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The Social Mission of Science

NOTHING has been more striking in the recent meetings of the British Association at Blackpool than the general indignation at the prostitution of the results of scientific inquiry for purposes of warfare, and the concern at the spread of political systems which reduce science itself and other of the richest elements in our intellectual heritage to servitude.

The opening address on cultural and social values of science (see NATURE, October 3, p. 594) with its emphatic repudiation of the inhumanity and insane misuse of science in the extension of aerial warfare to the destruction of cities and the killing and maiming of women and children by poison gas, incendiary bombs and high explosives, against which the only real defence is by retaliation, found echoes in the presidential address to Section G (Engineering) as in that of Prof. Philip to Section B (Chemistry). Sir Daniel Hall, speaking on science and social organization, uttered a grim warning that while of old every autocracy ended in a revolution, the chances of its successful overthrow in the face of guns and gas to-day are very different. Moreover, control by force is being reinforced by a subtler technique of subduing minds until the population is content to be slaves.

Prof. H. J. Fleure, in a further address on the science of man and the problems of to-day, urged the claims of science and intellectual freedom against aggressive and reactionary doctrines, nationalist and others, which are put forward to-day, and, like Dr. J. S. Huxley, strongly criticized the pretensions which attempt to erect fanatical racial hatred to the dignity of a science. Equally, Lord Horder emphasized the death which the totalitarian systems brought to the scientific spirit and the dangers which attend the sacrifice of individual freedom.

On many of the great issues of the modern world, the Blackpool meeting has made it plain where scientific workers in Great Britain stand. That they have not been unmindful of the responsibility to which the recent report of the University Grants Committee referred, is a hopeful sign; and it is well to remember that many of the addresses could scarcely have been delivered in some other European countries without disastrous consequences to the speakers. Even Sir Henry Dale's plea for support of tropical medical research more commensurate with our territorial responsibilities, for example, would almost certainly have been suppressed, in other circumstances, as detracting from the idea that the State can do no wrong.

It may be said, of course, that denunciation and demonstration are not enough, and in some of the speeches efforts were made to point out definite lines of advance. Scientific workers as such, however, can have no final power over policy, national or international; and without disparaging the need for practical proposals and definite organization, in which others besides scientific workers can participate, to prevent the infamous use of scientific work, it is well to remember that science has a spiritual message which her followers must give regardless of whether others heed its warnings or not.

This message of science also found welcome expression in discussions at the British Association meetings. The influence of science upon material progress and human comfort is much more commonly understood than its effect upon the human mind. To-day it is difficult to realize the liberation of life and intellect brought about by

the works of Copernicus, Galileo and other pioneers of experimental philosophy. The principles of self-determination and self-government now accepted as democratic rights are indeed social effects of the independence of scientific inquiry involved in the new philosophy. The freedom of thought and action possessed by progressive peoples are direct consequences of the work of Galileo and other founders of experimental science.

Accordingly, it is well that scientific workers should take up the challenge which modern autocracies offer, not only to science itself but also to all that is best in man's heritage of culture. It is not for nothing that one after another of the speakers who followed Sir Richard Gregory in the discussion on cultural and social values of science deplored the decline of democracy and enlightened outlook. The whole discussion demonstrated the deep and wide respect still to be found for liberal culture, and the strength of the support which could be secured for positive action by a successful co-ordination of those connected with all cultural activities. In another discussion, on the strain of modern life, Lord Horder even more explicitly asserted his faith in the individual and in the enormous potentialities of the human spirit, maintaining that a rebirth of this spirit in British political life would be one of the best medicines our strained lives could have administered to them.

When individual freedom had been sacrificed, Lord Horder saw little chance of achieving the control through which alone he believed salvation could come to the human race. Chief among the remedies for the ill-effect of the strain of modern life he placed science, and especially science directed toward the study and development of the mind and spirit of men. So, too, Prof. Fleure pleaded for the scientific study of mankind as essential if society is to advance. Disregard of its teachings is one cause of the dislocation and disturbance which are baffling us all. Like Sir Daniel Hall, he also entered a fine plea for freedom of conscience and self-control in action on scientific grounds as the life-breath of policy and science. We cannot restrict scientific thought and imagination to defined spheres : sooner or later it must intrude everywhere.

The true aim of science is the enrichment of life, and the specific value of an education based on science is that it will encourage, if not create, a habit of acting on reason rather than emotion. Moreover, such an education could destroy the dangerous delusions which loyalties of party, country and religion are apt to foster, and teach people from their earliest years that men and women, however diverse as individuals, are collectively very much alike, and for this purpose a scientific education is more effective than a purely literary education. Science taught, not as an aid to a vocation but as part of the training of a modern citizen, may develop a habit of mind as ethical as that usually only associated with the study of what are called the humanities.

Apart from this, the cultural claims of science, as Prof. L. Hogben has pointed out, rest on the social fact that the use and measure of science intimately affects the everyday life of every citizen in a modern community. Education for citizenship, in fact, demands a knowledge of how science is misused, of the ways in which we fail to make the fullest use of science for our social well-being, and some vision of what human life could be if we planned our resources intelligently.

The cultural and spiritual claims of science need such emphasis if scientific workers are ever to make the full constructive contribution to the solution of the world problems of to-day which lies within their power. It is well, therefore, that such emphatic warnings should be uttered against the mass movements which now threaten the finest elements in the national life of almost every country. Without criticism the very life of society is stifled, and descent to the community of soldier and worker is rapid. Only as we can enlist the citizen in the constructive task of using wisely the new powers which science has placed at our disposal can we hope to preserve what is best in the world's heritage of culture, let alone to add to it.

This is the task of science in the education of the citizen. Before a new world-wide social order can be built up worthy of the limitless powers which the advance of science has put into the hands of men, the general community and its leaders must be persuaded that acquaintanceship with scientific forces is an essential condition of enlightened government. Without an adequate scientific background, it is impossible to evolve a social and political system in which progressive knowledge is used for the wisest and best purposes.

Even though some scientific workers may regard it as of little use to protest against the use of scientific knowledge in implements of war, they should not be unmindful of the necessity for science first to deliver her spiritual message

regardless of whether it is heeded or not, and for her followers to seek to achieve the educational work which is an essential condition of transition to a better order. The misgivings expressed at Blackpool find support from such wide quarters as at Washington, in Mr. Cordell Hull's address to the delegates at the World Power Conference, in meetings of chemists at Bangalore, among scientific workers at the University of Cape Town, Cambridge and elsewhere; and they indicate that scientific workers are becoming ready to study these questions intensively, and either to develop an organization through which an effective common policy is possible or secure a re-orientation of existing organizations that would be equally effective. Nowhere is this feeling stronger than in Great Britain and the Dominions Overseas and in the United States of America, and the revived interest in the effect of science on society, as well as the quickened concern displayed at the British Association meetings at the use of science in the growing preparations for war, embolden the hope that a *rapprochement* for some such purpose as this between the British Association and the American Association for the Advancement of Science may not be impossible or impracticable.

The Rise of Man

Man makes Himself
By V. Gordon Childe. (The Library of Science and Culture.) Pp. xii+275. (London: Watts and Co., 1936.) 7*s*. 6*d*. net.

PROF. GORDON CHILDE has a sense of perspective in time, which has been developed to a degree exceptional even among archæologists, who juggle with millennia; and he is little more restricted in space, for he ranges from the north of Scotland to the Valley of the Indus with a familiarity which few may emulate. He is, therefore, in a position to recommend with confidence the study of archæology as an antidote to those modern pessimists, who are disposed to doubt the soundness of the foundations upon which the belief in 'progress', inherited from the late nineteenth century, takes its stand. Neither 'age', nor century, he argues, and equally no single area marked out by geographical or national limitations, can afford material adequate for such a judgment. The impartial inquirer must survey all time, and take the whole world as his province, before he ventures to pronounce upon the trend of events in present-day civilization.

However, even if the scope of inquiry in any estimate of modern development be extended to the broadest limits possible, the impartial point of view of a scientific investigator demands an objective standard by which 'progress' may be measured. As is well known, the judgment of the historian is apt to be coloured by his ideals—or prejudices; and essays in formulating an objective test, such as "an increased command over the material resources of Nature", are liable to be called into question. Prof. Childe offers as his objective standard the evolutionary principle of "survival of the fittest", which has the obvious merit that it links the study of man with biology and palæontology, and at the same time, as interpreted by him, bridges the awkward gap between physical and cultural, which has proved a stumbling block in much theorizing. Recognizing the ambiguity, or rather lack of content, in "the fittest", he interprets his criterion of progress as an increased capacity to enable members of the species to survive. In other words, the effect of any real advance in human development, physical or cultural, is shown in a consequent increase in population, as in the sharp rise in the population curve characteristic of the years which followed the Industrial Revolution of the early nineteenth century.

In the demonstration of the content of 'progress' which follows as a necessary corollary to his test of advance in the development of man, Prof. Childe shows that prehistory affords evidence of the occurrence of a succession of revolutions comparable to the Industrial Revolution, and of no less importance in the history of civilization. Some, indeed, almost certainly must have produced more far-reaching consequences than anything of which we know in recorded history. Here he elaborates suggestions which he put forward recently in his presidential address to the Prehistoric Society. He then pointed out that while the divisions of prehistory, the Stone, Bronze and Iron Ages, have lost the general and absolute chronological significance once attached to them, and as dates must now be regarded as applying only within restricted areas and under definite limitations, they are still significant as indicating certain crucial economic changes, which affect the

whole character of the civilization of the time. In "Man makes Himself", this conception is worked out in some detail. Prof. Childe shows how the domestication of animals and plants initiated the neolithic economy and the growth of the village community, while the introduction of metals necessitated an increased specialization in prehistoric industry and commercial intercourse, which paved the way for the growth of an urban civilization, and thus ultimately of the great national and imperial organizations of the Ancient East.

