the British Association at Liverpool on September 14.

application. I will not speak of those which have driven physiologists of high standing to reject the mechanistic theory of life as unworkable, for they do not bear directly upon my argument. It will be more to our purpose to raise, as William James did in his great treatise on psychology, the question of the higher æsthetic, moral, and intellectual qualities and achievements of man, and to ask how these are to be brought under the conceptions before us. We will not press the question how the emergence, say, of Beethoven's Fifth Symphony is to be explained in terms of physics and chemistry; for even the most stalwart mechanists scarcely expect that it will actually be done; they only believe that conceivably it could be done. But it is both fair and necessary to ask how the things of which the symphony is typical can be accounted for on the principle of survival-value. James, facing this question with characteristic candour, felt bound to admit that they have "no zoological utility." He concluded, therefore, that the powers and sensibilities which make them possible must be accidents—that is, collateral consequences of a brain-structure evolved with reference not to them but only to the struggle for material existence. The premises granted, I do not see how the conclusion can be avoided; but surely it is extremely unacceptable. If, with Herbert Spencer, we could regard art merely as something wherewith to fill agreeably a leisure hour, we might be satisfied by the hypothesis that our sensibility to beauty in form, in colour, and in sound, is an "epi-phenomenon" having no significance in relation to the real business of life. But when we think of men whose art was in truth their life, and consider how eagerly the better part of mankind cherishes their memory and their works, it is next to impossible to be satisfied with that view. Take the case of science. Votaries of pure science often seek to justify their ways to the outer world by the argument that discoveries which seemed at first to have only theoretical interest have often disclosed immense practical utility. It is a sound enough argument to use to silence the Philistine, but would the pursuit of science lose any whit of its dignity and intrinsic value if it were untrue? I will not lengthen the argument by extending it to the saints and the philosophers, for its point should be sufficiently plain. The activities of "our higher æsthetic, intellectual, and moral life" have such intrinsic worth and importance that to regard their emergence as accidental and biologically meaningless is outrageously paradoxical. They must be at least of equal significance with anything else in man's life, and may not unreasonably be held to contain the clue to life's whole meaning.

It may be helpful to put the conclusion in other language. Man's life is a tissue of activities of which many are plainly *conservative* in nature, their function being directly or indirectly to maintain the existence of the race and the individual. Agriculture, industry, defence, medicine, are obvious examples of the type. But there are other activities—art and pure science are capital examples—the character of which is best indicated by the term *creative*. The point made is that in any sane view of human life as a whole the creative must be regarded as at least as significant and important as the conservative activities.

Purely conservative and purely creative activities, if indeed they exist, are only limiting instances; in most, if not in all activities, the two characters are interfused. For example, the motive of pure science is unmistakably creative, yet its extrinsic conservative value is unlimited; on the other hand, the vast industrial organisations of to-day exemplify activities which, though conservative in their genesis, yet have developed the creative character in an impressive degree. Considerations of this kind prepare one to see that the higher creative life, far from being merely a splendid accident, is really the clearest and purest expression of the essential character of life at all its levels. The poets are, as the Greeks called them, the supreme *makers*, for all making has in it something of the stuff of poetry. In short, there is no life, however humdrum, however crabbed by routine, which is not permeated by the self-same element, the inflorescence of which is literature, art, science, philosophy, religion.

The foregoing discussion has a close bearing upon the questions what should be taught and in what spirit the teaching should be given. The curriculum always *will* be a partial reflection of the actual life and traditions of a community, and *ought* to reflect all the elements therein which have the greatest and most permanent value and significance. Without doubt these will, in general, be the things that have the highest significance and value for the human family as a whole, but there can scarcely be said to be a common human tradition. There exists, it is true, a common European tradition based mainly upon the Græco-Roman and Christianity, and it is vastly important for the happiness of the world to deepen and vivify men's consciousness of it. But even this lacks the concreteness needed to form the basis of popular education. In short, a nation is the largest social unit whose *ethos* has the necessary individuality. Hence, though we should aim at making our young people "good Europeans," we can do so only by shaping them into that particular brand of good Europeans who are rightly to be called good Englishmen. Hence the importance of fostering in our elementary schools the special traits of the English character at its best; of giving English letters a chief place among the studies of our youth; of cherishing the English traditions in the arts and crafts, including our once proud art of music; even of reviving the old dances which were so gracious and typical an expression of our native gaiety and manners.

Lest this contention should be misunderstood, I add that I preach neither the hateful doctrine that what is foreign should, as such, be excluded, nor the ignorant and presumptuous doctrine that what is our own is necessarily the best, and that we have nothing to learn from other peoples. The whole burden of my argument is that the things which have universal human value are the things of most importance in education. But the universal can be apprehended only where it lives in concrete embodiments. In the cases we are concerned with, these are elements or organs of a national culture; and the only national culture to which a child has direct and intimate access is his own. He should be taught to see, as opportunity permits, how much of it is derived from the common European tradition and how much it owes to the influences of

other national cultures; but it should, in its concrete individuality, be the basis of his education.

Lastly, I have urged that among the strains or currents in a national tradition the highest value belongs to those that are richest in the creative element. These are themselves traditions of activity, practical, intellectual, æsthetic, moral, with a high degree of individuality and continuity, and they mark out the main lines in the development of the human spirit. Do we not rightly measure the quality of a civilisation by its activities in such directions as these? If so, must not such activities be typically represented in every education which offers the means to anything that can properly be called fullness of life?

If the force of the argument be admitted, the principles of the curriculum take a clear and simple shape. A school is a place where a child, with its endowment of sensibilities and powers, comes to be moulded by the traditions that have played the chief part in the evolution of the human spirit and have the greatest significance in the life of to-day. Here is the touchstone by which the claims of a subject for a place in the time-table can be infallibly tested. Does it represent one of the great movements of the human spirit, one of the major forms into which the creative impulses of man have been shaped and disciplined? If it does, then its admission cannot be contested. If it does not, it must be set aside; it may usefully be included in some special course of technical instruction, but is not qualified to be an element in the education of the people.

The same criterion may be applied to the methods by which the subjects of the curriculum are taught. We are constantly told that the "educational value" of a subject lies in the mental discipline it affords, and, from this point of view, a distinction is made between its educational value and its import as an activity in the greater world; thus geometry is taught as a training in logic, the use of tools as "hand and eye training," and so forth. From the point of view I adopt that distinction is unjustifiable and may be dangerously misleading; it has, I fear, often been a source of aridity and unfruitfulness in school teaching. The mistake consists in supposing that the disciplinary value can be separated from the concrete historical character of the subject as a stream of cultural tradition. The discipline of the school workshop consists in using the tools of the craftsman for purposes cognate with his and inspired by his achievements. Similarly the discipline of school geometry consists in steeping one's mind in a certain noble tradition of intellectual activity and in gradually acquiring the interests, mental habits, and outlook that belong to it. To say this is not to minimise the importance of discipline or to expel from school studies the austerity which the grave old word suggests. What is insisted on is that the several forms of mental discipline are characters of concrete types of creative activity, practical, æsthetic, intellectual, and that they influence the mind of the learner favourably only in so far as he pursues those activities as adventures of the human spirit, laborious yet joyous and satisfying, and pursues them after the manner of the great masters. In short, true discipline comes simply by trying to do fine things in the fine way.

The foregoing principles are open to misconceptions against which it is desirable to protect them. In the first place, it may seem that I am designing the education of the people upon a scale which may be magnificent but is certainly impracticable. It is easy, no doubt, to form extravagant expectations, and by seeking to do too much to achieve nothing solid at all. But the argument is concerned far less with the standard to which school studies may be pursued than with their proper qualities and the spirit that should inspire them. In particular, it is directed against the attitude expressed recently by a public speaker who asked what good is poetry to a lad who will spend his days in following the plough and spreading manure upon the fields. Against this attitude it urges that a man's education, whatever his economic destiny, should bring him into fruitful contact with the finer elements of the human tradition, those that have been and remain essential to the value and true dignity of civilisation.

It may be objected, granted the soundness of the ideal, that the shortness of school life makes it impracticable. It is true that a study, to be of real value, must be carried far enough and followed long enough to make a definite and lasting impression. It is also true that some studies can scarcely produce their proper effects until a certain level of maturity has been reached. But what is to be deduced from these admissions? Surely the conclusion, which the public mind is slowly accepting, that so long as children leave school for good at fourteen some of the best fruits of education will be unattainable and the security of the others precarious. It is not merely a question of length of time, but also, and even mainly, of psychological development. The more carefully youth is studied the more significant for after-life the experience during the years of adolescence is seen to be. Its importance is not a modern discovery; for even the primitive races knew it, and the historic Churches have always taken account of it in their teaching and discipline. The case for universal education beyond the age of fourteen depends ultimately upon the importance of shaping the new capabilities of the adolescent in conformity with the finer traditions of civilised life. Public opinion, regretting the generous gesture of 1918, has not at the moment accepted the larger view of the mission of education; but as the nation learns to care more for the quality of its common manhood and womanhood and understands more clearly the conditions upon which that quality depends, the forward movement, now unhappily arrested, will certainly be resumed. For that better time we must prepare and build.

There is another objection to which I should think it unseemly to refer if it were not a stumbling-block to so many persons of good will. A liberal public education will, they fear, make people unwilling to do much of the world's work which, though disagreeable, must still be carried on. The common sense of Dr. Johnson gave the proper reply a hundred and fifty years ago. Being asked whether the establishment of a school on his friend Bennet Langton's estate would not tend to make the people less industrious, "No, sir," said Johnson, "while learning to read and write is a distinction, the few who have that distinction may be the less inclined to work; but when everybody learns to read and write it is no longer a distinction. A man

who has a laced waistcoat is too fine a man to work; but if everybody had laced waistcoats, we should have people working in laced waistcoats."

Lastly, the ironical may ask whether it is an error to suppose that the education of the people should furnish them with useful knowledge and abilities. Now the test of utility which the plain man applies to education is, in principle, sound and indispensable: the only point doubtful is whether the test is always based upon a sufficiently broad idea of utility. The only satisfactory definition of the useful is that it contributes definitely and positively to fullness of life. From that point of view it is useful to teach a ploughboy to love poetry and not useful to teach a public schoolboy to hate Greek. This is not an argument against teaching a subject the disappearance of which from our education would be an irreparable disaster. It means merely that the literatures of the ancient world, when taught, should be taught in such a way as to contribute positively to the quality of a modern life. But the term "useful," according to the definition, certainly includes utility in the narrower sense. The daily work of the world must be kept going, and one of the essential tasks of the schools is to fit the young to carry it on under the immensely complicated conditions of present-day civilisation. The only limitation imposed by our argument is that what is conservative in purpose shall be creative in its method and, being so, shall embody some dignified tradition of practical, æsthetic, or intellectual activity. The condition may be satisfied by a technical education based upon many of the great historic occupations of men and women, provided that inspiration is sought from the traditions of the industry or craft at their noblest. To conceive "secondary education for all" as meaning "the grammar school curriculum for all" would be to make a most serious blunder. The only mistake more serious would be to exclude adolescent boys and girls, even of the humblest station, from any essential part of the national inheritance of culture. But this error may be avoided while full account is yet taken of the far-reaching differences in the talents and *ingenium* of individuals and the rich diversity of the valuable currents, intellectual, practical, and æsthetic, in the life of the community, of which any one may be made the basis of a course truly liberal in quality.

The last hundred years have greatly accentuated the gravity of a problem which was discerned by the poet Schiller and diagnosed in the famous "Letters on Æsthetic Education" he published in 1795. In Schiller's view the immense progress of the modern nations has been purchased at the expense of the development of the individual soul, so that, in spite of the greatness of our achievements, we are, man for man, inferior to the various and well-rounded Athenians of the best days. It is the division of labour essential to a large-scale organisation of society which has at once made general progress possible and individual impoverishment inevitable, for it has cut individual men off from experiences that are indispensable to the full well-being of mankind. If this was true in the days of the French Revolution, how much more true it is to-day, and how much more grave the evil. We are told that before the era of industrialism the great mass of our people enjoyed a culture which, though simple, was sincere and at least kept them in touch with the springs of beauty. What truth there is in the picture I do not know, but it is certain that with what is called the industrial revolution the conditions that make it credible largely disappeared. Torn from the traditions of the old rural life and domestic industry and herded into towns where in the fight for mere existence they lost their hold on all that gave grace to the former life, the folk who now constitute the bulk of our population were cut off effectually from "sweetness and light." That was the situation when the task of public education was taken seriously in hand, and that, notwithstanding a great amelioration in details, is for far too many the situation to-day.

There are some who think that the only remedy is to cry halt to the modern movement and return deliberately to medievalism. That is a counsel of despair; instead of indulging idle dreams it will be more profitable, assuming the unalterable conditions of modern life, to consider how the rest may so be modified as to place the true dignity and grace of life within the reach of all who are qualified to achieve them. That can be done only by a system of education which brings the things of enduring and universal worth to the doors of the common people. It is what has been done by many an elementary school teacher, sometimes with scant assistance from public opinion, simply because, face to face with his helpless charges, he was impelled to give them the best he had to give. It will be done with increasing happy results the more clearly it is seen that the proper function of the elementary schools is something much more than to protect the State against the obvious danger of a grossly ignorant populace or to "educate our masters" in the rudiments of citizenship. Unless it be done, unless the natural hunger of the people for knowledge and beauty be wisely stimulated and widely satisfied, no material prosperity can in the end save the social body from irretrievable degradation and disaster.

New Discoveries and Paintings of Palæolithic Date in the Department of the Lot (France).

THE study of palæolithic man is many-sided. As a geologist, treating the tools and objects manufactured by prehistoric man as fossils, the prehistorian has determined an archæological sequence, and, by correlating this with the geological record of the earth's history, has been able to suggest a probable chronology. As an anatomist, the prehistorian has launched into the fascinating study of the evolution of man, and, although hampered by lack of authentic material, has already been able to show that this evolution was by no means a simple straightforward affair. As fresh material comes to hand it will become possible to elucidate further this complex branch of the subject. As an ethnologist, the prehistorian has attempted to trace the migrations of prehistoric races, and to compare their cultures with those of primitive folk still surviving.

But perhaps the most entrancing branch of prehistory is the study of the mural art of these very early peoples. Here we are not dealing merely with "dry bones" or objects made for some immediate and concrete use, nor indeed are we dealing, in the vast majority of cases, with mere "home" decoration. Primitive man, then as now, was concerned with his food supply, and the art was practised as a form of sympathetic magic. The veil lifts for a moment, revealing to us the very thoughts and aspirations—one might almost say the religion—of these early artists. The occurrence of prehistoric ceremonial burials has further helped in this study, indicating, as it probably does, something of the nature of a cult of the dead. Perhaps some of the cave art may be connected with this.

The palæolithic art for magic purposes occurs emblazoning the walls of caves. The darkness and silence of these entrances to the bowels of the earth is eminently suited to the production in primitive man of a state of mind receptive to magic influences. There is actually evidence to suggest that a priestly artist caste guided and controlled these emotions. The painted and engraved caves may indeed be described as prehistoric temples.

For this art to be practised, it is clearly necessary that natural caves should occur in the district. Hitherto three main areas of distribution have been located, one in Dordogne (France), around the village of Les Eyzies on the banks of the river Vezère, a tributary of the Dordogne; another in the Pyrenees, especially in the department of Ariège; the third in Cantabria (North Spain), and extending as far west as Asturias. It would now appear that, thanks to the energy of the Abbé Lemozi of Cabrerets near Cahors (Lot), a new region is in process of discovery. An announcement of this has appeared in *L'Illustration* of October 13, p. 354. The article, profusely illustrated, deals with the finds of the Abbé Lemozi. It does not pretend to be a scientific exposition written by an expert. On the other hand, an exceedingly interesting sketch is given of the archæological work done by the Abbé, which it is to be hoped he will publish himself in due course. Not only have a number of prehistoric "homes" been discovered under overhanging rocks, many of which have yielded rich industries in stone and bone, but a painted cave temple, worthy to be compared with those of the Dordogne, Pyrenees, and Cantabria, has also been explored.

Judging from the illustrations, the date of the art would seem to be in part Aurignacian, in part lower Magdalenian, but it is impossible to be precise on this point from the meagre account given. The animals and figures observed apparently include reindeer, horse, mammoth, bison, "negative" human hands, signs, etc. Obviously much further work is required before what promises to be a new and rich area is properly explored, but the Abbé is to be congratulated on what he has already done, and *L'Illustration* is to be highly commended for having brought forward his work in such an excellent way. A complete survey of the district around Cabrerets, with a scientific account of the diggings and of the cave art, will be eagerly awaited by all prehistorians. Some reproductions of the new prehistoric paintings appeared in the *Illustrated London News* of October 20. M. C. B.

An African Chalicothere.

By Dr. CHAS. W. ANDREWS, F.R.S.

A SMALL collection of fossils from the neighbourhood of Albert Nyanza has recently been sent for determination to the British Museum by Mr. E. J. Wayland, director of the Geological Survey of Uganda. The beds from which these remains were derived are of late Pliocene or, more probably, Pleistocene age, since they include teeth of Hippopotamus and Phacochœrus which do not seem to be distinguishable from those of recent forms: with these are bones of crocodiles, Chelonia, a large Siluroid fish, and fresh-water shells.

Accompanying these remains there are two or three fragments of much greater interest. The most important is a phalangeal bone of such peculiar form that it is at once seen to belong to a member of the Ancylopoda (Chalicotheroidea). These animals are very aberrant perissodactyl ungulates in which, instead of hoofs, great cleft claws are developed, and the consequent modification of the foot bones is such that even a single phalangeal bone is easily recognisable. These large cleft claws were known so long ago as Cuvier's time, and he regarded them as belonging to a giant Manis ("Pangolin gigantesque"). It was not until 1888 that Filhol was able to prove that they actually belong to an ungulate. The group first appears in the Middle Eocene of North America, and in later times it spread over the northern hemisphere, remains being found in the Upper Miocene beds of Samos and Pikermi, and in India and China in deposits as late as the Pleistocene.

The finding of a Chalicothere in Central Africa is of especial interest because a species occurs in Samos associated with Samotherium, which is very closely similar to the Okapi, the discovery of which a few years ago attracted so much attention. It seems just possible that a Chalicothere may still survive in the same region and may be the basis of the persistent rumours of the existence of a large bear- or hyæna-like animal. For example, in a letter to Mr. M. A. C. Hinton from Capt. C. R. S. Pitman, of Kenya Colony, the writer inquires if anything is known of the "Nandi Bear," stories of which are constantly cropping up. Whatever it may turn out to be, the beast seems to be nocturnal in its habits and to resemble a very large hyæna, an animal in which the proportions of the fore and hind limbs are much as in some Chalicotheres.

It is to be hoped that great efforts will be made to settle what this creature is, since, if the suggestion made above turns out to be correct, it will be a discovery of far greater interest than the Okapi. It does not seem at all improbable that, in such a country, even a large nocturnal animal might escape notice for a long time: even in England few people have ever seen a badger in the wild state.

Obituary.

THE HON. N. C. ROTHSCHILD.

BY the death on October 12, at the age of forty-six, of the Hon. Nathaniel Charles Rothschild, younger son of the first Lord Rothschild, Nature in a literal sense, entomology, and, it may be added, tropical medicine have each sustained a formidable blow. For Mr. Rothschild, whose career demonstrated in striking fashion that the pursuit of business is by no means incompatible with scientific achievement of the first rank, was at one and the same time an active partner in the firm of Messrs. N. M. Rothschild and Sons; the mainstay of the Society for the Promotion of Nature Reserves, to which he contributed practically all the funds at its disposal; and the leading authority on the Siphonaptera, or fleas, certain species of which are responsible for the dissemination of plague.

In 1895, on leaving Harrow, where, in conjunction with the late J. L. Bonhote, he had already while still a schoolboy produced a volume on the local butterflies and moths, Charles Rothschild went up to Trinity College, Cambridge, where three years later he obtained honours in Part I. of the Natural Sciences Tripos. After entering the City, besides devoting himself to his more immediate interests at New Court, Mr. Rothschild became chairman of the Alliance Assurance Company. The outbreak of the War caused him to become closely connected with, and to undertake most important work for, more than one Government Department; and his father's various duties, which were assumed by Mr. Rothschild on the death of the former in the spring of 1915, added to the strain of his many responsibilities. Overwork, cruelly prolonged, resulted in 1916 in a nervous breakdown, and from this Charles Rothschild never fully recovered; so that his lamented death at a comparatively early age was clearly an after-result of the War.

Mr. Rothschild, who was a Justice of the Peace and had been High Sheriff for Northamptonshire, was also a lieutenant for the City of London, and was president of the Entomological Society of London in 1915 and 1916. In addition, he was a fellow or member of many scientific and learned societies both at home and abroad, and had been a member of the honorary committee of management of the Imperial Bureau of Entomology, from the formation of the latter, as the Entomological Research Committee, in 1909. His presidential address to the Entomological Society on January 19, 1916, consisted in the main of an earnest plea for the preservation of many species among the British fauna and flora, now fast disappearing, or on the verge of, at any rate, local extinction; and appealed for support for the Society for the Promotion of Nature Reserves, and for the work of the National Trust for the Preservation of Places of Natural Beauty or Historical Interest.

Even in these days of specialisation, it is given to few zoological systematists to possess an encyclopædic and practically unique knowledge of an entire group. But Charles Rothschild soon became, as he remained until the end, the leading authority upon Siphonaptera; and to him, more than to any other, existing, accurate knowledge of the fleas of the world is due. Prior to Rothschild's day, the study of Siphonaptera lagged far behind that of most other orders of insects, and in fact, with a few notable exceptions, such as Taschenberg and C. F. Baker, had been almost entirely neglected by entomologists. Rothschild, however, was a prolific writer upon his favourite subject, and, while steadily accumulating his unrivalled collection of fleas, both exotic and endemic, he continued for a quarter of a century to diagnose and describe his material in a series of papers and monographs of the utmost value. The first papers by Mr. Rothschild on Siphonaptera (diagnoses of two new species of British fleas) appeared in 1897, when their author was but twenty years of age. Subsequently his interest was extended to the Siphonaptera of the entire world, and, in the interval between the appearance of his earliest contributions and last year, when the latest memoir written by him (a report upon the Siphonaptera collected by the Norwegian Expedition to Novaya Zemlya in 1921) was published, he was responsible, either singly or in conjunction with Dr. K. Jordan, his gifted collaborator, for a very large number of authoritative contributions to the literature of this group of ectoparasites.

Some ten years ago Mr. Rothschild, who was a generous and frequent benefactor to the Natural History Departments of the British Museum, presented to the Trustees of that institution his entire collection of Siphonaptera and other ectoparasites, with the proviso that the collection should remain in his hands during his lifetime. It is understood that the donor also set apart a sum of money, the interest of which, when the collection is handed over to the nation, is to be applied to its maintenance and improvement. E. E. A.

MR. WILLIAM THOMSON.

MR. WILLIAM THOMSON, F.R.S.(Ed.), F.I.C., the eminent Manchester consulting chemist and analyst, who died suddenly in his Laboratory on October 4, was a prominent figure in the chemical circles of Manchester and London during the last fifty years. Born in 1851 in Glasgow, he went to Manchester in 1869, and entered as assistant to Dr. Crace-Calvert at the Royal Institution Laboratory in Princess Street. Four years later, on August 25, 1873, at the age of twenty-two, he became a partner in the firm of Crace-Calvert and Thomson, and on the death of Dr. Crace-Calvert two months afterwards, took sole charge of the practice, and combined with this the office of public analyst for Stockport, which he continued to the time of his death.

Mr. Thomson joined the Manchester Literary and Philosophical Society in 1873, and served on the council for many years, acting as president from 1917 to 1919. The Society is the richer for his contributions on different subjects of scientific interest, some of which during his lifetime developed into renowned discoveries. Only in November of last year he presented to the Society the actual tubes containing sulphides of calcium, barium, etc., with which in 1877 he brought to the notice of Sir William Crookes the phosphorescent properties of these substances. They proved to be the first of three steps which led to the discovery of X-rays by Prof. Röntgen. He is also known for his work on the detection of arsenic in beer during the

outbreak of arsenical poisoning some years ago, and for his indefatigable and original work on the amount of soot in the smoke-laden atmosphere of Manchester. His efforts in association with the Manchester and Salford Sanitary Association to obtain a purer atmosphere should be a memorial to him among the public of that city.

In recognition of his many original contributions to science, Thomson was elected a fellow of the Royal Society of Edinburgh in 1876. He was also one of the original members of the Society of Chemical Industry, was elected to the committee in October 1884, and acted as chairman of the Manchester Section for some years. He was a prominent member of the Institute of Chemistry, of which he was elected a fellow in 1877; he served on the council from 1887 to 1890 and from 1893 to 1896. For some years also he was on the committee of the Society of Dyers and Colourists. He was the author of a book on "The Sizing of Cotton Goods," of which the first edition was published in 1877 and the second in 1879.

SIR WILLIAM RICE EDWARDS, K.C.B., K.C.I.E., C.M.G.

THE death on October 13 of Major-General Sir William Rice Edwards from pneumonia, after a very brief illness, at the comparatively early age of sixty-one, has come as a great shock to his many friends, and especially to the members of his service, who trusted and honoured him as their chief and loved him as an upright and sporting gentleman. He studied at the London Hospital, took the M.B. with honours and later the M.D. of Durham, and entered the Indian Medical Service in 1886, serving in his earlier years at the Eden Hospital, Calcutta, and on Lord Roberts's staff in India and later during the South African War, and was Residency Surgeon in Kashmir for some years before selection for the administrative grade. After a successful period as Surgeon-General, Bengal, where his abilities and accessibility endeared him to all who had the privilege of serving under him, he succeeded Sir Pardey Lukis in 1918 as Director-General at the most critical period in the history of the Indian Medical Service. He fought unflinchingly, without the least regard to his personal prospects, for the Service, first to obtain justice with regard to the increased pay recommended by the Public Services Commission, and afterwards to lessen, so far as possible, the disastrous effects of the Montague reform scheme. He succeeded in the first, with the help of the British Medical Association, but regretfully admitted, when speaking as chairman of the I.M.S. dinner only last June, that he had failed to a large extent in the latter superhuman task. He did much to foster the scientific work of the bacteriological department, while the successful organisation of the Calcutta School of Tropical Medicine was due in no small degree to his invaluable support.

BY the death, on September 4, of Prof. Dr. Paul Friedländer another favourite and successful pupil of Adolf von Baeyer has passed away. He had many friends and was highly esteemed by his colleagues beyond the boundaries of his native country. Paul Friedländer was born in 1857 at Königsberg, Prussia, where, having finished his school education, he began his academic studies under Graebe, and continued them in Strasbourg and Munich under A. v. Baeyer in 1878, whose private assistant he was at the time. From 1884 to 1887 Friedländer was chief chemist of the scientific laboratory of the Oehler Works at Offenbach a.M. Afterwards he entered upon his academic career in 1888 at Karlsruhe, where he was made professor-extraordinary in 1889; from 1895 to 1911 he was professor at the Museum of Industrial Technology in Vienna, whence he passed to Darmstadt as professor of chemistry of dyestuffs. Friedländer's most important work was connected with the group of indigo dyes; he found that the ancient Tyrian purple, the dyestuff of the shellfishes, contains highly brominated indigo derivatives; his discovery of thio-indigo red, a sulphur derivative of indigo, was most important in the development of vat dye manufacture, and enabled Friedländer to find a number of new compounds. His main literary work is well known and in daily use by colour and dyestuff chemists, though, so far as we know, published in German only.

MR. ARTHUR L. DEARLOVE, who died on October 19, was a well-known consulting engineer. He was senior partner in the firm of Messrs. Clark, Forde and Taylor. He superintended the laying of many thousands of miles of submarine cable, and did a large amount of cable work during the War. He did much careful research work on the Clark and Weston standard cells, and contributed largely to the technical journals.

WE regret to announce the following deaths:

Prof. Carl Harries, honorary professor of the Technical High School at Charlottenburg, and formerly professor of chemistry at Kiel, who was known for his work on the action of sodium on isoprene, aged fifty-seven.

Prof. P. W. Latham, formerly Downing professor of medicine in the University of Cambridge, on October 29, aged ninety-one.

Dr. Charles Frederick Millspaugh, curator of the department of botany of the Field Museum, Chicago, and professor of botany at the University of Chicago and the Chicago Medical College, on September 15, aged sixty-nine.

Prof. F. P. Spalding, of the School of Engineering of the University of Missouri since 1900, on September 4, aged sixty-six.

Dr. J. E. Stead, F.R.S., president of the Iron and Steel Institute 1920–21, on October 31, aged seventy-two.

Dr. A. Stutzer, the well-known agricultural chemist of the University of Königsberg, who has carried out many researches both alone and with collaborators on Chile saltpetre, soil organisms, and nitrifying and denitrifying bacteria, on September 3, aged seventy-four.