An outline of the argument which forms the thread of Prof. Childe's book does less than justice to his vivid interpretation of archæological evidence as a growth of civilization and a network of interrelated cultural developments. His incidental reflections are both inspiring and delectable. In this connexion may be mentioned a timely caveat against attributing ideas and concepts to prehistoric man, which cannot be inferred directly from the archæological evidence, but rest on the analogy of primitive peoples of like culture. Prof. Childe does not believe that the Australians, for example, stopped thinking for perhaps thousands of years. May it not be, however, that a people who had attained a state of stable equilibrium in material culture, as apparently had the Australian aborigines, had also attained the limit of development in idea in that environment at an equally early stage. There is evidence of such an early arrest among certain peoples of North America. The problem needs further examination. At present the evidence is too scant for final judgment; but Prof. Childe's warning is none the less valid.

In his more strictly professional work, Prof. Childe has shown himself a master of closely reasoned archæological argument. He now gives proof that he is equally at ease in exposition on a large scale and in general terms. His professional colleagues will find his book a brilliant and stimulating study, while to the layman it will serve as a lucid interpretation of an intricate subject-matter. With Prof. Childe as tutor, none could question the value of archæological studies as an academic discipline, or as a practical guide to an understanding of the course of events in the life and development of man.

History of Science and Mathematics

(1) The Study of the History of Science
By Dr. George Sarton. Pp. v+75.
(2) The Study of the History of Mathematics
By Dr. George Sarton. Pp. v+113.
(Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1936.) 1.50 dollars each.

THESE volumes represent the substance of two inaugural lectures, (1) on the establishment of a seminary of the History of Science at Harvard University, (2) preliminary to a course of lectures on the history of mathematics. Apart from appendixes, they cover 52 and 38 pages respectively. It is observed that the history of science as an independent subject is a comparatively new study, and that, although some historical efforts were made so early as the fourth century B.C. by Aristotle's pupil, Eudemus of Rhodes, and were continued by later Greeks, while there have come down to us from the Middle Ages and modern times a whole series of writings in Arabic, Latin and other languages which might be catalogued under the heading "History of Science", nevertheless the first scholar to conceive of that subject as an independent discipline was Auguste Comte (1798–1857), and the first scholar who deserves perhaps more than any other to be called the father of the study was Paul Tannery (1843–1904). Even Tannery could write, so late as 1904, that the history of science is "nothing but an individual conception", by which he meant that it was not yet represented by a series of standard works, constituting the tradition of a definite and independent subject.

Tannery may not have been acquainted with William Whewell's "History of the Inductive Sciences from the earliest to the present times" (3 vols., 1837). This was, however, a collection of special histories, vol. 1 dealing with Greek physics, Greek astronomy, medieval physics, and astronomy from Copernicus to Kepler; vol. 2 with the history of mechanics, physical astronomy, acoustics, optics, "thermotics" and "atmology"; vol. 3 with other branches of physics, chemistry, natural history, physiology, comparative anatomy, and geology; but these histories were not brought into relation with one another so as to constitute one picture illustrating "l'évolution de l'humanité", or the progress of mankind. At the present time, what is being aimed at is rather a complete history of 'scientific thought', with the histories of the

particular sciences thrown in, as it were. So far, apparently only one modern and complete treatise of this kind exists: Friedrich Dannemann, "Die Naturwissenschaften in ihrer Entwicklung und in ihrem Zusammenhange" (4 vols., second edition, Leipzig, 1920–23). Others have been begun, two of which should be mentioned: Federigo Enriques and G. de Santillana, "Storia del pensiero scientifico", vol. 1, Milano, 1932, and "Histoire des sciences" by Pierre Brunet and Aldo Mieli (of the Académie Internationale d'histoire des Sciences), vol. 1, Paris, 1935. It is claimed that the latter work will be unique in its kind; the first volume contains 1224 pages and covers the whole of antiquity and the beginning of the Middle Ages [see NATURE, October 10, p. 630].

Dr. Sarton's volume on the study of the history of science discusses generally the nature of the qualifications required by the scholar who would write a competent history of science, and the alternative points of view from which it might be written, involving different arrangements of matter; he adds warnings as to the pitfalls of various kinds against which the writer must guard himself. For example, the date of a discovery may be different from that of its publication: it may have been communicated earlier by word of mouth to a society or a circle of friends; the date given in the colophon to an old printed book has occasionally been shown to be wrong; even the particulars as to date of death or age on tombstones have sometimes been found to be inaccurate; the historian must verify everything.

The historian of science must have some acquaintance with the whole field of advancing knowledge. "One of the most pernicious types of error to which a false or shaky knowledge of living science frequently leads is the reading of modern conceptions such as atomic ideas, energy, evolution, into ancient texts." To appreciate a scientific text fairly, it is not enough to know how much of it is true from our more advanced point of view; we must find out how much of it was considered true or would appear plausible at the time of its composition, what led up to it, what was its influence; in short, it must be placed "as exactly as possible within the complicated network of our traditions".

A difficulty arises as to the relative amount of space to be given to different periods. Dr. Sarton observes that the tendency with some scientific workers is to divide the past not into periods of equal length, but into periods of equal productivity. On that basis, "the ancient times and the Middle Ages are entirely sacrificed to our more immediate past, when the slow gestation of centuries and millenaries was suddenly followed by an amazing outburst of discoveries".

The difficulty in the allocation of space is illustrated by the case of mathematics. Cantor's great history of mathematics was in four large volumes approximately equal in size and extending to about 4,000 pages in all. The first volume covered the period from the beginnings to A.D. 1200, the second A.D. 1200–1668, the third A.D. 1668–1758, and the fourth (which had to be written by a group of specialists under Cantor's direction) A.D. 1759–99. The growth of mathematics during the nineteenth and twentieth centuries has been so enormous that a history on the same scale could scarcely be contemplated. The late Prof. Cajori calculated that a history of nineteenth century mathematics (alone) on that scale would need some fourteen or fifteen additional volumes. The remedy lies in an alteration of the scale. "As only a fraction of the ancient mathematical writings have escaped destruction, any fragment, however insignificant, is very valuable, while for modern mathematics our task must be, on the contrary, to eliminate the great majority of the available writings and consider only a few". A general history in reasonable compass is that of Gino Loria, "Storia delle matematiche", in three volumes (1929), the first of which covers the period up to the Renaissance, the second the sixteenth and seventeenth, and the third the eighteenth and nineteenth, centuries; the last volume contains a good general account of modern mathematics.

As a practicable way of diffusing a knowledge of the history of modern mathematics, Dr. Sarton suggests that it should be the duty of instructors teaching special subjects to explain their history. He illustrates this idea by the theory of elliptic functions. If the teacher, in tracing the development of the subject, introduced the main creators of it, Fagnano, Euler, Lagrange, Legendre, Gauss, Abel, Jacobi, Clebsch, Kronecker, Halphen, and if he did this part of his task well enough, his audience would become familiar with some of the leading mathematicians of the last century. Similarly with other subjects taught in the universities to advanced students.

The volumes before us conclude with classified bibliographies for the history of science and the history of mathematics respectively, covering 16 pages in the first case and 25 in the second, besides notices of the greatest mathematicians of the nineteenth and twentieth centuries to the number of 118, with references to the best available biographies, editions of their collected works and editions of their correspondence in each case. These appendixes should prove extraordinarily useful.

T. L. H.

Biography of Coffee

The Saga of Coffee:
the Biography of an Economic Product. By H. E. Jacob. Translated by Eden and Cedar Paul. Pp. 384+27 plates. (London: George Allen and Unwin, Ltd., 1935.) 15*s.* net.

COFFEE has had much to contend with since its use as a stimulant was first made known to the world, and this biography of coffee deals in a very readable way with its vicissitudes during the last four to five hundred years, and with its influence on the development of western civilization.

The author first conceived the idea of writing the economic history of this product after seeing the bonfires of coffee at Santos which have been inaugurated by the Brazilian Government to meet the menace of serious over-production. It has been stated that 600,000 bags of coffee are destroyed every month in this manner.

How coffee-drinking and coffee houses were objected to by religious, political and medical bodies, how they were opposed by the ordinary taverns and the interests of the wine and beer trades, and how they were taxed for revenue purposes make fascinating reading. So also does the influence of coffee-production on colonial expansion in the tropics by the Western nations—the Netherlands in the East Indies, France in the West Indies, Portugal in Brazil, and, later, Great Britain in Ceylon.

The author, writing of the competition of tea and its popularity in Britain, makes a serious error in attributing this to the British conquests in India in the early part of the eighteenth century. No tea was produced in India until a century later, and only then were attempts made to grow it there because the East India Company feared trouble in China, which was the only source of supply. The first tea from India was sent to Great Britain in about 1840. At the period mentioned by the author the Dutch held the monopoly for spices and coffee in the East, and the British—who were there only as traders—were forced to bestow their attention on other commodities, of which tea from China was one of the most important.

Emulsions: Theory and Practice

The Theory of Emulsions and their Technical Treatment
By Dr. William Clayton. Third edition. Pp. ix+458. (London: J. and A. Churchill, Ltd., 1935.) 25*s.*

DR. CLAYTON'S book on "Emulsions" has been transformed completely since the first edition was issued in 1923. Indeed, an inspection of the references shows that a very large proportion of the contents of the present volume is of later date than the second edition issued in 1928. The present volume may therefore be considered in most of its aspects as if it were a new publication.