Prof. James Sully, emeritus professor of philosophy, University College, London, on November 1, aged eighty-one.

Current Topics and Events.

H.M. THE KING has approved of the following awards this year by the president and council of the Royal Society :—A Royal medal to Sir Napier Shaw, for his researches in meteorological science ; a Royal medal to Prof. C. J. Martin, for his researches on animal metabolism. The following awards have also been made by the president and council :—The Copley medal to Prof. H. Lamb, for his researches in mathematical physics ; the Davy medal to Prof. H. B. Baker, for his researches on the complete drying of gases and liquids ; and the Hughes medal to Prof. R. A. Millikan, for his determination of the electronic charge and of other physical constants.

THE following is a list of those recommended by the president and council of the Royal Society for election to the council at the anniversary meeting on November 30 :—*President* : Sir Charles Sherrington ; *Treasurer* : Sir David Prain ; *Secretaries* : Mr. W. B. Hardy and Mr. J. H. Jeans ; *Foreign Secretary* : Sir Arthur Schuster ; *Other Members of Council* : Sir Frederick Andrewes, Prof. C. G. Barkla, Sir William Bragg, Prof. W. E. Dalby, Prof. A. S. Eddington, Prof. T. R. Elliott, Prof. E. S. Goodrich, Sir Sidney Harmer, Sir Thomas Holland, Sir Frederick Keeble, Prof. T. R. Merton, Prof. H. F. Newall, Prof. D. Noel Paton, Dr. A. Scott, Mr. F. E. Smith, and Prof. J. F. Thorpe.

ON Saturday, November 3, His Majesty the King of Sweden, accompanied by Baron Palmstierna, the Swedish Minister, and the Royal Suite, visited the Linnean Society's rooms in Burlington House, and was received by Dr. A. B. Rendle, the president, the officers, council, and staff. An inspection was made of the various objects of interest connected with the great Swedish naturalist, Carl von Linné, such as his herbarium and zoological collections, manuscripts, correspondence, and volumes copiously annotated by their author. Before leaving, the King signed the Roll and Charter Book of the Society, on the emblazoned vellum page specially prepared for signature.

ACCORDING to a telegram from New York which appeared in the *Times* of October 31, an expedition of the Smithsonian Institution, of which Dr. J. P. Harrington is the head, has discovered, at Santa Barbara, in California, two human skulls for which a very high antiquity is claimed. They are said to belong to an era far earlier than that of Neanderthal man. The evidence upon which this claim is based would appear to be a low forehead and very pronounced eyebrow ridges. The mouth cavity is extremely large and the walls of the skull very thick. They are said to be twice the thickness of ancient Indians' skulls. Until more detailed evidence is available, judgment must be suspended as to the likelihood of this claim to a high antiquity being substantiated ; but it may be pointed out that skulls exhibiting Neanderthaloid characteristics, especially in the pronounced eyebrow ridges, have been found on more than one occasion in the United States. Although a great age has been attributed to them, upon further examination they have been pronounced to be merely a relatively modern variety of the Indian type. It is significant that the new Santa Barbara skulls were associated with a material culture, implements, fish-hooks, etc., which is said to show a great advance upon any culture that can be associated with Neanderthal man.

THE *Times* of November 1 contains an interesting account by its Peking correspondent of some results of the American Expedition to Mongolia organised by Prof. Osborn and led by Mr. R. C. Andrews, which included Mr. W. Granger as palæontologist, and Mr. F. K. Morris as zoologist. The expedition was despatched in consequence of the reported existence of vertebrate fossils in Mongolia. Mr. Andrews, in a preliminary visit to the area, found indications that a systematic search might yield a rich harvest of Mesozoic vertebrates. The expedition with five motors and seventy camels travelled through Kalgan to part of the Gobi Desert—about 300 miles south-west of Urga. Excavations there resulted in the discovery of seventy skulls and twelve complete skeletons. The local conditions are so favourable for the perfect preservation of fossils that fourteen fossil reptile eggs were found, one of which contains an embryo of an unhatched Dinosaur. Five eggs were found in a nest close beside the skeleton of what was presumably the parent reptile. The shells had been cracked and gradually filled by the fine, wind-blown dust which formed the loess. The skeletons are Mesozoic Dinosaurs and are regarded by Prof. Osborn as the ancestors of the famous fossil horned reptiles of Montana. One of them has been named *Protoceratops andrewsi*. Prof. Osborn considers that the Dinosaurs developed in the northern plains of the Old World and thence crossed into America through northern China. The collections are being taken to the American Museum in New York. It is hoped that funds will be raised to continue the work in Mongolia on a still larger scale. Preliminary technical reports on the discoveries have been already published in America, and announced by members of the expedition to the Geological Society of China.

THE foundation ceremony at Sukkur in the Province of Sind, India, on October 24, when Sir George Lloyd, the retiring Governor of Bombay, laid a stone which marks the commencement of operations for the construction of an irrigation barrage, is worthy of more than the casual note which has appeared in the daily press. It marks the inception of, perhaps, the largest and most impressive irrigation scheme constructed in any part of the world. Sind, which is one of the driest tracts in India, depends for its irrigation upon inundation canals from the river Indus, the overflow from which is sporadic and fluctuating. In flood times there is a full supply of water ; during the cold season only the most fortunately situated areas obtain any supply at all, while a minimum of 20,000 cubic feet of water per second runs waste to the sea. It is the object of the barrage

to regulate the flow so as to secure an adequate supply throughout the year. The barrage structure will be the largest of its kind in the world, far exceeding the Assuan Dam. It will measure 4725 feet between the faces of the regulators on each side. These regulators are seven in number, and of the canals they feed, three will be wider than the Suez Canal, and the central rice canal will have a discharge equal to that of the Thames. The gross area commanded by the works embraces 7½ million acres, of which 6½ million acres are culturable, and an annual area of 5⅓ million acres under irrigation is contemplated. The total cultivated area in Egypt is thus exceeded by half a million acres in this one scheme for a single province in India. The estimated outlay on the project amounts to more than twelve millions sterling.

APPARENTLY the principle of organic evolution is still under public discussion in the United States through Mr. W. J. Bryan's campaign against it. The Journal of the Washington Academy of Sciences (vol. 16, No. 13, October) contains the following amusing comments by Dr. C. W. Stiles from the Proceedings of the Biological Society of America, which is affiliated with the Academy: "According to Mr. Bryan's premises, all germs which cause disease must have been created in the beginning as they exist to-day. If it is to be conceded that these germs were originally created in some form other than as disease germs, the theory of evolution stands admitted. Obviously, since Adam was the last animal created and since the animals were not created until after the plants, it is unthinkable that any of the numerous germs which cause disease were created after Adam. Since disease germs are dependent for their existence upon animals and plants in which they cause disease, it is clear that these germs could not have been created or have existed prior to the creation of their victims. A challenge of this deduction would be an admission that the germs were not created as they are to-day, but that they later evolved into disease germs; but this would be an admission of evolution. Therefore, if Mr. Bryan's challenge is to be accepted, we must conclude that Adam harbored every germ disease which is characteristic of man or dependent on man for its life cycle."

A CRITICAL examination of Berthelot's work on Arabic chemistry has been published by Mr. E. J. Holmyard in *Chemistry and Industry* (Oct. 5 and 12). The criticism is arranged under three headings, dealing respectively with Berthelot's qualifications for his task, with his choice of material, and with his treatment of the material chosen. It is concluded that Berthelot undoubtedly possessed the necessary scientific qualifications, but was hampered by having to rely on translations from the Arabic which were not wholly accurate from a technical point of view. He also devoted his attention to three points only, namely, the Arabic originals of Latin works, to the influence of the Greek alchemists, and to the works of Jābir ibn Hayyān and their relation to the Latin works of Geber. The choice of material in the last case was quite inadequate. Berthelot's treatment of the material chosen was arbitrary and sometimes superficial, the most important Latin work at his disposal ("Liber de Septuaginta") receiving insufficient consideration. Although some recent criticism of Berthelot's undoubtedly great services to the history of chemistry has probably gone further than is justifiable, the conclusions of Mr. Holmyard, if accepted, will make it necessary to exercise great caution in following the French author in his treatment of Arabic chemistry. The great gap in our knowledge of the middle period of Arabic chemistry, to which Mr. Holmyard refers, will have to be filled in before any definite conclusions can be drawn as to the general influence of the workers of Islam on the progress of chemical thought. It may even now be asserted, however, that the judgments of previous historians may require modifications in several directions. Although some distinguished Orientalists abroad, notably Prof. E. Wiedemann and Prof. Ruska, have performed most valuable services in the region of Arabic science, the attention of other students is much to be desired.

DR. H. LEVINSTEIN, who is a member of the scientific committee directing the chemical exhibits for the British Empire Exhibition at Wembley, in the course of some remarks made recently, stated that the pure chemistry exhibit is being organised by a committee representing all the relevant scientific societies, supported and greatly assisted by the advice and co-operation of the Royal Society. The intention is to produce an exhibit which will make plain to the world what British men of science have done and are doing to build up the science of chemistry as it is known in the world to-day. The pure chemistry exhibit at Wembley should for ever destroy the illusion, which had some justification in the past, that British university training and research in chemistry is below the highest standard of other countries. This would not have been true in the same sense thirty years ago. The following conveners have agreed to organise the various sections of the chemical exhibit: Sir Ernest Rutherford (structure of the atom), Prof. J. C. McLennan (spectroscopy), Sir Henry Miers (crystallography and crystal structure), Dr. A. Lapworth (valency theories and theories of chemical combination), Dr. T. Slater Price (photography), Prof. F. G. Donnan (general physical chemistry), Dr. Alexander Scott (atomic weight determination), Mr. A. Chaston Chapman (analysis: hydrogen ion concentration), Prof. E. C. C. Baly (general inorganic), Prof. A. Smithells (flame, fuel, and explosion waves), Dr. Henry and Prof. F. L. Pyman (organic chemistry), Mr. J. L. Baker (biochemistry), Sir John Russell (agricultural chemistry), Principal J. C. Irvine (sugars), Prof. G. G. Henderson (terpenes), Prof. I. M. Heilbron (plant colouring matters), Dr. J. T. Hewitt (coal-tar colouring matters), Prof. J. F. Thorpe (general organic chemistry), Mr. C. F. Cross (cellulose), Dr. E. F. Armstrong (catalysis), Mr. W. F. Reid (explosives), Dr. W. R. Ormandy (plastics), Commander

R. E. Stokes-Rees (apparatus), Prof. J. W. Hinchley, (chemical engineering), Mr. R. B. Pilcher (historical).

THE first World Power Conference will be held on June 30–July 12 next at the British Empire Exhibition. It has been promoted by the British Electrical and Allied Manufacturers' Association (the B.E.A.M.A.), in co-operation with many technical and scientific institutions. The subject discussed will be the production and generation of energy in all its forms. It is very satisfactory to notice that practically every civilised country is sending delegates, and many engineers of world-wide eminence will read papers on power generation and distribution, and on electric traction. Considering what different solutions have been standardised in the various countries, a comparison of costs will lead to results of permanent value. One point, however, that the promoters of this international conference seem to have overlooked is that the date of the centenary of the birth of Lord Kelvin is on June 26. Few, therefore, of the eminent delegates will be able to take part in the celebration. As Lord Kelvin is admittedly the greatest physicist of the Victorian age, and possibly the greatest natural philosopher since Sir Isaac Newton, foreign men of science and engineers will doubtless want to take part in our celebrations.

THE opening meeting of the new session of the Newcomen Society for the Study of the History of Engineering and Technology was held on Friday, October 26, in the appropriate atmosphere of Prince Henry's Room, Fleet Street, when the president, Loughnan St. L. Pendred, delivered his presidential address on "The Value of the History of Technology." Mr. Pendred said he had in the first instance examined what were the views held as to the use of history in general, and, in spite of all that had been written on the subject, he found it impossible to believe, for example, that the events of the Hundred Years War were of the slightest use to us in the recent struggle with Germany or that the Battle of Jutland owed anything to Admiral Mahan's examination of Nelson's orders at Trafalgar. The importance of history resided in its evolutionary characteristics, and in this aspect technology, reflecting as it does the most important endeavours of mankind from the earliest times, is as worthy of serious investigation as those natural causes by which man himself was developed from a lower creation. Strange as it may appear, development has never received a modicum of the attention that is paid to systems of philosophy, yet these have made far less difference to the world than have advances in technology. This is partly the case because, while the documentation of the ordinary forms of history is abundant, that for the relationships of human progress to technical development is scanty. Mr. Pendred also alluded to the value of the historical method in teaching technology and, by inspiration from its achievements, in the formation of character.

OCTOBER rains were heavy over the British Islands, especially in the midland, western, and south-eastern districts. In London, according to the Greenwich observations, the total rainfall for the month was 5·07 in., falling on twenty-three days. October was by far the wettest month so far this year; the next wettest month was February, with 2·65 in. The monthly total is the heaviest since July 1918, when the fall was 7·35 in.; it is the wettest October since 1882, when the measurement for the month was 5·42 in., though in 1880 the rainfall for October was 7·65 in., the heaviest for the corresponding month for upwards of 100 years. At Greenwich the rainfall this year for the ten months to the end of October is 20·37 in., which is 1·41 in. more than the normal. At Eastbourne the rainfall, measured in the Old Town, for October was 7·48 in., rain falling on twenty-three days; the measurement for twenty-four hours on the morning of October 24 was 1·51 in. In 1889 the October rainfall at Eastbourne was 8·15 in., and in December 1915 the measurement was 8·37 in. The excess of rain at Eastbourne for the last ten months is nearly 7 inches. At the Rothamsted Experimental Station, according to the *Times* of November 3, the rainfall in October measured 4·97 in., an excess of 1·91 in.; of this 3·45 in. drained through 60 inches of soil, against an average for October of 1·67 in., giving an excess of 1·78 in. The soil is saturated, and it seems probable that the winter rains will increase the supply of underground water, which is still deficient.

A GENERAL discussion on "Electrode Reactions and Equilibria" will be held by the Faraday Society meeting at the Institution of Electrical Engineers on Monday, November 26. The first session of the meeting will extend from 3 to 5 P.M., and will deal with "Conditions of Equilibrium at Reversible Electrodes." Sir Robert Robertson, president of the Society, will preside, and the introductory address will be given by Dr. E. K. Rideal. Among the speakers will be Prof. Biilman, of Copenhagen, who will read a paper on "Some Oxidation and Reduction Electrodes and their importance to Organic Chemistry." After an interval for tea the meeting will resume at 5.30 P.M., and will devote itself to the consideration of "Irreversible Electrode Effects, including Passivity and Overvoltage." Prof. F. G. Donnan, vice-president, will preside over this session, and the introductory address will be given by Prof. A. J. Allmand. At the conclusion of the meeting a dinner will be held at the Holborn Restaurant to be followed by an informal conference. Members of the Chemical Society, the Physical Society, and the Institution of Electrical Engineers, have been invited to attend this discussion. Others interested should apply to the Secretary of the Faraday Society, 10 Essex Street, London, W.C.2, from whom a full programme may be obtained.

COL. ROOKES EVELYN BELL CROMPTON, past-president, has been elected an honorary member of the Institution of Electrical Engineers.

AT a general meeting of the members of the Royal Institution held on November 5, the thanks of the members were returned to Mr. F. Coston Taylor for his donation of one hundred guineas to the research fund, and to Mr. Robert Mond for his gift of busts

and medallions of Dr. Ludwig Mond, Cannizzaro, Liebig, Berzelius, and others; statuette of Sir James Dewar, and many portraits and photographs. The death of Prof. Jules Violle, an honorary member of the Institution, was announced, and a resolution of condolence with the family was passed.

THE Dr. Mann Juvenile Lectures of the Royal Society of Arts for the new session will be delivered respectively by Prof. W. A. Bone and Mrs. J. W. Henshaw. Prof. Bone's lectures will deal with "Fire and Explosions," and be given on January 2 and 9. Mrs. Henshaw's lecture, entitled "Among the Selkirk Mountains of Canada, with Ice-axe and Camera," will be given on January 16. The lecture hour in each case will be 3 o'clock.

A TECHNICAL assistant is required by the Royal Aircraft Establishment, South Farnborough, Hants, whose duties will be research in problems relating to electric ignition. Candidates should possess an honours degree in physics or electrical engineering, or equivalent qualifications, and have had experience of research work in electrical subjects, preferably in connexion with high frequency work. Applications should be addressed to the Superintendent of the Royal Aircraft Establishment, quoting reference A20.

THE Department of Agriculture in Kenya is requiring an agricultural assistant to help the director and deputy-director of agriculture in supervising agricultural work, particularly native agricultural services. Candidates should possess a degree or diploma in agriculture, a good knowledge of tropical agriculture, and have had experience in agricultural practice. Written applications for the post should be sent to the Assistant Private Secretary (Appointments), Colonial Office, Downing Street, S.W.1, upon forms obtainable from the same address.

MR. B. M. HEADICAR, honorary secretary of the Universities' Library for Central Europe, sends us a list of German chemical literature at his disposal for exchange for similar English literature published since 1914. Alternatively any literature of scientific interest would be accepted and a *quid pro quo* exchange is not stipulated. Inquiries may be addressed to Mr. Headicar at the London School of Economics, Clare Market, London, W.C.2. The list includes volumes of the *Berliner Berichte*, *Zeitschrift für angewandte Chemie*, *Chemiker Zeitung*, "Technisch-Chemisches Jahrbuch," Abegg's "Handbuch der anorganischen Chemie," and *Zeitschrift für Chemie und Industrie der Kolloide*.

THE October number of the Journal of the Royal Photographic Society is devoted to the Society's Exhibition. It is copiously illustrated and contains several articles which refer chiefly to pictorial matters. But Dr. B. T. J. Glover, of Liverpool, writes as "a technician," and points out, with examples, how often the gradation of the prints is falsified by under exposure, over development, and manipulation, as in the making of gum prints and bromoils. Indeed with regard to bromoils he asks, "Can any one show me a bromoil print in which they [tone values] are right?" As he also gives examples that show "an exquisite quality" resulting from sound photographic technique, a study of his comments cannot fail to be of interest to those who favour pure photography as well as to those who think that photography is not good enough and seek to improve it by what they call "control."

Our Astronomical Column.

A BRIGHT METEOR.—Mr. W. F. Denning writes from Bristol that on November 3, at $6^h\ 23^m$ G.M.T., he observed a large meteor, equal to Venus in brightness, shooting downwards in the southern sky from $295\frac{1}{2}° + 6°$ to $308° - 21°$. The nucleus gave a flash at the end of its flight and left a white streak. The direction of the course of the object was from a radiant point near β Ursæ Majoris, which supplies many meteors at this time of the year and appears to be a well-defined centre of recurrent radiation at various periods of the year. The shower or showers has or have been frequently observed in the last quarter of the year and deserves more thorough investigation.

SPECTROSCOPIC AND TRIGONOMETRICAL PARALLAXES.—A. Pannekoek (*Observatory*, October 1923) gives reasons for believing that the variation of intensity of certain spectral lines is not directly a measure of the star's absolute luminosity, but of the intensity of gravity at its surface, which affects the ionisation of its atmosphere. For the same spectral class the quantity derivable from the spectrum is the ratio of luminosity to mass. The mean spectroscopic parallaxes of groups of stars will not be affected, but those of individual stars will be, if their mass differs from the mean mass of the class. For example, the trigonometrical parallax of ϵ Indi is $0{\cdot}28''$, while $0{\cdot}45''$ has been given as the spectroscopic value. If there is no error in either value, the star's mass is 2·6 times the mean mass of spectral type K5. This would thus appear to be a method of determining the masses of the nearer stars if non-binaries, while the binaries would serve to test the truth of the principle.

W. J. Luyten contributes a paper to Proc. Nat. Acad. Sci. (September 1923) in which he examines the systematic errors of trigonometrical parallaxes. Van Rhijn recently gave reasons for thinking them to be too large from a study of the proper motions and radial velocities. Luyten uses the same material as Van Rhijn, but discusses it differently. He deduces two graphs: one by grouping the stars by measured parallaxes and forming a graph connecting mean apparent magnitude with reduced parallax; the other by grouping according to apparent magnitude, and again forming a graph. He considers that the truth lies between his two graphs, and deduces that the Allegheny parallaxes are not too large, as Van Rhijn stated, but if anything too small. He further compares the absolute magnitudes deduced from the measured parallaxes with those deduced from proper motions. He thus obtains for the Ko giants the mean absolute magnitude 0·8 (two independent discussions give 0·6 and 1·0), while the trigonometrical parallaxes give 0·7, again suggesting that the latter are if anything too small.

It is useful to apply these tests, for the spectroscopic parallaxes would be affected by systematic errors in the trigonometrical ones that were used for calibration of the spectral curves.

Research Items.

INDIAN VILLAGES IN THE EASTERN UNITED STATES.—Various writers during the eighteenth century mentioned the Indian tribes in the Upper Missouri Valley, but their accounts are vague, and little was known of these tribes until the transfer of Louisiana to the United States. The condition and structure of their abandoned villages have been examined by Mr. D. I. Bushnell in Bulletin No. 77 of the American Bureau of Ethnology. Natural environment influenced the various types of structure. Thus in the densely timbered country to the north, about the head-waters of the Mississippi and far beyond, the mat- and bark-covered wigwams were developed and employed practically to the exclusion of all other forms of dwelling. But in the plains, and in the regions bordering on the great buffalo ranges, the skin-covered tipis predominated, though other forms were sometimes constructed by the same people. The earth lodges erected by the tribes in the Missouri Valley were the most interesting structures east of the Rocky Mountains, and these at once suggest the rotundas, or great council-houses, once built by the Cherokees and Creeks east of the Mississippi. The discussion of these various types of habitation is most instructive, and, as is the case with other publications of the Bureau, the monograph is fully illustrated by admirable photographs.

PURPOSIVE OR MECHANICAL PSYCHOLOGY.—In the *Psychological Review* (Vol. 30, No. 4) Prof. Wm. McDougall gives a very clear and interesting account of the rival theories of purposive and mechanical psychology. Some years ago, in his well-known book, "Body and Mind," he reviewed the position as it stood then from the historical and modern point of view; in this paper he reaffirms his belief in purposive psychology and considers that form of mechanistic psychology which is popular now, namely, that of behavourism. He admits that there is no logical reason why behaviourists should necessarily be mechanists, but shows that actually very many of them are. For certain very limited purposes mechanical psychology may have value as providing a convenient terminology; but as soon as a study of personalities is required, then the student is immediately concerned with energy, persistence, ambition, etc., qualities which the mechanistic psychology cannot explain. If a psychology is required which shall be able to explain the life of man in society or to aid those in mental distress, or to direct education, or to further the problems of ethics, politics, or economics, then that psychology must take into account purposes and motives; mechanical psychology as such can know nothing and teach nothing about human motives.

NITROGEN-FIXING BACTERIA IN LEAF NODULES.—L. A. Boodle, in an interesting note in the *Kew Bulletin* (No. 9, for 1923, p. 346), directs attention to the little-known phenomenon of nodules containing nitrogen-fixing bacteria occurring as a rule upon the leaves of some of the tropical Rubiaceæ. The bacteria occur in the seed, between the embryo and endosperm, so that the seedling is infected on germination. The bacteria then establish themselves in the leaf-buds, in a gummy secretion within the stipular sheath, and from thence enter the young leaves through stomata. The nitrogen-fixing capacity of these bacteria has been experimentally established by von Faber; Rao in India recently confirming this fact. It is interesting to learn that native practice in India and Ceylon values highly the leaves of species of Pavetta and Chomelia, which bear nodules harbouring these bacteria, for use as green manure.

NEW PLANTS.—Part iv. of the new volume (148) of Curtis's *Botanical Magazine* contains several plants of especial systematic interest. *Clethra Delavayi*, Franch, belongs to a genus regarded as having Ericoid affinities, although with free petals. Reasons have also been given for placing Clethra with the Theaceæ and Dilleniaceæ among the more primitive Parietales, but Dr. Stapf argues that our respect for the taxonomic value of gamopetaly must make us resist a recent suggestion to bring the Ericaceæ also over to the side of the Theaceæ. *Carmichaelia australis*, R. Br., is a plant belonging to a remarkable genus, almost confined to New Zealand, not before illustrated in this work. Cheeseman terms the genus the most difficult in the New Zealand flora for the systematist; "everything but the pods seems to be in a state of flux." *Rhododendron sinogrande*, Balf. f. et W. W. Smith, was regarded by Sir I. Bailey Balfour as the Chinese representative of the Himalayan *R. grande*, Wall. It is described as having "the finest leaves of any evergreen yet seen in this country." Admiral H. Lynes is quoted for an admirable description of the habitat on the Lake Chad-Nile divide where the brilliantly coloured *Hæmanthus Lynesii*, Stapf, was first discovered. The new species is illustrated from one of the last plants sent in to Kew by the late Mr. Elwes from his garden at Colesborne Park. *Wattakaka sinensis*, Stapf, is a climbing Asclepiad, which has figured under many generic names, but Dr. Stapf agrees with recent systematic reports that the Chinese species must go with its Malayan fellow, *W. volubilis*, into a separate genus, the name for which is derived from the Malayan species. *Echium cœleste*, Stapf, is another endemic species confined to a very restricted area within the Canary Islands. There are already three other endemic species of Echium known from the island of Palma, and one of these, *E. gentianoides*, like the present species, is known only from the mountains above Garafia. *E. cœleste* is perhaps the most beautiful of this striking group of endemics, and may therefore be of interest to horticulturists, as several striking hybrids have already been produced from species of Echium.

AUSTRALIAN DUNG BEETLES.—In the Records of the South Australian Museum, vol. ii. No. 3, June 1923, are several noteworthy papers on Australian insects. Mr. Arthur M. Lea treats of the dung beetles of the sub-family Coprides, but in comparison with other parts of the world Australia is poor in indigenous species of these insects. This, however, is scarcely surprising considering the dearth of large indigenous mammals. Dung beetles of several kinds have multiplied with the distribution of domestic animals, and many European species have been introduced. Several of the genera are of exceptional interest, especially Macropocopris, species of which live in fur about the anal region of marsupials, and have developed very powerful claws: one species, *M. symbioticus*, has been found in the cloaca of a wallaby.

PRAYING INSECTS OF AUSTRALIA.—The Mantidæ or praying insects of Australia are enumerated by Mr. Norman B. Tindale in the Records of the South Australian Museum, vol. ii. No. 3, June 1923. They are evidently abundantly represented. The known Australian species now number 76, including 4 genera and 16 species added by Mr. Tindale. One of the

most interesting forms is *Bolbe maia* sp. nov., which is the smallest known mantis and attains a length of only 8 mm. Mr. Tindale mentions that it came freely to light in a camp, and was so active that it was very difficult to capture; it often seized flies and other insects which had been likewise attracted. Another new mantid, *Parhierodula majuscula*, is probably the largest Australian member of the family, and the female measures 95 mm. long, while the outspread tegmina have an expanse of 113 mm. A third species, *Orthodera ministralis* Fab., seems to occur in all parts of the continent as well as in Tasmania. It exhibits a wide range of variation, which has resulted in an extensive synonymy; notwithstanding its wide distribution, it does not appear to have developed any clearly defined local races, unless the Tasmanian form is to be regarded as coming under that category.

THE EARLY PROBOSCIDEANS.—Much has been written on the genus Moeritherium, which is known from its remains in the Qasr-el-Sagha beds of the Fayūm in Egypt, and was first described by C. W. Andrews of the British Museum. H. Matsumoto (Bull. Amer. Museum Nat. Hist., vol. 48, p. 97, 1923) now reviews the species, with the aid of specimens in the American Museum of Natural History, and concludes that M. Schlasser was not justified in regarding the smaller forms styled *M. gracile* and *M. trigodon* as sexual varieties respectively of *M. lyonsi* and his species *M. andrewsi*. Schlasser retained only the last two names; Matsumoto points out that, even in that case, the name *trigodon* has priority over Schlasser's *andrewsi*. He concludes, however, that all four species are distinct, and he thus keeps the happily named *M. andrewsi* on the list. He regards some early Moeritherium as ancestral to Palæomastodon, with which three of the known species are associated in the Oligocene (or "Upper Eocene") beds. *M. gracile* is known only from the lower series, the Qasr-el-Sagha beds, here styled Middle Eocene. The author supports the views of Andrews, and emphasises the proboscidean characters as against those that have been held by others to be sirenian. He remarks that, while Moeritherium no doubt haunted watery places, its anatomy does not indicate that it was more aquatic than Hippopotamus.