The earlier chapters are naturally devoted to the fundamental principles of surface-phenomena, including air-liquid and liquid-liquid interfaces, which play so large a part in the production and stabilization of emulsions. Since water-in-oil emulsions are not formed, and stable emulsions of pure oil-in-water are limited to particles of the order of 10^{-5} cm. and to a maximum concentration of 1 in 10,000, the formation of emulsions depends on the presence of an emulsifying agent. These were formerly hydrophilic colloid such as gelatine; but in more recent years sulphates and sulphonates and sulphinates of known structure, and bases such as triethanolamine, $N(CH_2.CH_2.OH)_3$, have been used extensively.

Properties and theories of emulsions occupy two considerable and well-illustrated chapters, in which the recently defined property of 'thixotropy' plays an appropriate part; and inversion of phases is discussed in a chapter on dual emulsions. The problem of emulsification forms the subject of two chapters, concluding with a substantial section on the important process of 'homogenizing' milk and cream; but the converse process of de-emulsification is discussed in a separate chapter in which the majority of the references are of recent date, and an appendix is devoted to the separation of technical emulsions, with special reference to crude oil-field emulsions.

The practical character of the book is maintained throughout the new edition and is one of its most valuable features. Thus whipped cream is discussed in Chapter ii, and churning and

separated milk in Chapter xii, whilst the whole of Chapter viii is devoted to biological investigations of milk, etc. Chapter ix is similarly devoted to miscellaneous emulsions, including emulsified bitumen as a road dressing, emulsified oils and fats as leather dressings, margarine and salad dressings as edible emulsions, with brief references to the delustring of rayon, the sizing of paper, and the preparation of agricultural sprays.

Author and subject indexes are provided, but the latter fails to guide the reader to clear definitions of terms such as cybotaxis, dineric interface and thixotropy, which may be cited as cases where it would be of real value to quote the first usage of names which are relatively new in the literature. The new edition is of obvious merit and is likely to prove indispensable even to those who already possess one of the earlier issues.

Animal Life in the Forth Area

A Vertebrate Fauna of Forth

By Leonora Jeffrey Rintoul and Evelyn V. Baxter. Pp. lv +397 +16 plates. (Edinburgh and London : Oliver and Boyd, 1935.) 25*s*. net.

HALF a century ago, Harvie-Brown projected a great co-operative work on the vertebrate fauna of Scotland, each volume to deal with one of the zoo-geographical divisions delimited by the principal watersheds and other natural boundaries. The greater part of the scheme was accomplished, with valuable results, but some gaps remained : one of these has now been filled, through the successful undertaking by Misses Rintoul and Baxter of the task which William Evans did not live to complete. Considering the great disparity in time, the unity of the series is chiefly important on the historical side, and as a contemporary account the new book must stand on its own merits. It can well do so.

This volume on "Forth" is, indeed, of value from much more than a local point of view. It deals with a highly interesting region, which constitutes almost a cross-section of Scotland at the junction of Lowlands and Highlands, and includes a wide variety of country. The region consists of the drainage area of the River Forth, and of all the lesser streams that flow into its great estuary between St. Abbs Head and Fife Ness. On the map it appears roughly Y-shaped, two long arms enclosing the Firth of Forth and a shorter stem following the valley to its head. On the east it has its island outposts such as the Bass Rock, and on the west the land rises above 3,800 feet at the summit of Stobinian. The whole of three counties and large parts of five others are included, with fragments of three more.

There is thus a great diversity of environment, from the waters of the firth with their seals and gannets to the high mountains with their blue-hares and eagles. There is, too, the added interest attached to a transitional zone : it approaches, for example, the northern limit of the garden-warbler and includes the most southern point in the range of the Scottish ptarmigan. Birds, of course, bulk more largely in the book than all the other vertebrates together : the fishes are rightly dealt with quite briefly, as the purely marine forms cannot be very usefully discussed on this regional basis. The major interest is therefore inevitably for the ornithologist.

The two experienced naturalists who have written the book are well equipped for the purpose. They have lived all their lives in the area, giving much time to study of its fauna, and they have already made numerous and notable contributions to the subject. During the last ten years, moreover, they have systematically worked the area with the special object in view, visiting all parts at every season. The statements as to present status and distribution are therefore based to a remarkable extent on first-hand observation —although the help of others has also been freely used—and are definite, comprehensive and up to date. As was to be expected, the authors are particularly informative regarding migratory movements of the birds : in a special chapter they deal generally with this topic, and throughout the avifaunal section are to be found the abundant results of their well-known work on the Isle of May.

As it fortunately happens, there is also available a wealth of information relating to earlier times, and the published sources of this have been diligently and critically examined. It has thus been possible to present some picture of the effects which changes in the environment have wrought upon animal life in the area : a special chapter is devoted to this aspect, and there are also numerous references in the main body of the work which bring out points of much interest.

The modern standard for regional faunistic studies is a high one ; but Miss Rintoul and Miss Baxter have produced a volume which can take its place among the very best of its kind. A. L. T.

The Systematic Identification of Organic Compounds: a Laboratory Manual. By Prof. Ralph L. Shriner and Prof. Reynold C. Fuson. Pp. ix+195. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 11*s*. net.

INTEREST in organic identification work in the University of Illinois was first aroused by Prof. C. G. Derick in 1908, and the course was developed by Prof. O. Kamm, whose book on the subject, published in 1922, is widely known. The present volume is based on a one-semester course of two three-hour laboratory periods a week, now in force at the University of Illinois for students who have had a year of organic chemistry.

By means of a systematic examination of its solubility relationships, the unknown organic compound is relegated to one of nine solubility classes. Classification reagents are then introduced, and the search is narrowed to members of a few homologous series. Physical constants are next noted, and suitable derivatives are prepared. The subject is handled on these lines in a clear and up-to-date manner, and the book contains full practical directions, and many tables of physical constants. A later chapter deals with the separation of mixtures.

The authors have provided a useful manual for a type of work in which "the student's faculty for careful observation, his ability to make correct deductions from his observations, and his originality in planning his work are at a premium". It is clear that this sort of training provides excellent experience for those preparing for research work in organic chemistry.

Industrial Electronics

By F. H. Gulliksen and E. H. Vedder. Pp. xiv+245. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 17*s*. 6*d*. net.

IF the reader is not full of wrath when he discovers, by diligent search or by stumbling over a single sentence on page 41, that this book denies communication engineering a place in industry ("This type of equipment is used primarily for communication purposes, which is outside the scope of this book"), he will like it; its English is in general well above the level of the unhappy example which has intruded itself here. Even without its applications in the communications industry, "industrial electronics" is a wide subject of very general appeal. The engineer will find the book interesting and valuable, not merely for the large amount of detailed information which it provides on applications already effected, but also because it is stimulatingly suggestive of new applications and developments yet to be made. The authors have succeeded in compressing a great deal of information into a relatively small compass, but the compression has been carried too far; clarity and ease of reading have been sacrificed. Fig. 85, p. 67, will suffice as an example of loss of clarity which might have been avoided by adding three lines of text.

Among the applications outlined are light-sensitive controlling, indicating and recording devices (such as door controllers, smoke indicators, colour matchers), timing devices for welders, rectifiers and inverters, etc. A final and valuable section of the book deals with electronic regulators, including anti-hunting circuits, speed and voltage regulators, etc.

The book is well worth reading; its very defects stimulate thought.

Der Schwammspinner (*Porthetria dispar* L.) in Euroasien, Afrika und Neuengland

Von Dr. Karl E. Schedl. (Monographien zur angewandten Entomologie, herausgegeben von Prof. Dr. K. Escherich, Nr. 12.) Pp. iv+242. (Berlin: Paul Parey, 1936.) 16 gold marks.

THE main idea, underlying the production of the monographic series to which this memoir belongs, is to provide the latest and fullest scientific information with respect to specific subjects of economic importance. The purely scientific and economic aspects of entomology now intergrade so much that Dr. Schedl's contribution, like its predecessors, contains matter of interest to workers in both these fields. Its subject is the insect known in English as the gypsy moth which, although now extinct in Great Britain, is a pest of forest and shade trees more or less all through the South Palæarctic region to Japan. Its entry and spread in North America, and the prolonged campaign for its control on that continent by biological means, have often been recounted. In the present memoir a very complete account will be found of the biology, influence of environment, distribution, natural enemies and methods of control of this familiar insect. There is also a useful summary of Goldschmidt's famous work on sex determination, which has brought the name of gypsy moth to the notice of many biologists. The reader will, therefore, find little to complain of on the score of completeness of information, while the long list of references given will satisfy any crave to delve further into the subject. The work is well up to the standard of other contributions in its series and needs no further commendation.

A. D. I.

Die Blatt-Minen Mittel- und Nord-Europas: Bestimmungs-Tabellen aller von Insekten-Larven der verschiedenen Ordnungen erzeugten Minen. Von Prof. Dr. Martin Hering. Lief. 2: Brunella—Filipendula. Pp. 113–224+2 plates. (Neubrandenburg: Gustav Heller; 's-Gravenhage: W. Junk, 1936.)