GEOLOGY OF THE WEALD.—The Geological Survey of Great Britain has issued a memoir on "The Concealed Mesozoic Rocks in Kent," by G. W. Lamplugh, F. L. Kitchin, and J. Pringle (E. Stanford, Ltd., 1923; price 7*s*. 6*d*.). A great deal of interesting information is here brought together as to the floor on which the best-studied Cretaceous rocks in Britain rest, and special attention is directed to the comparison now possible of the Kimmeridge Clay of Kent with that of Dorsetshire. In the Proceedings and Transactions of the Croydon Natural History and Scientific Society, vol. 9, pt. 3 (Croydon: Roffey and Clark; price 5*s*., 1923), Mr. C. C. Fagg, president for 1922, treats of the recession of the chalk escarpment in the district south of Croydon, and shows how the dry gaps have been influenced by the lowering of the surface of the Gault. He points out that the River Mole just below Dorking tends to disappear in summer, and how, in no long geological time, it will cease to run through the gap, and will be captured by tributaries of the Wey. Numerous sections illustrate this paper. It is followed by one by Mr. G. T. McKay on meanders, dealing specially with the Mole. The influence of the veteran geologist, Mr. Wm. Whitaker, at Croydon has clearly been fruitful in guiding geological research.

CHEMICAL PORCELAIN.—An article by Dr. G. N. White on "The Manufacture of English Chemical Porcelain" appears in the *Chemical Age* for Sept. 29. The basis of all pottery is china clay, which is a complex, but relatively unstable, substance, for it decomposes at about 600° C., the products of decomposition being alumina and silica. The latter substances unite only at very high temperatures, about 1650° C.; the use of lower temperatures yields a porous product which is useless for chemical ware. Fluxes are added (*e.g.* silica and felspar mixture), so that a vitrified product results, though for chemical ware the amount added must be a minimum. The article is illustrated with photomicrographs, and types of fracture—mechanical and heat—are discussed.

DEFINITIONS OF PHOTOMETRIC QUANTITIES.—The National Illumination Committee of Great Britain has now supplemented the useful work it has already done in connexion with definitions of the chief photometric quantities by a list of symbols denoting luminous flux (F), candle power (J), illumination (E), and brightness (B). Greek letters are also proposed to indicate reflection, absorption, and transmission ratios. The aim has been twofold: (*a*) to unify existing practice, and (*b*) to avoid possible confusion with international electrical symbols. Explanations of the reasons leading to the adoption of these symbols are given in tabular form. Those for luminous flux, illumination, and brightness are already widely adopted. The only notable departure is in the adoption of "J" for candle power—a symbol general in Germany, but not elsewhere. The reason for rejecting "I," which is at present very generally used, is that this symbol is unfortunately already assigned to current in international electrical nomenclature.

CORROSION OF CONDENSER TUBES.—Some of the more important recent results of the investigations conducted for the Corrosion Committee of the Institute of Metals are contained in a paper presented to the North-east Coast Institution of Engineers and Shipbuilders on October 19 by Dr. Bengough, Mr. R. May, and Miss Pirret. Very rapid corrosion of condenser tubes is essentially a recent trouble, and takes the form of smoothly water-worn depressions, extending over several feet of the tube, and mostly in certain positions. Electrolytic protection fails to prevent it. Should a tube survive the first few weeks under the given conditions, attack of this kind is not likely to occur later. The effects are not due to uneven composition of the tubes or to surface imperfections, and laboratory experiments show that the cause is the presence of entangled air in the water, which in modern practice travels with a high velocity. The critical period in the life of a tube is its early life, before a coating of scale has had an opportunity of forming; once this scale has firmly established itself the resistance to corrosion is very greatly increased. Different waters also differ in regard to their power of foaming, those which readily foam being the most corrosive in presence of air. The attack is usually limited to certain parts of the condenser, and when defects are discovered the renewal of tubes should be limited to those parts, as the wholesale re-tubing of the condenser may mean the removal of a large number of perfectly good tubes which have already received their protective coating of scale. High water speeds and high vacua are the modern conditions that have brought about this trouble. It is suggested that the artificial production of a scale on the tubes before putting into use may be found to be practicable.

Scientific Activities in Birmingham.

THE closing days of October have witnessed two highly interesting and important functions in the educational life of Birmingham. The former of these events was the visit of Sir Robert Hadfield on October 30 to the Metallurgical Society of the University of Birmingham to receive the Thomas Turner Gold Medal and to deliver an address on "The History and Progress of Metallurgical Science and its Influence upon Modern Engineering." In presenting the medal the Principal of the University, Mr. C. Grant Robertson, stated that about three years ago a Birmingham manufacturer, desirous of commemorating the valuable work done by Prof. Turner in metallurgy, generously presented a sum of money to the University to found a Thomas Turner gold medal. The donor stated that it was his express wish that the medal should only be awarded to such persons as had rendered eminent service to metallurgy. In Sir Robert Hadfield they had a man who was not only the head of a large firm of world-wide reputation, but one who was also a fellow of the Royal Society, eminently distinguished by his own metallurgical researches. The authorities were perfectly unanimous in deciding that the first award of the medal should be made to him. Mr. Grant Robertson then handed the medal to Sir Robert, who, after expressing his deep appreciation of the honour conferred upon him, delivered his address. More than three tons of exhibits were on view, and the address was illustrated with lantern slides and a series of unique cinematograph pictures. One slide was particularly impressive. It showed Sir Robert's own motor car together with a $4\frac{1}{8}$ inch projectile. It was pointed out that the car, when travelling at the rate of 60 miles per hour, possessed exactly the same energy as the small projectile on leaving the gun with a velocity of 1100 feet per second. The cinematograph pictures were likewise highly instructive. They included, by special permission of the Directors of Artillery and Naval Ordnance respectively, pictures of the loading and firing of a 15-inch gun. This type of gun, which was used largely during the War, weighs 97 tons, is 57 feet in length, and carries a projectile weighing 1910 lb. At full elevation and with a muzzle velocity of 2500 foot seconds, the range is 20 miles.

Sir Robert's address has been printed *in extenso*, and is issued as a beautifully illustrated monograph which repays careful study. An interesting account is given of modern artillery practice, reference being made to the 18-inch naval gun, the largest yet constructed, which weighs 150 tons, but is now prohibited as the result of the Washington Conference. Armour-piercing projectiles, $1\frac{1}{2}$ tons in weight, were made by Messrs. Hadfield for this gun and could be hurled for a distance of 30 miles. Even at this extreme range they could pierce nearly one foot of ordinary steel armour. Attention is directed to the practical difficulty of hardening these projectiles, for a mass of something like 10,000 cubic inches of steel at 900° C. has to be quenched suddenly in a cold bath. This induces internal strains which may continue for weeks or months, leading to rupture during storage, unless suitable treatment is applied.

A considerable portion of the address is devoted to Birmingham itself, and contains a résumé of the lives of its great men, past and present. It is pointed out that our present Prime Minister, the Rt. Hon. Stanley Baldwin, was once a student in the Metallurgical Department of the old Mason College in Edmund Street, under Prof. Turner. So also was the present Chancellor of the Exchequer, the Rt. Hon. Neville Chamberlain, who was that evening unanimously elected an honorary member of the University Metallurgical Society. Dr. F. W. Aston, a Nobel Prizeman, is another old student of the College.

Birmingham is the second city in England, and the fourth city in the Empire, as regards population. In 1700 it contained 15,000 people, a number that had swelled in 1921 to 920,000. With these figures before us it is natural to inquire into the cause of the steady growth of the city. But upon doing so we are at once confronted with a difficulty. Most of our large industrial cities have received help from their geographical position. What does not London owe, for example, to the Thames; Liverpool to the sea; Manchester to her climate; Sheffield to her mineral wealth? But Birmingham has none of these advantages. Situated in the centre of England, one hundred miles from the sea, helped by no large river, supported by no great mineral wealth, it has nevertheless more than managed to hold its own. This is the more striking when we recollect that Dudley, with all its ancient prestige and mineral wealth, is still a small neighbour; whilst Aston, which once was of far greater importance than Birmingham, has now been swallowed up in the extension of this latter city.

Why is this? There have, no doubt, been many contributory causes. Small things ofttimes determine which rivulet, among many, shall ultimately grow into a mighty river. So with cities. In the twelfth century Henry II. granted to Peter de Bermingham the right to hold a weekly market. This much coveted privilege, though long since obsolete, exerted no small influence on the future of the town, by converting it into an important Midland trading centre. In later years Birmingham became popular for its broad-minded policy of religious toleration, which led many worthy persons to take up residence in the town, thereby strengthening its intellectual life and quickening its industrial vitality.

It not infrequently happens that those whom Nature has most richly endowed fail to achieve greatness because their path through life has been too easy. It may well prove that the very lack of natural advantages, so far from being a hindrance, has actually been one of Birmingham's greatest assets, in that it has taught the sons of Birmingham to rely upon themselves. A strong mental calibre has thus been developed together with a spirit of sturdy independence—attributes that have enabled Birmingham to raise itself to a position of eminence within the Empire. A city that can boast an intimate association with Watt, Boulton, Murdoch, Priestley, Bright, Chamberlain, and scores of others known to fame, need not fear the future.

This brings us to the second event of which we write, namely, the opening by Sir Robert Hadfield on October 31 of a new research laboratory and lecture room in the Chemistry Department of the Birmingham Municipal Technical School. The Principal, Dr. W. E. Sumpner, stated that two years ago these rooms were merely attics filled with lumber. They have now been cleared and made habitable by the Education Committee, the equipment being provided out of funds amounting to more than 400*l.* voluntarily subscribed by local firms. This recognition by manufacturers and others of the value of technical education and research is a most encouraging sign of the times. The Rt. Hon. the Lord Mayor, Alderman Sir David Davis, presided, and in his introductory remarks pointed out that the rooms could not have been opened under more auspicious conditions. The Hadfield Works in Sheffield, the home of manganese steel, are a striking example of the efficiency attainable by the co-operation of science and industry, and

no one could speak with more authority on this subject than Sir Robert Hadfield himself.

The new laboratory has been equipped more particularly for research on corrosion and its prevention. For this purpose it is provided with large corrosion tanks of varying design and with other equipment not usually found in a chemical laboratory. At one end is a dark room containing a magnificent micrographic apparatus purchased with the aid of a grant awarded by the Government Grant Committee of the Royal Society to the head of the Chemistry Department in order to enable him and his research students to study the micrography of corrosion.

As Sir Robert wisely pointed out, the object of a school laboratory is different from that of a works laboratory. The latter is designed to turn out material results; the former is primarily intended for training the men, so that when they pass into industry they will know how to tackle their problems along the most approved lines.

As a further inducement to research three prizes for theses have been offered, namely, one each by Sir Robert Hadfield, the Dunlop Rubber Company, and the Mond Nickel Company respectively. It is hoped that manufacturers and students alike will avail themselves to the full of the new facilities. It is only by the closest co-operation between science and industry that we can hope to capture that portion of the world's trade which is so essential to our national existence. J. N. F.

Aeroplane Performances.

COMPARISON of the "Wren" light plane with recent U.S.A. Navy racing and fighting aeroplanes shows the price of speed in a definite way. The following table gives some of the more significant figures:

Name.	Power.	Speed Range m./s.	Total Mass.	Lifting Surface.
Wren	4½ kw.	25/12·5=2	175 kg.	11 m²
U.S.A. sea-racer .	350 kw.	90/34 =2·6	1000 kg.	13·5 m²
U.S.A. land-racer	350 kw.	112/33 =3·4	900 kg.	14·5 m²
U.S.A. land-fighter	300 kw.	76/27 =2·8	1250 kg.	24·5 m²

The racers have less surface than many of the light planes at Lympne, and the bodies are of the same order of length and cross-section, and show the same scrupulous cleanness of line. To pass from the Wren to the racer, about eighty times the power has been concentrated within the limits of an external surface scarcely distinguishable by the layman from similar types of light plane. The speed obtained is about four and a half times greater. Thus the power required is approximately as the cube of the speed.

This rule is even more accurate in comparing the seaplane with the landplane at the fine incidences occurring at the upper limit of their wide speed ranges. It may be inferred, therefore, that the floats cost half the total power available $(90/112)^3$, in spite of some sacrifice of the lower limit of speed (landing speed), by reduction of surface. The essential inferiority of the seaplane is evident.

In the land-fighter, the inclusion of machine-gun equipment and the reduction of the all-important landing speed to 27 m./s. is obtained by roughly doubling the surface, and sacrificing one-third of the racer's speed, equivalent to about two-thirds of the power.

Great range of speed is always an index of very large margin of power, and therefore of high rate of climb, at sea-level, falling off with height and density, and finally of a high "ceiling" or limit of height attainable.

Assuming liberally in the case of the racer that 100 kw. is required for level flying at 40 m./s. near sea-level, this leaves 250 kw. for climbing. Taking the airscrew efficiency as 0·7 and g as 9·81 m./s², this gives an initial climb of $0{\cdot}7 \times 250 \times 1000$ watts/$900 \times 9{\cdot}81$ m.kg.s.$^{-2}$ =20 m./s. =1·2 km./min. To calculate the ceiling height with any accuracy much more precise data are required.

The official height record, of 10·75 km. at this date, rests with France, but the same pilot, M. Sadi Lecointe, has since claimed over 11 km. A U.S.A. claim, not officially accepted in the absence of sufficient control, gives an altitude of 12·5 km., which would mark the invasion by man of the heights of the stratosphere.

The Floor of the North Sea.[1]

THE report on the marine deposits of the south part of the North Sea, referred to below, may be characterised as being long overdue, since it is founded on about 600 samples taken by the Marine Biological Association's steamers in 1904–8, when that Society was undertaking the English share of the International investigations. How extraordinarily efficiently that share of the work was done is illustrated by the reports published on the collections and material and in the peculiar discrimination shown in the selection of these samples. It is common knowledge that much of the substance of this report was known to the Admiralty during the War, proving of value in respect to navigation in foggy and other difficult weather. The area treated, the North Sea roughly from the latitude of the Scottish border to the Straits of Dover, is an exceedingly difficult one on account of the complexity of its past geological changes and the variety of its currents, whether produced by wind or other means, acting in a comparatively shallow sea, much broken by banks (especially in its western parts) and intersected by pits and troughs, of which the Dogger Bank, depth 7 fm., and the Silver Pit, 56 fm., may be mentioned.

The samples were taken out of the material collected by a conical dredge with bag dragged along the bottom and thus selected at each haul out of a considerable quantity of deposit. The colour of the sample was carefully noted, and a series of illustrations of representative samples, showing colour and texture, is published; they are a little hard, as is inevitable with all colour-process work as compared with lithography. The estimations of the amounts of the various grades (determined by least diameters of contents) of gravels, of sands, and of silt were done quantitatively, mainly by means of a special levigating apparatus designed by the author of the report under notice. The different grades after drying and weighing were then examined and their mineral and other contents noted. The absence of the organisms of decay from the samples, which were usually of about 2 kg. weight, was interesting, worms being found still alive after 17 months in the bottles. The percentage present of each sized grade in a sample, having been carefully taken, is multiplied by

[1] Ministry of Agriculture and Fisheries, Fishery Investigations. "The Marine Deposits of the Southern North Sea." By J. O. Borley. (H.M.S.O., 15s. 1923.)

the diameter factor of the grade (least diameter in mm.) and divided by 100, so as to determine the "representative number" of the sample.

The advantage in this technique lies in the fact that the numbers increase roughly in accordance with the increased coarseness of texture of the bottom. The whole method shows a great advance in that it eliminates so far as possible human judgment. It only remained to chart the grounds in accordance with these "representative numbers," this being the basal chart, and then in respect to the percentages present of the grades it was desired to consider especially closely. This has been done in a series of twelve singularly informative charts, which are substituted for the interminable text-descriptions of many authors, a most welcome innovation here with little real loss of matter. The basal chart shows a considerable series of very irregular areas, especially numerous and irregular towards the English coast, and the rest represent the kind of analysis of the bottom material such as would be necessary for the understanding of the conditions, currents and other, that produced these areas. The text shows the actual organic and mineral constituents present in each type of ground.

Thus, while the report is eminently useful to the practical fisherman in his navigation in foggy weather and in telling him about the ground on which he is shooting his nets—each kind of ground is correlated with the abundance or rarity of different species of fish—it constitutes the publication of a research of basal importance in respect to the general erosion of the eastern coasts of England. The bottom, while influenced by land material off each estuary, shows the more gradual passage from the stones or coarse gravels of the English coast to the fine silt of the centre and to the continental sands. The causes of this distribution, so far as present knowledge goes, are attractively discussed—attrition, the grade of material kept in motion by different strengths of currents, the correlation of the areas with the currents as known by independent observations of both surface and bottom movements, and so on.

To conclude, this publication is a practical fisheries report and at the same time a research of very great scientific importance, embodying novel methods of treatment of knowledge and suggesting many further lines of research; the Ministry of Agriculture and Fisheries is to be heartily congratulated on its appearance. J. S. G.

The Physicist in the Textile Industries.[1]

THE development of the textile industries has been one of the greatest factors in civilisation, but it has been said that the great weakness of the cotton industry—and this applies equally to the other textile industries—is that it is not using to the full the immense powers bestowed on this generation by scientific discovery. In the mill, perfection of manipulation seems, at first glance, to have been attained. It may be said that, if such skill can be developed in the past without the aid of the physicist, then there is no need for him, and this, no doubt, is the attitude of some people whose conservatism still holds them members of the "rule of thumb" school. It is impossible not to admire what has been achieved by such methods, but at the same time one cannot help but wonder what advantages might have been gained had the great skill of the operative been united with the insight of a trained scientific mind. For example, if an attempt is made to probe the inner functions of any of the complicated, or simpler, machines, one soon finds how little is really known about the treatment to which the material is being subjected. On inquiry, varieties of explanation are offered, each, no doubt, a carefully weighed opinion, but still, only an opinion. The reason is that many of the investigations that have hitherto been made took place under vaguely defined, and, therefore, unscientific conditions, with the result that other experimenters have held contrary views, and valuable time has been wasted.

Might not the application of scientific methods settle such controversial matters, and possibly in the end lead to improved machines? There is no question of decrying the ability of the skilled operative; his skill based upon years of mill experience can never be attained by a man whose younger years have been spent in training for scientific work. Undoubtedly the duties of scientific workers are complementary to those of the operative. Here lies the opportunity of the physicist—to bring scientific method into the testing rooms, and even into the mill, in order to ensure that tests made upon the various products of the different machines shall be comparable with those obtained at other times, either on the same or similar machines.

[1] Synopsis of a lecture delivered before the Institute of Physics on October 22 by Dr. A. E. Oxley.

The textile industries offer an almost entirely unexplored and unlimited field for the research physicist, and it is not a question of searching for a problem worthy of investigation, but one of selecting, from the great number of attractive problems presented, a few which shall form the most trustworthy basis on which to build a secure foundation for the development of a progressive research programme. It should be remembered that physical research in the textile world is by no means in such an advanced state as it is in the metallurgical world. Although in the textile industries many of the research problems are of a physical nature, and all have a physical aspect, the number of physicists engaged is only about twenty. A brigade of trained physicists would be more in proportion to the problems urgently awaiting solution. It is safe to say that there is no other industry so much in need of co-operation with the physicist as is the great textile group.

There is one outstanding factor which must be brought to the notice of the physicist contemplating textile research, and this applies to textile materials in general. The material he has to investigate is generally of a most disturbing character on account of its variability. The result is that a very careful selection or sampling of the test specimens must be made, and in many cases very laborious series of tests are needed before a result representative of the bulk, which is the only material recognised by the manufacturer, can be obtained. This fact differentiates rather sharply the physicist of textile research from the physicist in other industries.

Slides were shown by the lecturer to illustrate the types of research on which the textile physicist is engaged. These included investigations on (1) rigidity of the single fibre, a property of fundamental importance in spinning; (2) sorting of samples (*a*) to examine the various fibre lengths in pure cottons or mixings, and (*b*) to detect what damage, if any, is caused to the fibres by the different machines; (3) regularity of threads, a property of great importance in the production of threads for weaving fabrics of fine structure; (4) oscillation stresses on threads such as are met with in weaving; and (5) the measurement of the lustre in finished threads and fabrics and the relation of lustre to doubling twist.

University and Educational Intelligence.

BELFAST.—A letter has been received by the Senate of the Queen's University intimating that the late Hugh Wisnom, of Larne, directed his trustees to invest a sum of 1000*l.* for the foundation of an annual scholarship in the University to be called the "Hugh Wisnom Scholarship," to be awarded in such manner as the governing body shall decide for the encouragement of scientific research.

BIRMINGHAM.—The first award of the Thomas Turner gold medal was made on October 30 at a meeting of the Birmingham University Metallurgical Society, when the Principal (Mr. C. Grant Robertson) presented the medal to Sir Robert Hadfield, Bart., in recognition of his distinguished contributions to the metallurgy of steel. The medal is the outcome of a gift of 525*l.* by a Birmingham manufacturer who desired to perpetuate the memory of the work done by Prof. T. Turner in the metallurgy of iron. The money was invested and is held by trustees for the provision of a gold medal, to be called the Thomas Turner gold medal, which is to be awarded from time to time to distinguished metallurgists. A portion of the fund is applied to the award of a bronze medal and a prize of books to a student to be selected annually from one of the metallurgical schools of the district. The obverse of this medal bears the profile of Prof. Turner and on the reverse is the well-known diagram published by him in 1885 showing the relation between silicon content and tensile strength of iron.

BRISTOL.—For the new degree of Bachelor of Agriculture, a curriculum extending over five years has been prescribed—two in the University, two in the recently reopened Royal College of Agriculture, Cirencester, and one in a selected farm.

CAMBRIDGE.—Mr. H. H. Thomas, Downing College, has been appointed University lecturer in botany.

A grant of 100*l.* has been made from the Balfour Fund to Mr. Cyril Crossland, Clare College, in aid of his researches into the biology of the coral reefs and banks of the South Pacific.

The Regius Professor of Physic announces a short series of lectures on the history of medicine. The lectures this term will be on November 13 and 16 at 5 P.M., on "The Hippocratean Period" and "The Alexandrian Period" respectively.

LONDON.—A course of two free public lectures on "Problems of Variation" will be given by Dr. J. W. Heslop Harrison in the department of zoology, Imperial College of Science and Technology, at 5.15 on Thursday and Friday, November 22 and 23.

THE following scholarships for 1923–24 have been awarded by the Institution of Electrical Engineers: Salomons scholarship (value 50*l.*), to Mr. James Linton (Heriot-Watt College, Edinburgh); David Hughes scholarships (value 50*l.* each), to Mr. R. MacWhirter (Royal Technical College, Glasgow), and to Mr. R. E. Banks (University, Birmingham).

MR. E. S. ELDRIDGE is the first student to pass through the Imperial College of Tropical Agriculture at Trinidad and to secure an appointment in the Colonies. He left on October 25 to take up the position of farm manager in charge of the Empire Cotton Growing Corporation's Cotton Experiment Station in Nyasaland.

PRINTING may now be taken as one of two principal subjects of study for the degree of Bachelor of Commerce of the University of Leeds, and in this connexion the Leeds Central Technical School Printing Department has been affiliated to the University.

FROM the Technical College, Bradford, we have received an illustrated prospectus for 1923–24. The College provides, in addition to part-time evening and day courses, full-time courses covering from one to four years in textile industries, chemistry, dyeing, engineering, physics, and, exceptionally, in biology. The teaching body includes 42 whole-time lecturers. Special courses in advanced study and in training in the methods of research are available, a special physical chemistry laboratory having been recently equipped for research purposes and additional accommodation provided for research in dyeing.

THE annual meeting of the Science Masters' Association will be held on January 3-5, 1924, in the buildings belonging to the Household and Social Science Department, King's College for Women, situated in Campden Hill Road, W., where, in addition to suitable accommodation for lectures, exhibits, etc., there will be residential quarters for about eighty members attending the meeting. The Association has accepted the invitation to participate in a joint conference with the members of the Royal Meteorological Society, and of the Geographical Association, to be held at Birkbeck College, London, on Thursday, January 3. The conference will discuss the present state of knowledge of meteorology and the bearing of the science on cognate school subjects.

AMONGST prospectuses issued by University College, London, for 1923–24, is one of twenty-seven pages, devoted to post-graduation courses of lectures and practical work, including special courses by the new professor of chemical engineering and six courses in the recently established department of "History and Method of Science," by Dr. Charles Singer (general, biological, and anatomical), Prof. Filon (astronomy), and Mr. W. J. Perry (anthropology). In the Rockefeller anatomy building is to be installed, in a room for cinematographic study of animal movements, equipment designed in the Marey Institute of Paris capable of taking 300 photographs a second of moving objects. Post-graduation and research students of the college in 1922–23 numbered 431, including 133 from outside Great Britain.

THE teaching of civics is receiving much attention at present in America. Prof. Edgar Dawson, of Hunter College, New York, has contributed to the Biennial Survey of Education, 1920–22, a chapter (published separately as Bulletin, 1923, No. 23) on "The Social Studies in Civic Education," in which particulars are given of some developments in this field. The new Pennsylvania State course in the social studies aims at giving effect to a conception of "civics" as training in practical good citizenship and, as such, a vital part of the schooling of every child, and even "the only justification of the tax-supported public-school system." It begins with the first year of school life and continues without a break to the end of the twelfth year, being adapted, grade by grade, to the various psychological stages through which the normal child passes. The last three years of the course are primarily intended to train pupils "to investigate, to reason, to compare, to judge." To neglect any longer the provision of specific training in the problems of American democracy, the solution of which will soon be in the hands of the secondary school pupils of to-day, is, in the opinion of the State department, to render a social cataclysm inevitable.

Societies and Academies.

LONDON.

Royal Society, November 1.—E. G. T. **Liddell** and Sir Charles **Sherrington**: A comparison between certain features of the spinal flexor reflex and of the decerebrate extensor reflex respectively. Comparison of the tetani of the knee flexor, evolved by motor nerve stimulation and by reflex excitation, shows somewhat close resemblance between them. A constant difference is the presence of after-discharge in the latter. A further difference frequently found is, the myograph records being isometric for both, a steeper ascent and sharper ascent-plateau turn for the reflex. The reflex tetanus, like the "motor-nerve" tetanus, appears to engage from its very beginning the full quota of the motoneurones that it will at any time under its further continuance engage. The steeper ascent in the reflex is due to after-discharge setting in early, so that some of the motoneurones activated by the reflex cannot respond to the immediately succeeding series of stimuli. Intensity and not duration in the external stimulus is therefore the sole arbiter of the intensity of the reflex tetanus. Similar comparison of the crossed reflex of the knee extensor with the "motor-nerve" tetani of that muscle shows that the reflex tetanus develops much the more slowly, and that the ratio between the tension developed by the reflex contraction to a single shock and that to a serial stimulus is much less than under "motor-nerve" stimulation. The reflex at its outset appears to activate only a small fraction of the quota of motoneurones that it will gradually bring into activity.—J. **Barcroft** and H. **Barcroft**: The blood pigment of Arenicola. The blood pigment of *Arenicola Marina* differs from the hæmoglobin of human blood in certain respects. The α band of the oxy-hæmoglobin is situated 18 Å.U. nearer the violet and the α band of the carbon monoxide hæmoglobin is situated 11 Å.U. nearer the violet than the corresponding human band. The dissociation curves show a greater affinity for both oxygen and carbon monoxide than those of human blood. The affinity for carbon monoxide is about 70 times that for oxygen, as compared with 250 in man and 140 in the mouse. The possibility of a relationship between the position of the bands and the affinity of the pigment for gas is discussed. The main unloading of oxygen from the pigment of Arenicola would appear to be between 1 and 3 mm. pressure. The mean oxygen capacity of the hæmoglobin per gram of Arenicola is about 0·01-0·013 c.c. A comparison between the oxygen capacity of the pigment and the total oxygen consumption of the worm shows that the pigment holds sufficient oxygen to supply the animal for 1-2 hours, and probably acts as a reserve to tide it over the period at low-water when its hole is closed.—T. **Deighton**: The basal metabolism of a growing pig. The basal metabolism of a pig has been measured at various ages from seventy-five days upwards, and it has been shown that in the pig, as in human beings, the metabolism per unit area is greatest in mid-youth. This increase of metabolism in youth seems to be directly ascribable to growth. Metabolism after the ingestion of food reaches a maximum after five hours and then declines. The rationing of pigs for maintenance and growth is discussed, and it is concluded that the curve of rationing for growth and maintenance, without fattening, cannot possibly be a two-thirds power curve.

Physical Society, June 22.—Dr. Alexander Russell in the chair.—F. **Horton**: The excitation and ionisation potentials of gases and vapours. The study of ionisation potentials dates back to the discovery of the phenomenon of the ionisation of gases by collision, but the theoretical importance of a knowledge of the least difference of potential through which an electron must fall in order to acquire sufficient energy to ionise a gaseous atom or molecule on collision with it has greatly increased since the propounding by Bohr of his theory of atomic structure. Bohr's theory predicted the possibility of an atom being excited to emit radiation by the impact of an electron having energy in excess of a definite minimum amount—an amount corresponding to an "excitation" potential less than that required for ionisation. The experimental methods of investigation may be divided into two classes: (1) Those depending on the detection of the loss of energy by the colliding electron; (2) those depending on the detection of the radiation or ionisation resulting from the collisions.