THE attention of entomologists and botanists is directed to "Die Blatt-Minen Mittel- und Nord-Europas" (including England) edited by the well-known authority, Dr. Martin Hering. It is to be completed in 5–6 Lieferungen, each being issued at a subscription price of 12 gold marks, and the publishers state that the work will be completed by the middle of 1937. The whole monograph will comprise about 700 pp. with 500 text-figures and 7 plates. The part to hand (Lieferung 2) is arranged alphabetically under plant genera: it consists of diagnostic tables of all known leaf-miners affecting each genus referred to. The work is evidently designed to facilitate easy reference and will cover the chief aspects of its subject.

Correlation of the Coal Measures

THERE are two quite different aspects of Coal Measure correlation. In the first place, there is the desirability of dividing the thousands of feet of Coal Measure strata into zones or other subdivisions, which can be recognized in different coalfields and can be used in the comparison of sequences in different areas; in the second place, there is the demand of the mining engineer for criteria which will make it possible for him in a given area to identify individual coal seams or other rock beds. The broad zoning has its economic uses in the exploration of undeveloped areas in known coalfields and in the interpretation of deep borings into concealed coalfields. In these preliminary stages, it is sufficient to know what part of the Coal Measures has been reached, but as mining operations proceed, especially in areas where seams are much disturbed and faulted, there is need for much more precise information than can be gained from a study of zones which may themselves be hundreds of feet thick.

For many years, the methods of correlation of the Coal Measures lagged behind those used in other formations. When nearly every other system had been divided into palæontological zones, the Carboniferous rocks were still unzoned, and even then zonal methods were applied to the Lower Carboniferous before much progress was made with the Upper. Meanwhile, however, much success attended the work of geologists who used lithological characters and matched sequences with reference to the distribution of coals, and such workers as Wheelton Hind and Stobbs found valuable datum planes in the marine bands which mark temporary but widespread incursions of the sea into the area where Coal Measures were deposited.

The advances in Coal Measure correlation which have taken place in the past ten years were summarized in a discussion in Section C (Geology) of the British Association during the recent Blackpool meeting; geologists certainly can no longer be charged with neglecting the study of correlation in the rocks which are of most economic importance. It has to be emphasized, however, that the needs of the mining engineer can only be met by a scheme of correlation much more detailed than those developed in almost any other formation, and while zonal classifications of the Coal Measures are now available, efforts are being made to develop methods which will facilitate the identification of individual seams.

The most important fossils for the zoning of the Coal Measures are the plants and those lamellibranchs (*Carbonicola*, *Anthracomya* and *Naiadites*) which are now believed to have lived in 'non-marine' (if not wholly freshwater) conditions; while the marine bands form useful reference planes, they are too few and their fossils too restricted to afford a general basis for zoning. The non-marine shells have provided six major zones; these are now recognized in practically every coalfield in Britain, and a similar sequence is known on the Continent in coalfields so far afield as the Donetz basin. The precise limits of some of the zones are rather indefinite, but they appear to afford a reasonably secure basis for correlation. Several of the zones can be subdivided: Dr. W. B. Wright has used a number of sub-zones in working out the structure of the Lancashire coalfield, and Dr. J. Weir and Mr. D. Leitch have found that certain of these can be recognized in the Scottish coalfields.

In limited areas, these 'mussel' shells are often sufficiently characteristic of the roof of a seam to be an infallible means of identification. Some mussel bands have long been used in this way: in the highly disturbed anthracite area of South Wales, recognition of the worked seams by means of these faunas is now an established practice. The nomenclature of these excessively variable shells presents a difficult problem, but the closeness of correlation is greater than can be expressed by lists of specific names. Mr. S. G. Clift demonstrated this for horizons in Nottinghamshire and Scotland.

Detailed zoning by means of fossil plants is a still more recent feature of Coal Measure correlation in Great Britain, although on the Continent plant-zones were being used some years ago. The palæobotanical work of Kidston and others, however, laid the foundation of an accurate nomenclature of the plants, and by collecting systematically from an established sequence in South Wales, Dr. Emily Dix has recently been able to subdivide the Coal Measures into zones which appear to be traceable over the whole of Britain. The results of this plant correlation in all the areas yet investigated substantiate the results based on the Lamellibranchs; as plants are usually abundant in those places where shells are rare, these two methods may often be regarded as complementary.

One striking result of the closer correlation of the sequences in various coalfields has been the recognition of the wide distribution of some characteristic bands. The great extent of certain marine bands (the equivalent of the Mansfield

Marine Bed is known in practically every coalfield from Scotland to South Wales and Somerset) proves that occasionally very wide areas were submerged ; the remarkable frequency with which thick coals occur at comparable horizons in different coalfields (as at the base of the *Similis-Pulchra* Zone) also suggests a comparative uniformity of conditions at certain stages in Coal Measure times. For some years, there had been a tendency to assume that the basins in which the Coal Measures were deposited were restricted in extent and more or less coincident with the existing coalfields : it was thus thought that the freshwater shells could not be used for correlation since they were only of local occurrence. Their wide distribution and the similarity of their sequences in different countries indicate at least a free communication between the areas.

Work on the spores of the coals has likewise tended to reveal the wide lateral extent of characteristic features. The classic investigation by Dr. L. Slater and others of the distribution of megaspores in the Silkstone and Better Bed coals of Yorkshire and the Arley of Lancashire, which confirmed the correlation of the Better Bed with the Arley, already put forward by Dr. D. A. Wray on stratigraphical grounds, clearly showed the value of these methods, and lent further support to the view that the main coals of these two coalfields were formerly continuous.

More recently, Dr. A. Raistrick has developed with remarkable success a technique for the examination of the microspore content of seams. He has applied this method to the coals of Northumberland and Durham, many of which appear to have a characteristic microspore content which persists over wide areas. He has recently been investigating the difficulties which are introduced by changes in the structure of the seams and in the chemical and physical properties of the coals. The various methods of using spores (both megaspores and microspores) in correlation, and the problems which arise in that work, are also being explored by the Government Department responsible for fuel research (Mr. J. J. Walker and Dr. J. O'N. Millott gave an account of this work).

There can be little doubt that these methods will be of immense importance in the identification of seams, especially in the Lower and Middle Coal Measures, where the floral changes are most pronounced. In the highest Coal Measures, as Mr. G. A. Kellaway showed, the microspore content of successive seams is much less varied, and these methods of correlation present greater difficulties. They are likely, however, to be of great use in the parts of the Coal Measures which are most worked. They will probably supplement rather than replace the use of the plants and shells, from which conclusions can generally be reached so much more rapidly. A. E. TRUEMAN.

Bracken as a Weed

THE Brake Fern or Bracken (*Pteridium aquilinum*) is an ancient plant of world-wide distribution in temperate and even tropical parts. Although a plant favouring the less dense woodlands and deeper soils, it may invade and dominate grass or heather even on shallow soils where the winters are not too severe or the summers too dry. This characteristic has made it a serious agricultural pest not only in Britain but also in Australia and New Zealand.

During the past forty or fifty years, the spread of bracken, especially in Scotland and Wales, has been so excessive that in many cases the available grazing land has been reduced by one half or more. This is not the only loss, however, for sheep which have been struck by the maggot fly (*Lucilia sericata*) take cover in dense bracken (which they normally avoid) and die there, although many could have been saved if treated in time. These carcasses are the breeding ground for more maggots. From the farmer's point of view, bracken (i) reduces the total grazing available and the number of sheep the ground should carry, (ii) leads to loss of sheep each of a value of 20*s*.–30*s*. or more, and (iii) adds to the costs of management, as in the absence of bracken a shepherd and his dogs can work a greater area of sheep-run.

The spread of bracken is due to many causes : (*a*) mild winters, (*b*) discontinuance of its use for thatching, litter, and as a source of potash for soap and manure, etc., (*c*) spore distribution, (*d*) depopulation of rural areas, and (*e*) reduction of cattle and horse grazing. Horses and cattle do not eat bracken extensively—it possesses a cumulative poison in their case—but heavy animals tramping and grazing amidst the fronds damage it and encourage grass. Pigs are the only animals which eat it ; they dig up the subterranean stems or rhizomes.

In a moderately dense patch of bracken there will be 40 tons of rhizome and about 10 tons of fronds to the acre. The huge amount of material built up each year is used for replenishing the

depleted rhizomes, the formation of new buds for future rhizomes and fronds, for the production of spores and for the elongation of the perennating rhizome—its chief method of spreading. This may grow as much as a yard each year. In this way a 1/40 acre bracken plant could become an acre in extent in 34 years, or 24 such plants could invade 1,000 sq. yd. in a year.

Unfortunately, bracken possesses few natural insect and fungoid enemies, and none of these materially damages it when it is growing in congenial sites. The one effective measure of control is continuous destruction of the fronds, so that the rhizome is exhausted in forming new fronds. The best time is when the frond is almost completely unfolded (mid-June to early July). A second and even a third removal of the fronds may be necessary for the first two years; thereafter the plant is much weakened and a single cut per year for a further two to five years should exterminate it.

Until recently, fronds have been destroyed by the scythe or by the sickle at a rate of 0·5–3 acres per day, at a cost of 3*s*.–8*s*. per cut per acre, and this on land probably worth only a shilling or two per acre. Now various machines have been produced, and this year the Department of Agriculture for Scotland has granted half the purchase price of machines (spread over three years) for areas satisfactorily cut with the Collins' power bracken cutter or the Glaslyn bracken cutter. The former can cut more than an acre an hour and the latter about an acre an hour, thus reducing the cost to approximately 1*s*. 6*d*.–2*s*. 6*d*. per acre. This season other promising machines have been produced: (*a*) the Denny hand scythe, (*b*) for horses or tractors, the Crossley thistle cutter and the Holt bracken breaker, and (*c*) the Allan and the Gordon motor machines. Reports of a demonstration of these and the two former machines appeared in the *North British Agriturist* and the *Scottish Farmer* of September 3 and 5, 1936, respectively*, and results of their use over extensive areas will be awaited with interest.