Royal Meteorological Society, October 17.—Dr. C. Chree, president, in the chair.—Sir Napier **Shaw** and D. **Brunt**: Towards a basis of meteorological theory: thirty-nine articles of condition for the middle atmosphere. The propositions refer to the "middle layers" of the atmosphere, or those from 4 to 8 kilometres above mean sea-level; that is, the region lying above the effects of the friction of the earth's surface and below the stratosphere. Owing to the normal increase of potential temperature with height, the middle atmosphere is possessed of resilience and may be regarded as made up of separate aerospheres or horizontal layers which are thermally and therefore dynamically distinct. Air will not pass from one aerosphere to another without some internal source of energy, but there is no resilience for horizontal motion within an aerosphere. That a wide field for discussion is opened is evident from quotation of No. 6 as an example: "The chief effective cause of the general circulation between the equator and the poles and the correlated circulation round the poles is the cooling of the slopes and plateaux of high land in the polar regions."

Royal Microscopical Society, October 17.—Prof. F. J. Cheshire, president, in the chair.—W. F. **Charles**: Peculiarities in the development of the ant's foot. On the inside of the lower palate of the snapdragon, and surrounding the base of the stamens, there is a series of glandular hairs containing a viscous fluid; but these capitate hairs cannot be ruptured by the ordinary claws of the insect. Within the pulvillus of each foot of ants found on snapdragon there appears to be a minute pair of forcep-like claws, developed expressly to enable the insect to grasp and pull itself along hairy surfaces. These claws were sufficiently sharp to puncture certain minute depressions upon the surface of the glandular hairs, releasing the viscous fluid and entangling the ant. The depressions on the hairs, which are covered with one epidermis only, appear to facilitate the rupture.—M. T. **Denne**: A new variable light screen for use with the microscope. The instrument consists of a cylindrical cell provided with an end plate of glass, and a piston sliding within it bearing a second glass plate arranged so that adjustment with respect to the fixed plate may be effected by a high-pitch screw and nut combined with worm gearing. A coloured or neutral-tinted fluid can be introduced between the plates. With stained preparations, the screen permits the gradual intensification of the image of certain elements at the expense of others; with unstained preparations, it gives increased visibility, while dark ground effects are distinctly improved. The range given is from total transmission to nearly extinction of the incident beam.

Industrial Applications Section, October 24.—Prof. F. J. Cheshire, president, in the chair.—Marie C. **Stopes**: The microscopy of recent coal research. Early workers like Dawson and Huxley tended to treat "coal" as if it were a uniform substance. Hence arose disputes, and apparent contradictions, one demonstrating that "coal" was made of spores, others saying that "coal" was made of wood, others of bark. Recent work has shown differences between the finer bands even in the same lump of coal, where only a few millimetres apart one zone may show a preponderance of spores, another a preponderance of leaf or stem tissue, and another a uniform glue-like texture. The four main types composing bituminous coal are fusain, durain, clarain, and vitrain. Prof. Seyler has shown similar zones in anthracite by an opaque method of examination by reflected light.

Zoological Society, October 23.—Dr. A. Smith Woodward, vice-president, in the chair.—E. A. **Spaul**: Experiments on acceleration of metamorphoses of frog-tadpoles by injection of anterior-lobe pituitary-gland extract and iodine.—A. **Subba Rau** and P. H. **Johnson**: Observations on the development of the sympathetic nervous system and suprarenal bodies in the sparrow.—H. C. **Abraham**: A new spider of the genus Liphistius from the Malay Peninsula, and some observations on its habits.—Mr. A. **Smith**: A review of the lizards of the genus Tropidophorus on the Asiatic mainland.—J. G. H. **Frew**: On the larval anatomy of the gout-fly (*Chlorops taeniopus* Meig.) and two related acalyptrate muscids, with notes on their winter host-plants.—A. **Loveridge**: (1) Notes on mammals collected in Tanganyika Territory, 1920–1923. (2) A list of the lizards of British East Africa (Uganda, Kenya Colony, Tanganyika Territory, and Zanzibar), with keys for the diagnosis of the species.

EDINBURGH.

Royal Society, October 22.—F. O. **Bower**: Remarks on the present outlook on descent. At the moment we seem to have arrived at a phase of negation in respect of the achievements of phyletic morphology. So far from presenting a tree with a single trunk, the results of comparison offer us what appears little better than a bundle of sticks. The prospects appear depressing to young aspirants, and it is said that phyletic morphology leaves them cold. But this depends very largely upon the mode of presentment. How, then, are we to proceed in inquiry as to the origin of living things? Surely by a continued study of morphology in its broadest sense. Mr. Tansley, in his address to the British Association at Liverpool, advocated the study of "process of development," that is, physiological inquiry: but he rightly recognises how "process and structure continually act and interact." Structure may be held as the record of process. Any school based primarily on "process" and with "record" relegated to the background might turn out good statisticians, but it would probably fail in converting them into historians. Provided, however, that the study of "process" and "record," that is, of physiology and morphology, be co-ordinated, all may be well with the future of phyletic morphology.

MANCHESTER.

Literary and Philosophical Society, October 23.—H. **Clay**: The economic aspect of the Ruhr problem. The Ruhr is the richest coalfield in Western and Central Europe. Before the War, its output was 60 per cent. of the coal and 80 per cent. of the coke output of Germany; it was the chief centre of the steel industry and the chief source of the coal-tar used by the dye industry and of sulphate of ammonia used in agriculture. Territorial changes under the Treaty have enhanced the relative importance of the Ruhr in Germany's national economy. The occupation by the French, coupled with passive resistance, rapidly reduced the economic activity of the Ruhr. Reparations deliveries of coal almost ceased, and 46 French blast-furnaces out of 116 were damped down between January and April. The Ruhr population was maintained by subsidies from Berlin. The dislocation of industry caused by the separation of the Ruhr and the demoralisation caused by the depreciation of the currency have steadily reduced the efficiency of German industry, until it can no longer produce at world-prices. Unemployment is growing; it is certain to increase if the Berlin (or any other) Government succeeds in floating a new, stable currency and checking inflation. It is unlikely that any German Government will be in a position to pay any reparations, so far ahead as it is practicable to look. The French are unlikely to gain any economic benefit from their occupation of the Ruhr. The policy, so far as its objects were economic, has paid insufficient regard to two fundamental truths; first, that the wealth of a country is not a stock of goods that can be seized, but the output of an organisation that continues only so long as the organisation functions; and, second, that the direction and activity of the industrial organisation responds only very slowly and incompletely to political dictation.

SHEFFIELD.

Society of Glass Technology, October 17.—A. R. **Sheen** and W. E. S. **Turner**: The effect of titania on the properties of glass. Batches were calculated on the basis of the formula, $6SiO_2$, xNa_2O, $yTiO_2$, where $x+y=2$. The first six members of this series gave glasses readily; *i.e.* where the value of y varied from 0·1 to 0·6. Above 0·8 (*i.e.* 13 per cent. TiO_2) it was found difficult to melt the glass at 1400° C. When compared with the corresponding lime and magnesia glasses, the titania-containing glasses had somewhat lower annealing temperatures, durability similar to that of magnesia glasses, and thermal expansion slightly less than that of lime glasses. Heat-resisting properties were also indicated.—A. **Cousen**: The estimation of selenium in glass. Twenty grams of finely powdered glass were dissolved slowly in hydrofluoric acid and, after standing in the cold, the products of decomposition, with the exception of selenium, were dissolved by pouring into excess of boiling water. The selenium itself was filtered off on a filter pulp pad in a Gooch crucible. From the pad the selenium was removed by treating with a dilute chlorine solution (about 1/300 N). To the filtered solution was added 1 c.c. of 5 per cent. gum arabic and 5 c.c. of ½ per cent. phenyl hydrazine hydrochloride, the whole being made up to 50 c.c. Colloidal selenium was obtained, a yellow colour slowly developing. After half an hour this colour was matched against a standard solution of sodium selenite similarly treated.

PARIS.

Academy of Sciences, October 15.—M. Albin Haller in the chair.—A. **Lacroix**: The notion of doliomorph type in lithology. The term "doliomorph" is applied to lithologic types, which, from the chemical point of view, do not correspond with their mineralogical composition. According to the usual mode of expression, quartziferous rocks, rocks with free silica,

acid rocks are regarded as synonymous. It is shown that this equivalence is not always legitimate. In the new classification, doliomorph types are not classed with rocks of the same qualitative mineralogical composition, but with those of the same chemical composition, with some of which they are heteromorphs.—Jean **Perrin**: Radiochemistry and fluorescence. Results of measurements on the disappearance of "new methylene blue" under the action of light, completing the theory proposed in an earlier communication (*C.r.*, 1923, p. 612).—L. **Joubin**: The meeting of the International Council for the Exploration of the Sea, held at Paris. An account of the work done by the committees.—V. **Grignard**, J. **Dœuvre**, and R. **Escourrou**: The constitution of natural methylheptenone. The ketone exists in two isomeric forms, and this has given rise to some uncertainty regarding its constitution. The authors have applied the method of oxidation by ozone and have estimated the oxidation products, formaldehyde (with formic acid and carbon dioxide) characterising the α-form, acetone the β-form. Methylheptenones from four different sources were examined by this method, and it was shown that the natural ketone is a mixture of both forms; the α-form is in the smaller proportion, about 25 per cent.—Ervand **Kogbetliantz**: The unicity of trigonometrical series.—F. H. **van den Dungen**: Integral equations, with several parameters and their technical applications.—N. Vasilesco **Karpen**: The mechanism of hovering flight.—J. **Guillaume**: Observations of the sun made at the Observatory of Lyons during the third quarter of 1923. Owing to bad weather, observations were possible on only sixty-two days during the quarter. The usual tabular summary is given.—Mlle. **St. Maracineanu**: A method of measurement suitable for a strong radiation. The method described is applied to the cases of polonium and actinium.—Claude **Bonnier**: Aqueous solutions of ammonium bicarbonate. When ammonium bicarbonate is dissolved in water in a closed vessel, there is evolution of gas, and pressure is set up. In the present note the influence of concentration of the solution and of the ratio of the volumes of the liquid and gas phases on the pressure is studied, and the experimental results expressed in the form of curves.—M. **Bourguel**: The preparation of true acetylene hydrocarbons by sodium amide, starting with 2-3-dibrompropylene. Hexine and cyclohexylpropine. The dibrompropylene, $CH_2Br . CBr : CH_2$ (prepared from allyl bromide), is treated with a magnesium alkyl bromide, RMgBr, under conditions exactly defined, giving the bromide, $R . CH_2 . CBr : CH_2$, and hydrogen bromide is removed from this by treatment with sodium amide. The hydrocarbons obtained are true acetylenes, and the method is a general one.—Raymond **Delaby**: The catalytic dehydration of ethylglycerol.—J. F. **Durand**: Double decompositions, in aqueous solutions, between metallic acetylides and salts.—Jean **Bordas**: A cause of error in the Iodlbauer method for the estimation of total nitrogen. The presence of tannins in substances analysed by this method causes errors due to loss of nitrous fumes.—P. **Gaubert**: The planes of Grandjean.—Emile **Belot**: A form of latent vulcanism in connexion with earthquakes and tidal waves. The experimental reproduction of a tidal wave.—E. **Rothé**: The earthquakes observed in France in the course of the year 1922. Fourteen shocks were felt during the year, a number much higher than the average. Details are given of each.—René **Souèges**: The embryogeny of the Joncaceæ. The development of the embryo in *Luzula Forsteri*.—V. **Lubimenko**: The influence of leaf wounds on the production of dry substance in green plants.—E. **Lesné** and M. **Vagliano**: The differentiation of vitamin A and the factor preventing rickets.—F. **Vincens**: A disease of the bee (muscardine) due to *Beauveria Bassiana* produced experimentally in bees. This fungus, when present in the food, is readily communicated to bees, causing death within six days.—E. **Roubaud** and J. **Descazeaux**: A bacterial agent pathogenic to the common fly, *Bacterium delendæ-muscæ*. This new coccobacillus was isolated from a spontaneous infection which occurred during the study of *Stomoxys calcitrans*. Details are given of its morphology and culture. The domestic fly is very resistant to bacterial infection, and the fact that it is attacked and killed by the new type is of great interest.—A. T. **Salimbeni** and Y. **Kermorgant**: A new spirochæte met with in the blood of patients suffering from measles.—Fernand **Wyss**: Variation in the morphology and acido-resistance of the human tubercle bacillus under the influence of a saponine.

Official Publications Received.

Memoirs of the Department of Agriculture in India. Botanical Series Vol. 12, No. 2. 1: History of the Operations against Bud-rot of Palms in South India; 2: Inoculation Experiments with *Phytophthora palmivora* Butl., on *Borassus flabellifer* Linn., and *Cocos nucifera* Linn. By W. McRae. Pp. iv+21-70. Botanical Series, Vol. 12, No. 3: Studies in Inheritance in Cotton, I. History of a Cross between *Gossypium herbaceum* and *Gossypium neglectum*. By G. L. Kottur. Pp. iv+71-133. (Calcutta: Thacker, Spink and Co.; London: W. Thacker and Co.) 1.4 rupees; 2s., each.

Bulletin of the Imperial Institute. Vol. 21, No. 1: Report on the Operations of the Imperial Institute. Pp. 290+iv. (London: John Murray.) 3s. 6d. net.

Report of the Council of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne, intended to be presented at the Annual Meeting of the Society, October 30th, 1923. Pp. 33. (Newcastle-upon-Tyne.)

Canada. Department of Mines: Geological Survey. Summary Report, 1922, Part A. Pp. 145A. Summary Report, 1922, Part D. Pp. 98D. (Ottawa: F. A. Acland.)

Canada. Department of Mines: Geological Survey. Memoir 133, No. 114 Geological Series: The Southern Part of the Sydney Coal Field, Nova Scotia. By A. O. Hayes and W. A. Bell. Pp. 108. Memoir 134, No. 115 Geological Series: Brockville-Mallorytown Map-area, Ontario. By J. F. Wright. Pp. 63+4 plates. (Ottawa: F. A. Acland.)

Canada. Department of Mines: Victoria Memorial Museum. Bulletin No. 37, Anthropological Series, No. 8: An Album of Prehistoric Canadian Art. By Harlan I. Smith. Pp. iii+195. (Ottawa: F. A. Acland.) 50 cents.