The employment of chemical sprays and powders applied by autogiro, tractor, horse-sprayer or hand, has so far proved to be costly and clumsy compared with the cutting methods, and often the resulting growth of herbage is less satisfactory.

* *The North British Agriculturist*, **88**, No. 37, 855 (1936). *The Scottish Farmer*, **44**, No. 2277 (1936).

Developments in Electroplating

WITH the ever-growing demand for materials possessing new and more varied combinations of properties, it is seldom that any one of the commoner metals has all the properties desired for special applications. Suitable mechanical strength may be offset by susceptibility to corrosion, suitable density by insufficient hardness, amenability to mechanical processing by unsatisfactory appearance. The use of alloys of two or more metals affords one important method of escape from these limitations, especially since a small addition of an alloying element often produces profound alterations of properties. On the other hand, since it is frequently only the surface properties which particularly need modification, an alternative method is to cover the surface with a suitable coating. Thus, the metal may be coated with various enamels, paints, or lacquers; or with a thin layer of a different metal which may be applied by direct immersion in the molten metal—as in the production of tin-plate or galvanized iron—by electrodeposition from a solution of a salt of the metal, or by other means.

The two ways of using a metal to modify the properties of another—as an alloying element and as a coating—have both been extensively exploited, but their fields of application have seldom overlapped. Thus the range of utility of steel has been enormously extended by the use of coatings of tin, zinc and cadmium, but no alloys of these metals with steel have found application. Nickel has been used in both ways in relation to steel, but the applications of the respective products have been notably different. Indeed, chromium seems to be the only metal employed both for alloying with steel and as a coating on steel in order to produce the same type of result, namely, a tarnish-resisting surface.

These were among the matters discussed by Mr. D. J. Macnaughtan in introducing a symposium on electroplating before Section B (Chemistry) of the British Association at the recent meeting in Blackpool. The other papers presented were "The Development of Control in Electrodeposition Processes", by Mr. A. W. Hothersall; "Electrodeposited Coatings as Corrosion Preventives", by Dr. S. Wernick; "Non-tarnishable Finishes", by Mr. E. A. Ollard; "Advances in Industrial Electroplating", by Mr. C. F. J. Francis-Carter; and "The Future of Electrodeposition", by Dr. H. J. T. Ellingham. The whole group of papers afforded a survey of the development of electroplating

practice, and directed attention to the striking advances which have been made in recent years. The achievements of modern electroplating were effectively illustrated by means of an exhibition specially arranged in conjunction with the meeting by the Electrodepositors' Technical Society.

In the more restricted sense of the term, electroplating connotes the electrodeposition of a thin, adherent coating of a metal over the surface of a metallic object in order to provide a decorative finish, to protect the underlying metal against corrosion, tarnish or wear, or to achieve a combination of these effects. The use of the term is often extended, however, to include a number of cognate electrolytic processes such as : the electrodeposition of relatively thick and very strongly adherent layers of metal for 'building up' worn or undersized machine parts ; the production of adherent oxide coatings on aluminium and its alloys by anodic treatment (anodizing) ; and the electrodeposition of non-adherent layers of metal which, on detachment from the surface on which they are formed, faithfully reproduce details of surface structure (as in the production of electrotypes and gramophone matrices) or the complete shape of an object (electroforming).

Although electroplating became a commercial process nearly a century ago, developments during the last twenty years have been so important as to change completely the scope and status of the industry. The list of metals electrodeposited in plating practice has been extended by the important addition of chromium and, quite recently, of rhodium ; and now comprises zinc, cadmium, tin, lead, iron, cobalt, nickel, chromium, copper, silver, gold, palladium, platinum and rhodium. The anodizing of aluminium and its alloys has been introduced ; and progress has been made in the electrodeposition of two metals simultaneously, so as to produce alloy coatings such as copper-zinc, copper-tin and zinc-cadmium.

Apart from the introduction of new metals and new processes, there has been also an all-round improvement in the quality and reliability of electrodeposited coatings, and an enormous expansion of the range and scale of their applications. Electroplating is now practised as one of the regular series of operations involved in the manufacture of a large proportion of metal articles of industrial and domestic utility.

For the protection against corrosion of a wide range of iron and steel articles and fittings, electroplating with zinc or cadmium has become an important commercial process. Electrodeposited coatings of tin and, in special circumstances, of lead are also being used for this purpose ; and as a result of the new methods employed in rolling mills, whereby steel sheet is produced in the form of a continuous strip, electrodeposition of tin is now becoming a practicable alternative to 'hot-dipping' in the large-scale manufacture of tin plate. Although the particular difficulties which beset the electrodeposition of adherent metal coatings on aluminium have been partly overcome, it is fortunate that, by anodic treatment of this metal and some of its alloys in suitable electrolytes, it is possible to bring about a considerable thickening of the oxide film which normally covers the surface, and thus effectively protect the underlying metal against corrosion. Since, moreover, the resulting oxide layer is a good insulator, is resistant to wear and readily takes up dyes—thus furnishing various decorative effects—it is not surprising that this anodizing process has rapidly found a wide range of applications.

The enormous expansion in the scale of nickel-plating during the last twenty years—it is estimated that an area of about 250 million square feet is now deposited annually—must be partly attributed to the development of chromium-plating. While very thin coatings of chromium on steel are liable to be too porous to afford much protection against corrosion, and thicker deposits are likely to crack, a highly satisfactory tarnish-resisting surface is produced by first coating the steel with a sound nickel deposit and then covering this with a 'flash' of chromium. In this two-stage process, which has been very widely adopted, it is most important that the nickel 'undercoat' shall be firmly adherent, uniform and non-porous ; and the thorough investigation of the factors which determine these properties has led to outstanding improvement in the quality and reliability of electrodeposited nickel coatings. The now widespread use of chromium as a non-tarnishing finish on base metals may be paralleled by the similar application of rhodium on the precious metals. Thus an extremely thin flash of this hard and highly resistant metal on silverware furnishes a lustrous surface, barely distinguishable in appearance from that of silver itself—but which does not require periodic cleaning.

In all these new developments important parts have been played by the metallurgist, the physicist, and especially the chemist. As a result of careful study of the functions of various ingredients in plating baths, considerable simplification of the older 'formulæ' has been effected, and it has become possible to exercise a much more exact control over conditions of operation, and hence over the character and properties of the deposit. The study of the influence of the *p*H value of solutions, especially in the deposition of nickel, has been important in securing adherent deposits free from pin-holes. Investigation of the factors which determine the 'throwing-power' of plating

baths has led to the development of solutions which yield deposits of almost uniform thickness over the whole surface of an object of complicated shape. Examination of the effects of various kinds of 'addition agents'—especially colloids and other substances of high molecular weight—in the solution, has resulted in the production of smooth, coherent coatings from baths which otherwise yield coarsely crystalline, irregular or spongy deposits; and is now leading to the direct production of coatings so lustrous as not to need polishing—a matter of some importance when the size or shape of the article or the nature of the deposit renders the polishing process difficult and costly, or where a particularly smooth surface is a necessary condition for the success of a subsequent process, such as the deposition of chromium on electrodeposited nickel.

The introduction of quantitative tests for such properties of the coating as hardness, porosity, internal stress and adhesion, has enabled these properties to be correlated with the conditions of deposition and hence to be brought under control. Microscopical examination of etched surfaces and sections has done much to indicate the size, shape and general arrangement of the crystallites of which the deposit is built up, and even to detect the presence of non-metallic matter, such as oxides, which may enter the deposit, probably in the colloidal state, and profoundly affect its properties. Such problems are now being further investigated by X-ray and electron diffraction methods.

Although the thickness which an electrodeposit should attain in order to fulfil its purpose depends not only on the nature of the metal deposited but also on the character of the basis metal and the conditions of service to which it is to be subjected, the following values (expressed in thousandths of an inch) give a general indication of the thicknesses of various metal coatings used in ordinary practice: lead, 3; nickel and silver, 1; zinc, 0·5; cadmium, 0·3–0·5; tin, 0·2–0·5; oxide film on anodized aluminium, 0·04; chromium (over nickel), 0·02; gold, platinum, palladium, rhodium, less than 0·01. These figures may be compared with 0·023 for the wave-length of sodium light and 0·0001 for the thickness of the air-formed 'passive' film on chromium, expressed in the same units.

The introduction of scientific control at every stage of electroplating processes, including the very important preliminary cleaning operations required to free the surface of the basis metal from traces of oxide, grease or other impurities which would prevent perfect adhesion of the coating, has raised the general standard of quality and reliability of plating to a remarkable extent, and given users confidence in its value for a wide range of new industrial purposes. The resulting increase in demand has stimulated the development of mass production methods for plating articles in automatic plants. The articles to be plated are carried at a regulated rate by conveyor chains through a succession of tanks and chambers in which the operations of cleaning, washing, plating, rinsing and drying are conducted in their proper sequence and each for its appropriate time. Although the modern type of automatic plating plant dates back only to 1929, twenty-seven such plants are now working in Great Britain. They operate on the deposition of pure metals such as zinc, cadmium, tin, nickel, chromium, copper and silver; of alloys such as copper-tin, copper-zinc and zinc-cadmium; and where no intermediate polishing is needed, successive deposits such as nickel and silver or copper and nickel may be produced in proper sequence; or finishing processes such as 'oxidizing' or chemical colouring may be carried out at the conclusion of a plating operation. Such plants are often of very large capacity. Thus, whereas a few years ago a 500 gallon plating tank would have been considered very large, 3,000–5,000 gallon tanks are now common, and the largest plant now operated in Great Britain—a nickel plating plant—has a tank capacity of 12,000 gallons, which represents about 60 tons of solution containing about 13½ tons of nickel sulphate.