Departement van Landbouw, Nijverheid en Handel: "'S Lands Plantentuin" (Jardin Botanique de Buitenzorg). Treubia: Recueil de travaux zoologiques, hydrobiologiques et océanographiques. Vol. 3, Livraison 1. Pp. 126. Vol. 3, Livraison 2. Pp. 127-242. Vol. 3, Livraison 3-4. Pp. 243-432. (Buitenzorg: Archipel Drukkerij.)

University College of the South-West of England: Session, 1922-23. List of Members of the Court of Governors, Annual Report of the Council, Annual Report of the Senate, Accounts. Pp. 57. (Exeter.)

County Council of the West Riding of Yorkshire. Nineteenth Annual Report of the Education Committee, presented at a Meeting of the West Riding County Council on 10th October 1923. Pp. 54. (Wakefield.)

Lawes Agricultural Trust: Rothamsted Experimental Station, Harpenden. Report 1921-22, with the Supplement to the "Guide to the Experimental Plots" containing the Yields per Acre, etc. Pp. 105. (Harpenden.) 2s. 6d.

The National Institute of Agricultural Botany. Fourth Report and Accounts, 1922-23. Pp. 16. (Cambridge.)

Statens Meteorologisk-Hydrografiska Anstalt. Årsbok, 3, 1921. IV: Meteorologiska iakttagelser i Sverige, Band 63 (IV: Observations météorologiques suédoises, Vol. 63). Pp. xi+181. (Uppsala: Almquist & Wiksells Boktryckeri A.-B.) 10 kronor.

Meddelanden från Statens Meteorologisk-Hydrografiska Anstalt. Band 2, No. 1: Vegetationens Årliga utvecklingsgång i Svealand. By H. Wilh. Arnell. Pp. 80. (Stockholm.) 4 kronor.

The Indian Forest Records. Vol. 10, Part 1: The Constituents of some Indian Essential Oils. By John Lionel Simonsen. Part 11: The Essential Oil from the Leaves of *Cupressus torulosa*, Don. Pp. 10. (Delhi: Government Central Press.) 3 annas.

Tide Tables for the Eastern Coasts of Canada for the Year 1924: including the River and Gulf of St. Lawrence, the Atlantic Coast, the Bay of Fundy, Northumberland and Cabot Straits; and Information on Currents. (Issued by the Tidal and Current Survey in the Department of Marine and Fisheries of the Dominion of Canada.) Twenty-eighth Year of Issue. Pp. 75. (Ottawa: F. A. Acland.)

Tide Tables for the Pacific Coasts of Canada for the Year 1924: including Fuca Strait, the Strait of Georgia, and the Northern Coast; with Data for Slack Water in the Navigable Passes and Narrows, and Information on Currents. (Issued by the Tidal and Current Survey in the Department of Marine and Fisheries of the Dominion of Canada.) Twenty-fourth Year of Issue. Pp. 75. (Ottawa: F. A. Acland.)

Smithsonian Institution: Bureau of American Ethnology. Bulletin 79:

Blood Revenge, War, and Victory Feasts among the Jibaro Indians of Eastern Ecuador. By Rafael Karsten. Pp. vii+94+10 plates. 60 cents. Bulletin 40: Handbook of American Indian Languages. By Franz Boas. Part 2. With Illustrative Sketches by Edward Sapir, Leo J. Frachtenberg, and Waldemar Bogoras. Pp. v+903. (Washington: Government Printing Office.)

Iowa Geological Survey. Vol. 28: Annual Reports, 1917 and 1918, with Accompanying Papers. Pp. viii+558. (Des Moines.)

Smithsonian Institution: United States National Museum. Bulletin 125: North American Later Tertiary and Quaternary Bryozoa. By Ferdinand Canu and Ray S. Bassler. Pp. vii+302+47 plates. (Washington: Government Printing Office.) 75 cents.

Smithsonian Institution: United States National Museum. Contributions from the United States National Herbarium. Vol. 23, Part 3: Trees and Shrubs of Mexico (Oxalidaceæ-Turneraceæ). By Paul C. Standley. Pp. iii+517-848+v-xxviii. (Washington: Government Printing Office.)

Department of the Interior: United States Geological Survey. Bulletin 744: The Lime Belts of Massachusetts and Parts of Eastern New York and Western Connecticut. By T. Nelson Dale. Pp. vi+71+8 plates. 30 cents. Bulletin 751-B: Progress Report on a Subsurface Study of the Pershing Oil and Gas Field, Osage County, Oklahoma. By W. W. Rubey. Pp. iv+23-70+3 plates. (Washington: Government Printing Office.)

Department of the Interior: United States Geological Survey. Water-Supply Paper 501: Surface Water Supply of the United States, 1919-1920. Part 1: North Atlantic Slope Drainage Basins. Pp. 330+2 plates. 30 cents. Water-Supply Paper 510: Surface Water Supply of the United States, 1919-1920. Part 10: The Great Basin. Pp. vi+348+2 plates. 30 cents. Water-Supply Paper 512: Surface Water Supply of the United States, 1919 and 1920. Part 12: North Pacific Slope Drainage Basins. A: Pacific Basins in Washington and Upper Columbia River Basin. Pp. v+262+2 plates. 25 cents. (Washington: Government Printing Office.)

U.S. Department of Agriculture. Farmers' Bulletin No. 1335: Controlling the Gypsy Moth and the Brown-Tail Moth. By A. F. Burgess. Pp. ii+68. Farmers' Bulletin No. 1349: Increasing the Potato Crop by Spraying. By F. H. Chittenden and W. A. Orton. Pp. ii+22. Farmers' Bulletin No. 1352: The Tobacco Flea-Beetle in the Southern Cigar-Wrapper District. By F. S. Chamberlin and J. N. Tenhet. Pp. ii+10. Farmers' Bulletin No. 1353: Clothes Moths and their Control. By E. A. Back. Pp. ii+28. (Washington: Government Printing Office.) 5 cents each.

Department of the Interior: Bureau of Education. Bulletin, 1923, No. 27: Hampton Normal and Agricultural Institute; its Evolution and Contribution to Education as a Federal Land-Grant College. Prepared under the Direction of Walton C. John. Pp. v+118+13 plates. 25 cents. Bulletin, 1923, No. 30: An Americanization Program. By E. J. Irwin. Pp. iii+60. 10 cents. Bulletin, 1923, No. 33: Educational Hygiene. By Willard S. Small. Pp. iii+36. 5 cents. Bulletin, 1923, No. 39: Consolidation and Transportation Problems; Report of the Second National Conference on Consolidation of Rural Schools and Transportation of Pupils, Cleveland, Ohio, February 26, 1923. By J. F. Abel. Pp. 22. 5 cents. (Washington: Government Printing Office.)

R. Ufficio Centrale di Meteorologia e Geodinamica, Roma. Notizie sui terremoti osservati in Italia durante l' anno 1911. Compilate dal Prof. Giuseppe Martinelli. (Appendice al Vol. 18, 1914, del "Bollettino della Società Sismologica Italiana.") Pp. 588. (Roma.)

Department of Scientific and Industrial Research: Memoirs of the Geological Survey. Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for 1922, with Report of the Geological Survey Board and Report of the Director. Pp. iii+164. (Southampton: Ordnance Survey Office; London: E. Stanford, Ltd.) 4s. net.

Diary of Societies.

MONDAY, NOVEMBER 12.

ROYAL GEOGRAPHICAL SOCIETY (at Lowther Lodge, Kensington Gore), at 5.—Discussion of two papers on Isostasy: Doubts on Terrestrial Isostasy, Prof. A. Alessio; Abnormal Densities in the Earth's Crust disclosed by Analysis of Geodetic Data, W. Bowie.

BRITISH PSYCHOLOGICAL SOCIETY (Education Section) (at London Day Training College), at 6.—Prof. T. P. Nunn: The Philosophy of Gentile.

ROYAL SOCIETY OF ARTS, at 8.—S. H. Davies: The Cultivation of Cocoa in British Tropical Colonies. (Cantor Lecture.)

FARADAY SOCIETY (at Chemical Society), at 8.—A. J. Allmand and A. N. Campbell: The Electrodeposition of Manganese.—S. Glasstone: The Cathodic Behaviour of Alloys. Part I. Iron-Nickel Alloys.—A. L. Norbury: The Volumes occupied by the Solute Atoms in Certain Metallic Solid Solutions and their Consequent Hardening Effects.—J. B. Firth and F. S. Watson: The Catalytic Decomposition of Hydrogen Peroxide Solution by Blood Charcoal.—E. E. Walker: The Properties of Powders. Part VIII. The Influence of the Velocity of Compression on the Apparent Compressibility of Powders.—L. Anderson: (*a*) An Investigation of Smoluchowski's Equation as applied to the Coagulation of Gold Hydrosol; (*b*) The Effect of Sucrose on the Rate of Coagulation of a Colloid by an Electrolyte.—H. H. Paine and G. T. R. Evans: A Method of measuring the Rate of Coagulation of Colloidal Solutions over Wide Ranges.—J. A. V. Butler: Studies in Heterogeneous Equilibrium. Part I.

ROYAL SOCIETY OF MEDICINE (Tropical Diseases and Parasitology Section), at 8.30.—Prof. L. S. Dudgeon: Presidential Address.—Dr. E. C. Faust: Some Biological and Practical Aspects of Schistosomiasis in China.—Miss G. Le Bas: The employment of Fasciola Hepatica as a substitute for infected Snails' Liver for the Fairley reaction in Bilharziasis.

TUESDAY, NOVEMBER 13.

INSTITUTE OF HYGIENE, at 3.30.—Dr. A. M. Hewat: Pure Food Supplies.

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts), at 5.30.—A. Millar: Galician-Canadian Pole Tool Fishing Methods.

INSTITUTE OF MARINE ENGINEERS, INC., at 6.30.—Adjourned Discussion on Paper by H. J. Young and E. Wood, on Cast Iron for Marine Engine Castings from the Metallurgical and Engineering Points of View.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—A. C. Banfield: Some Interesting Optical Munitions from the Mechanical Point of View.

QUEKETT MICROSCOPICAL CLUB, at 7.30.—T. M. Offord: A Talk on Spiders.—J. Wilson: Report on Proceedings of the British Association.

ILLUMINATING ENGINEERING SOCIETY (at Royal Society of Arts), at 8.—Reports on Progress during the Vacation and Developments in Lamps and Lighting Appliances.

WEDNESDAY, NOVEMBER 14.

INSTITUTION OF AUTOMOBILE ENGINEERS (at Institution of Mechanical Engineers), at 6.30.—L. Murphy: The Misuse of the Internal Combustion Engine and Suggestions for its more efficient application.

INSTITUTION OF CHEMICAL ENGINEERS (at Engineers' Club, Coventry Street), at 7.30.—M. B. Donald and R. D. Hunneman: A Study of the Conditions of Constant Rate of Flow in Filter Presses.—M. B. Donald and C. W. Tyson: A Study of the Absorption Tower.

ROYAL SOCIETY OF ARTS, at 8.—E. Belin: The Electric Transmission and Reproduction of Writing, Designs and Photographs without Wires.

THURSDAY, NOVEMBER 15.

ROYAL SOCIETY, at 4.30.—Sir William Bragg and Prof. G. T. Morgan: Crystal Structure and Chemical Constitution of Basic Beryllium Acetate and Propionate.—G. I. Taylor: Experiments on the Motion of Solid Bodies in Rotating Fluids.—L. C. Jackson: Investigations on Paramagnetism at Low Temperatures.—L. C. Jackson and Prof. H. Kamerlingh Onnes: The Magnetic Properties of Some Paramagnetic Double Sulphates at Low Temperatures.—H. H. Potter: Some Experiments on the Proportionality of Mass and Weight.—*To be read in title only*:—Lord Rayleigh: Further Studies on the Glow of Phosphorus and its Extinction by Moist Oxygen.—Prof. H. A. Wilson: An Experiment on the Origin of the Earth's Magnetic Field.—Dr. H. Robinson: The Secondary Corpuscular Rays produced by Homogeneous X-Rays.—Lt.-Col. J. W. Gifford, with an Introduction by Prof. T. M. Lowry: Some Refractive Indices of Benzene and Cyclohexane.—J. A. V. Butler: Note on the Significance of the Electrode Potential.

ROYAL AERONAUTICAL SOCIETY (at Royal Society of Arts), at 5.30.—H. R. Ricardo: The Thermodynamics of Aircraft Engines.

INSTITUTION OF MINING AND METALLURGY (at Geological Society), at 5.30.

CHEMICAL SOCIETY, at 8.—

ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE (at 11 Chandos Street, W. 1), at 8.15.—Preceded by a Demonstration at 7.45 of various Spirochætes.—Dr. J. Gilks: Yaws in Kenya Colony.

FRIDAY, NOVEMBER 16.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—W. J. Kearton: The Possibilities of Mercury as a Working Substance for Binary Fluid Turbines.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—J. V. Lyle: Realism and Reality.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—Annual General Meeting.

SOCIETY OF CHEMICAL INDUSTRY (Chemical Engineering Group) (at Chemical Industry Club, 2 Whitehall Court), at 8.—Prof. J. W. Hinchley: A New Source of Potash, and its Industrial Exploitation.

PUBLIC LECTURES.

SATURDAY, NOVEMBER 10.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Dr. H. S. Harrison: Fashion amongst Savages.

TUESDAY, NOVEMBER 13.

WESTFIELD COLLEGE, at 5.15.—Mrs. Tufnell: A Glimpse of Czechoslovakia.

UNIVERSITY COLLEGE, at 5.30.—W. J. Perry: The Aims of Anthropology.

WEDNESDAY, NOVEMBER 14.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—W. B. Smith: The Extravagance of a Smoke-polluted Atmosphere.

UNIVERSITY COLLEGE, at 5.30.—Sir Jagadis C. Bose: The Physiology of Photosynthesis.

THURSDAY, NOVEMBER 15.

LONDON SCHOOL OF ECONOMICS, at 5.30.—F. Pick: The Problem of London Traffic: The Objects and Effects of Traffic Control.

FRIDAY, NOVEMBER 16.

IMPERIAL INSTITUTE, at 5.30.—E. Audra: France and Europe. (League of Nations Union Lecture.)

KING'S COLLEGE, LONDON, at 5.30.—C. E. M. Joad: The Philosophical Background of Music and Poetry: The Function of Music.

ROYAL SOCIETY OF ARTS, at 8.—Major H. Barnes: Hygiene and Architecture: Preventive Hygiene—Health and the Building. (Chadwick Lecture.)

SATURDAY, NOVEMBER 17.

GILBERT WHITE FELLOWSHIP (at 6 Queen Square, W.C.1), at 3.—G. Morris: The Prehistoric Survey of Selborne.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—S. H. Warren: The Cave-Paintings of Stone Age Man in Europe.