Improved control of the electrodeposition process has also led to notable developments in fields somewhat outside that of standard electroplating practice, such as the deposition of hard, wear-resistant facings on press tools, printing cylinders, gauges, etc.; the building up of worn machine parts; and the production of seamless metal tubing by depositing a thick, non-adherent coating of metal on a mandrel rotating in a plating bath. Cylindrical shells of copper deposited in this way may be slit up to form sheet, with mechanical properties superior to that of ordinary rolled sheet. By successive deposition of two metals, for example, copper and nickel, 'bi-metallic' sheet may also be produced.

With a continuance of the close co-operation which has now been established between the research laboratory and the plating shop, there is every reason to believe that all the lines of development referred to above will be extended. Additional metals will no doubt be introduced into plating practice, in some cases probably by the use of non-aqueous solutions; and the whole field of alloy deposition is only just beginning to be explored systematically. Methods of control of existing processes will be still further improved, and new developments in various other industries will undoubtedly open up a variety of new and hitherto unsuspected applications of electroplating.

London University Degrees: a Faraday Letter

AT the recent celebrations of the centenary of the University of London, the Royal Institution presented to the University a letter written by Faraday on August 10, 1859, to the Rev. John Barlow, F.R.S. The special appropriateness of the gift for the occasion lay in the reference the letter contains to that pioneering activity of the University, the institution of degrees in science. With the movement to accord full recognition to science as an object of academic study Faraday was, it is scarcely necessary to say, in complete sympathy. He was indeed actively concerned in the measures taken, for he was a member of the Senate of the University at the time, a circumstance which adds point to his comments. As this and other points in the letter may be of interest to readers of NATURE, it is printed below.

Hampton Court Green
10 Aug. 1859

My dear Barlow

It was very kind of Mrs. Barlow to write to my wife, and I think that a letter from me to you, is hardly the fit way to acknowledge it :—yet as I write to you you must say something fit for us, with our kindest remembrances, and I expect my wife will write soon. We are exceedingly glad to hear that your journey has been good—your company a happy one—& your present life healthy & joyous. Before I forget remember me to Mr. Esmead—I cannot tell whether I have been at Spa, or have any friends there ; if there are such I dare say you will find them out. We are jogging on or rather we are *not* jogging on :—for on Monday last the workmen ceased to come, the builders strike being on. As far as I can learn, both Masters & Men enter *quietly* into it ; so that though it seems as if it might come to an end in a few days, it may perhaps go on for some time & cause great distress and trouble. We must just wait.

I am not able to give Mrs. Barlow's message to Tyndall, for I think he started last Monday Morning for Chamounie, and I have not seen him since Saturday. Frankland goes with him. He spoke of taking the higher optics for his next course of lectures, and I agreed with him in the propriety (if he saw occasion) of spending £20 on apparatus fitted for the course and for investigation. I do not suppose that he will come across any clear good optical *rock salt*, but we find great difficulty in raising it from the mines in England. Indeed it is rather an impossibility than a difficulty.

As I have been out here with only runs into town I really know very little of what is going on there :—and what I learn I forget. The Senate of the University accepted and approved of the Report of the Committee for Scientific degrees, so that that will go forward (if the Government approve) and will come into work next year. It seems to give much satisfaction to all who have seen it, though the subject is beset with difficulties :—for when the depth & breadth of Science came to be considered, and an estimate was made of how much a man ought to know to obtain a right to a degree in it, the amount in words seemed to be so enormous as to make one hesitate in demanding it from the student :—and though in the D.S. one could divide the matter and claim eminence in one branch of Science, rather than good general knowledge in all—still in the B.S. which is a progressive degree a more extended though a more superficial acquaintance seemed to be required. In fact the matter is so new & there is so little that can serve as previous experience in the founding and arranging these degrees, that one must leave the whole endeavour to shape itself as the practice & experience accumulates.

We have had very hot weather but it is & has been cooler for a few days— The Thames has very rarely been seen so low in water here, as it is now. In London its bad condition seems to increase ; or else my nose accustomed to a better odour here feels it more. The harvest all round us is nearly in ; being very early ; but they tell me the corn is not so heavy as was to be desired. Want of rain has kept it small.

Ever My dear Barlow
Very truly yours
M. Faraday

Dear Mr. Barlow

My right hand Jane being absent in Scotland I am afraid my husband has promised more for me than I can perform so Mrs. Barlow will kindly take Mr. Faraday's letter as an answer with my best remembrances

Sincerely yours
S. Faraday

The letter is, first of all, an admirable example of the simplicity and directness of its author's style as a letter writer. It is written from the house on Hampton Court Green which had, only in the previous year, been placed at Faraday's disposal as a summer residence by Her Majesty the Queen—on the Prince Consort's suggestion it is said. The workmen spoken of were engaged that summer on alterations at the Royal Institution, and their strike evidently went on for many weeks, for it was reported in November that the work had been much delayed by it. The Rev. John Barlow, to whom the letter is addressed, and who was abroad on holiday with his wife, was at the time nearing the end of a long period of office as secretary of the Royal Institution. The correspondence which is preserved shows that out of their association in the business of the Institution there had grown up, between the Faradays and the Barlows, a close and affectionate friendship.

John Tyndall, whose lectures and activities in Switzerland are mentioned, had been Faraday's

junior colleague since his appointment to the professorship of natural philosophy in 1853, and had long since been admitted to the intimate circle of the home at Albemarle Street. That Tyndall's search for rocksalt of optical quality was ultimately successful is evident from the valuable collection of prisms, lenses and rough blocks of the mineral, formerly his property and used in his researches, now in the possession of the Royal Institution. A large block was presented to him by the King of Würtemburg in 1867.

The letter contains one of Faraday's not infrequent references to his loss of memory—and a complaint on a different matter, the insanitary condition of the River Thames, a favourite topic, his strictures on which had provoked, a few years earlier, a cartoon in *Punch* of Prof. Faraday, holding his nose, rebuking Father Thames from the side of a steamboat.

The postscript is in Mrs. Faraday's handwriting, and the reference is to their niece Jane Barnard, who lived with them at the Royal Institution.

T. M.

Obituary

Prof. H. L. Le Chatelier, For. Mem. R.S.

THE death of Henry Louis Le Chatelier, which occurred at Miribel-les-Échelles on September 17, removes one of the great pioneers in the physical chemistry of the last quarter of the nineteenth century; he was born in Paris on October 8, 1850. His father, Louis Le Chatelier, who died in 1873, was a man of high technical abilities and scientific talents; in 1842, when France possessed only six hundred kilometres of railroads, he was put in charge of railway development and became largely responsible for the construction of the present French railway network. Louis also played a great part in the perfection of the locomotive, in the improvement of coal mining and utilization, in the manufacture of open hearth steel and of aluminium and in the organization of the Bordeaux pine forests.

The intense application of scientific methods to practical ends which marked the career of the father, gave direction to the life-work of the son. Henry Le Chatelier was essentially a scientific man of great talents and resource but most of his work seemed to aim at some technical application; the tendency of his mind was well shown in a money gift which he made to the Académie des Sciences in 1922 with a condition that the income should be given to "persons possessed of such scientific aptitude and facilities for work as would enable them to carry out essentially scientific work involving precise measurements which would be sooner or later applicable to industry". The same interests were manifested in the frequent occasions on which he exhorted his countrymen to apply scientific methods to the improvement of industrial practice; the work of F. W. Taylor in the United States on scientific management first obtained publicity in France through Le Chatelier's writings.

Le Chatelier was educated at the Collège Rollin, the École Polytechnique and the École des Mines; he taught at the latter school and at the Collège de France and in 1907 succeeded Moissan as professor at the Sorbonne. As the fundamental importance of his work became universally recognized, honours came in rapid succession. He was a Grand Officer of the Légion d'Honneur and was elected to the Chemistry Section of the Académie des Sciences in 1907; he became a foreign member of the Royal Society in 1913 and received the Davy Medal in 1916. He was made a foreign member of the Chemical Society in 1908 and an honorary member of the Institute of Metals in 1913; an associate member of the Académie Royale de Belgique in 1913, a foreign member of the Accademia dei Lincei in 1918, and an *Ehrenmitglied* of the German Chemical Society in 1931. He was a Président d'Honneur of the French Chemical Society and probably its senior member, having been elected in 1878.

Le Chatelier early devoted himself to the study of the thermal changes which accompany chemical reactions and dissociations, following in this Berthelot and his teacher Sainte-Claire Deville; his work on this subject is monumental and he contributed much to the application of thermodynamics to chemical reactions. His experimental work was characterized by a delicacy previously unknown and was accompanied by mathematical analysis of a searching character; thus, he was able to predict that calcium carbonate should be appreciably dissociated by water vapour at the ordinary temperature and to show experimentally that the prediction is correct. His great generalization now known as the principle of mobile equilibrium dates from 1884 and states that "toute transformation infiniment petite d'un système en équilibre chimique qui est produite par la variation d'un seul des facteurs de l'équilibre s'éffectue dans un sens tel qu'elle tende a produire une variation en sens inverse du facteur considéré". He introduced great improvements in the methods of determining heats of reactions, specific heats of gases at high temperatures, explosion pressures and in the optical measurement of high temperatures. He made the thermoelement an efficient instrument for the determination of high temperatures in face of the criticisms of Regnault, who thought that the use of such an appliance involved sources of error which could not be eliminated; he was the first to use the platinum–platinum-rhodium thermoelement in thermochemical practice. Le Chatelier established a number of

principles connected with the second law of thermodynamics which now form part of our classical knowledge of gas reactions ; in this connexion he took out a patent for the synthesis of ammonia which anticipated the Haber process, now so widely used.

Le Chatelier extended the work of Vicat, a friend of his grandfather, on hydraulic cements and was the first to apply petrological methods to the study of this subject ; he thus identified several components of Portland cement, and his researches in this connexion still form the framework of our knowledge of cements and mortars. He was a pioneer in the application of heat dilatation, electrical conductivity and etching methods to the study of metals and their alloys.

In this brief notice it is impossible to give any adequate account of the vast field covered by Le Chatelier in the course of his original work ; some mention should be made, however, of his literary activities. In 1899 he published a French translation of the papers of Willard Gibbs, with the work of whom his own was so closely interwoven, and he founded the *Revue de Métallurgie* in 1904. He published a series of lectures on carbon in 1908 and, with the collaboration of his daughter, Madame Jean Royer, produced in 1925 a book of more general appeal entitled "Science et Industrie". These two books reveal Le Chatelier as he was known to his friends—a profound and original thinker and a high-minded and patriotic Frenchman with a deep sense of humour. His reminiscences of his old friends were many and usually combined wisdom and jest. Thus he recalled that Sainte-Claire Deville was a discursive lecturer who furnished his students with little likely to be of service in the approaching examinations. He likened the chemical affinity between sulphuric acid and potash to that existing between a dog and a bone ; the dog has an affinity for the bone but it may be equally claimed that the bone has an affinity for the dog and the two mutually absorb each other to form one single entity. The only difference lies in the fact that the dog has personal feelings which are absent in the bone ; but how can one say which is the more noble, the acid or the alkali ? In such a manner Sainte-Claire Deville expressed his antipathy for so-called scientific theories in which empty words often stand for non-existent ideas, the term reciprocal affinity serving merely as a vague mode of recalling an experimental fact.

Le Chatelier was a man of fine presence and of courtly manner ; he was a brilliant talker and, although advancing years brought deafness, his personal charm always remained. With his death we lose one of the great figures of the scientific France of last century.

WM. J. POPE.

Mr. Sherard O. Cowper-Coles

THE name of Sherard Cowper-Coles is closely linked to the progress which has been made in numerous branches of electrodeposition work during the last half-century. Born in 1867, his first patent was brought out while he was still a minor, although this had no connexion with electrodeposition ; thereafter, there has scarcely been a year when his name has not appeared in the index to the *Patent Journal*.

Cowper-Coles's life was largely devoted to work in electrodeposition problems, his speciality being processes of electro-forming and applications of electrolysis which were rather outside the sphere of electroplating. If processes which are connected with the decoration and protection of metal surfaces interested him less, it is nevertheless a curious fact that what may possibly be considered his most important contribution from the industrial point of view was a method of protecting steel which is very widely practised to-day, and to which he gave his name—sherardizing. This process consists in the production of a zinc coating on ferrous articles, not by electrolysis but by cementation ; later, it was progressively improved and now finds considerable application.

Among the many problems which interested Cowper-Coles were the electrodeposition of rubber, deposition on glass, sound recording, needle sharpening, production of white lead by electrolysis, transparent paper, sound-proof ventilation, while he also carried out some work on the smoke abatement problem.

For many years, Cowper-Coles worked in a private laboratory, which he built at Sunbury-on-Thames. Here, favoured visitors would be shown over a most fascinating and unique collection comprising examples of almost every aspect of applied electrodeposition, from electrolytic copper gramophone records to electrodeposited iron tubes of giant size. Most of these exhibits had been produced by Cowper-Coles during his lifetime, and some of them were shown at the Electrodeposition Exhibition held last year by the Electrodepositors' Technical Society at the Science Museum.

During the latter part of his life, Cowper-Coles devoted his efforts to the production of sheets by direct electrodeposition processes. He had a considerable financial as well as scientific genius, and a number of companies were formed to exploit his processes. He published a large number of papers in the proceedings of numerous societies and institutions. A man of considerable personal charm of manner, his courtliness was reminiscent of an age long passed. The niche which he filled in the world of electrodeposition was truly unique.

S. WERNICK.

We regret to announce the following deaths :

Sir George Hampson, Bt., formerly assistant keeper in the Natural History Museum, known for his work in entomology, on October 15, aged seventy-six years.

Prof. Alexander Larmor, formerly McCrea professor of natural philosophy in the Magee University College, Londonderry, on October 12.

Prof. Pietro R. Pirotta, formerly professor of botany in the University of Rome, on August 4, aged eighty-three years.

News and Views

Lord Nuffield and the University of Oxford

ON October 16, it was announced that Lord Nuffield had offered to the University of Oxford the magnificent sum of £1,250,000 for the development of a post-graduate medical school with a staff of full-time professors. This is the greatest benefaction ever made by an Englishman in his lifetime to a specific public object, and the biggest sum a university in Britain has received since Mr. Carnegie's gift of two million pounds to the Scottish universities thirty-five years ago. Until recently, Oxford's small but good medical school did not engage itself much either in teaching or research beyond the subjects of the second professional examination. The men who had reached this stage were encouraged to continue their work at one of the big training hospitals in London or other large city, and to return to Oxford only to take examinations. In 1927, however, the new school of pathology was built and endowed by gifts from Sir William Dunn and Mr. Theodore Williams, and, more recently, Lord Nuffield made available for medical research the Nuffield Institute by buying the Radcliffe Observatory buildings and surrounding land and endowing it with £16,000. It is now proposed greatly to extend these beginnings so that the comparatively small city of Oxford may have the kind of medical school which in Great Britain has been considered feasible only in a large university city. The main purpose of this, however, will be research, not teaching. Disease is to be studied over the widest possible front; the clinical training of medical students will be incidental and definitely subsidiary.

IN his letter to the Vice-Chancellor of the University announcing the gift, Lord Nuffield briefly outlined what he had in mind. He would like clinical departments in medicine, in surgery and in obstetrics, and a department of anæsthetics, to be established immediately. Each of these would be under the direction of a new university full-time professor. They and their principal assistants would be so remunerated that their energies could be wholly given to their work in the hospitals and at the University and not, in part, distracted by private practice. The new posts would be open to any qualified practitioner whether a graduate of Oxford or not. Young research students proposing to work under the supervision of seniors on clinical problems would be encouraged. The body entrusted with the execution of the scheme will include representatives of the University, of Lord Nuffield and of the two large hospitals—the Radcliffe Infirmary and the Wingfield-Morris Orthopædic Hospital—which will be mostly concerned. These and the Oxford Eye Hospital contain approximately seven hundred beds and serve a district extending in some directions nearly thirty miles from the city, which contains a quarter of a million people. Much of the credit for advising on the objects to which the benefaction will be directed is due to the regius professor of medicine, Sir Farquhar Buzzard, and it is a matter of satisfaction in Oxford that the new scheme will be begun under his guidance. Not content with this great benefaction for medical studies, Lord Nuffield has also given £100,000 to the University to help its endowments generally. The University is at present deeply committed financially for the building of the great Bodleian extension, and until that building is paid for, money for the extension of the scientific departments cannot be so readily available as otherwise. This gift, accordingly, makes more hopeful, although indirectly, the provision of two new science laboratories which are badly needed—a new University department of physical chemistry, and the replacement of the Clarendon Laboratory for physics.

Belluno Earthquake of October 18

At about 4 a.m. (3 a.m., G.M.T.) on October 18, a destructive earthquake occurred in northern Venetia and caused considerable loss of life and damage to property. The centre seems to have been close to Sacile, which lies about thirty-seven miles north of Venice and twenty miles south-east of Belluno. The area of damage is not less than forty miles in length and includes Belluno, where nearly all the old buildings were injured, Borgato Zago and Conegliano. The shock is said to have lasted twenty seconds and was felt at Milan, 166 miles to the west of Sacile, so that the disturbed area may contain about ninety thousand square miles. On June 29, 1873, there was a similarly destructive earthquake in the Belluno district, which was carefully studied by Höfer, Bittner and others. According to these investigators, the epicentre lay about two miles to the east or south-east of Belluno. Höfer assigned the origin of the earthquake to movements along two faults, one directed nearly north-east and south-east, and the other east, from the epicentre. He estimated the depth of the focus at 7·91 km., or very nearly five miles. It would thus seem that, in the recent earthquake, the centre was displaced some miles to the south-east to a point on, or not far from, the north-easterly fault marked out by Höfer.

Science in South Africa

IN his presidential address to the South African Association for the Advancement of Science on October 5, at Johannesburg, H.E. the Right Hon. the Earl of Clarendon, Governor-General of the Union of South Africa, after referring to the part which applied science has played in the transformation of Johannesburg during the last fifty years, discussed particularly the part which the work of the man of science plays in everyday domestic, social

and business life. The work which the Association is doing to bring home to the ordinary man the great debt which he owes to the scientific worker entitles it to the support not only of scientific men but also of the general public, and Lord Clarendon suggested that this is one of the most important aspects of the Association's work. Referring to the efforts of the scientific worker in the matter of health, nutrition and disease, he pointed out that much as we already owe to the discoveries of science, much more could be done if the requisite funds were available. Essentially the eradication of malaria, nagana, East Coast fever, tuberculosis in cattle is a matter of funds, lack of which prevents the carrying out of measures already known to be effective.

ACCORDINGLY Lord Clarendon argued that the support and fostering of scientific research should not be limited by national frontiers. The best utilization of national wealth involves the utilization of discoveries made elsewhere. Many scientific problems have been solved by international co-operation, and while the influence and guidance of politicians and financiers may still be necessary, we can also look forward to a brighter future in which a large proportion of the troubles of the world will be treated as scientific problems and dealt with on this basis by international congresses of men of science. In furthering this ideal, the diffusion of a knowledge of science and of the world's debt to scientific investigation is of vital importance. In a reference to the place in science of the amateur, Lord Clarendon suggested, contrary to the usual belief in scientific circles, that specialization has so handicapped the work of the amateur, at any rate in the physical sciences, that his contribution is now becoming insignificant, that the growth of leisure would greatly increase the number of amateur workers, particularly in the conception of leisure as "the opportunity to work hard at things which really interest one".

Research and Finance

A MEMORANDUM on the development and finance of the Department of Scientific and Industrial Research was discussed in a leading article of NATURE of July 11 last. The view appears to prevail that this memorandum embodies the considered views of the Parliamentary Science Committee; but this is not so. The history of the memorandum is as follows. Some three years ago the British Science Guild and the Association of Scientific Workers appointed a joint committee to explore this question. Considerable material was gathered, and certain progress was made. Eventually the two bodies referred the subject to the Parliamentary Science Committee in 1935, together with the results of their labours. Obviously it was desirable that this material should be collated, brought up to date, and even amplified. This was done by a distinguished scientific worker at Cambridge. His preliminary draft was circulated to the executive of the Parliamentary Science Committee last March. Before proceeding to consider the memorandum in detail, the executive deemed it expedient to refer it to the councils of its constituent bodies and to the individual members of its own general and executive committees to secure their considered views in writing. This has proved to be a leisurely process, as some councils meet at infrequent intervals —and not at all during high summer! A considerable volume of constructive and polemical criticism has been received; and an amended memorandum is now being prepared at Cambridge incorporating many of the suggestions received. It appears, therefore, that the Parliamentary Science Committee has not yet settled down to work, as a deliberative body, on this memorandum. In a sense, the committee may be said to have given it a 'first reading', and committed it to a select committee for consideration before proceeding to the 'second reading' and subsequent stages. The 'Parliamentary draftsman' has to finish his labours before the Parliamentary Science Committee can claim any credit for accepting the result of his public-spirited labours—or for rejecting the memorandum on 'third reading'.

Plant Organisms in Permanently Frozen Subsoil

SOME rather sensational newspaper reports on the discovery, by Russian scientific workers, that organisms which had remained frozen for thousands of years in Siberian soils can be revived (see NATURE, Sept. 26, p. 540), is now followed by an account on this work, carried out by P. Kapterev in the Amurland, at lat. 53° 58′ N. (*Comptes rendus, Academy of Sciences, Moscow*, 3, No. 3; 1936). The depth of the permanently frozen layer at that place has not been definitely determined, but is estimated at about 60 metres. The upper 2·5 metres of the soil may thaw during summer, and below that level the permanently frozen layer begins. This frozen subsoil is loamy and includes some peaty intermediate layers, which probably were formed at the bottoms of pools. Samples of peaty material taken at depths up to 4·25 metres, when placed in flasks with distilled water, invariably developed a fairly rich flora of algæ belonging to some twenty genera such as *Stigocleonium*, *Mougeotia*, *Oedogonium*, *Closterium*, *Cosmarium*, *Oscillatoria*, *Phormidium*, *Navicula*, *Gomphonema*, *Anabaena*, *Lyngbia*, *Chroococcus*, *Ulothrix*, *Chlamydomonas*, etc., as well as fungal hyphæ and green stems of a Hypnaceous moss. In one sample, a crustacean, ***Chydorus Sphæricus*** (Cladocera) has been found. The possibility that these organisms were introduced into subsoil by water percolating from upper layers is rejected, since the permanently frozen subsoil is practically impermeable to water. Nor can it be suggested that the cultures were infected accidentally, since it would be difficult to expect then a whole complex of organisms, which moreover varied with the depth of samples. It is considered, therefore, that the organisms actually came from the permanently frozen subsoil. The age of the layers from which the samples were taken is estimated as possibly from one to three thousand years. Carefully planned investigations of still deeper layers are being continued under the auspices of the Moscow Academy of Sciences.

Administrative Classification of Australian Aborigines

A NEW policy for the control of the aborigines under the jurisdiction of the Federal Government of the Commonwealth of Australia is announced by Mr. Paterson, Minister for the Interior (*The Times*, Oct. 4). These aborigines, that is, the inhabitants of the Northern Territories only, are estimated to number approximately 20,000 out of a total aboriginal population of 76,000, of whom 22,000 are half-castes. In future they will be classified in three divisions: (1) detribalized natives, such as those near Darwin and other northern towns; (2) tribes on or near pastoral stations and other white settlements; and (3) aborigines beyond civilized control. This classification corresponds broadly with the facts, and will involve no very drastic interference with existing conditions. At the same time, official recognition and acceptance of a very real distinction should facilitate discrimination and increase efficiency in administering and applying any ameliorative policy. The disposition of the aborigines proposed under the new regulations is that the completely detribalized aborigines should be educated to a white standard, with the view of training them to become economically and occupationally efficient. Areas are to be set aside at Darwin, on which they will be encouraged to abandon their nomadic habits and to settle in family houses, cultivating the soil and rearing domestic animals. Barracks, schools and recreational and sanitary facilities will be provided. Semi-detribalized natives will be settled in reserves, in which they will be enabled to live in native fashion; and *myalis*, aborigines completely under tribal institutions, will live in the inviolable reserves. The Australian aboriginal has shown himself singularly adaptable to the advantages of white civilization; but it will be interesting to watch how far this experiment in checking so deeply engrained a tribal habit as nomadism meets with success.

Public Lighting

IN his address at the opening meeting of the Illuminating Engineering Society on October 13, the president, Mr. Arthur Cunnington, referred to several questions of outstanding interest in connexion with lighting, such as the need for greater uniformity in conditions of supply of gas and electricity, the desirability of designing fittings that are easy to maintain as well as efficient, and the effect of surroundings on conditions of illumination. In this connexion, he suggested that if owners of buildings would make a practice of steam-cleaning the surfaces of buildings before the period of the Coronation, this would not only improve the appearance of the streets but would also greatly facilitate floodlighting. The concluding section of the address emphasized the value to large consumers of trained lighting engineers who could form an impartial opinion of the merit of different systems and appliances. The need for expert public lighting engineers in large towns and cities has recently been emphasized, but there are many other bodies such as Government departments, railways and docks and large industrial concerns which could benefit from their services.

Progress in Illumination

IN accordance with the usual practice of the Illuminating Engineering Society at its opening meeting, a report on progress prepared by the Technical Committee and summarizing advances in lighting and photometry during the past year was presented, and a series of exhibits was arranged. Among the most striking of these was a new form of small electric discharge lamp (80 watt and 125 watt), produced by leading manufacturers in Great Britain. This lamp, which resembles in size and shape an ordinary filament lamp, is the first of the kind capable of being applied (with only a choke in circuit) on circuits of 200–250 volts (A.C.) for domestic and office use. These lamps have an initial efficiency of 40 lumens per watt and an average efficiency of 30 lumens per watt during life. Of considerable interest also were the demonstrations of the effect of bulbs coated with fluorescent powder, whereby the natural spectrum of the light can be considerably improved, and of various stroboscopic effects. Other exhibits included a model illuminated aerodrome and a model stage, improved forms of catalytic methods of ignition for gas burners, and a method of studying the brightness of illuminated roadways by the aid of accurate photographs taken by artificial light.

The Microscope in Engineering and Industry

THIS was the subject chosen by Mr. A. E. Bingham for the address with which, as chairman, he opened the session of the Junior Institution of Engineers on October 9. After explaining the lens system of the modern instrument, he gave a résumé of its history and evolution to its present capacity for the production of photomicrographs of metallic surfaces with great clearness at high magnifications. In the majority of engineering investigations, the specimens under examination are opaque, and the difficulties of illumination and the most advantageous methods to use were discussed, as also were the preparation of metallic specimens and the making of photomicrographs. The petrological microscope, as used for the magnification of rock sections of less than one thousandth of an inch in thickness, and for their examination under polarized light, was also introduced. Many examples of the applications of microscopy were given, among them the examination and measurement of particles of abrasive powders, determination of the lengths of fibres used in the paper, artificial silk and other industries, checking the results of heat treatment of steel, hardness testing, and the examination of profiles of screws, wheel teeth, and small products by means of the profile projector.

Alcoholism and Psychiatry

THE seventeenth Norman Kerr Memorial Lecture before the Society for the Study of Inebriety was delivered by Dr. D. K. Henderson, professor of psychiatry at the University of Edinburgh and physician superintendent of the Royal Edinburgh Hospital for Mental Diseases, on October 13, the subject being alcoholism and psychiatry. At the

outset, Dr. Henderson stated that though the admission rate to his hospital for cases of mental disorder due to alcoholism has been reduced from one half to one third of what it was twenty to thirty years ago, much more could be accomplished by more intense propaganda, educational campaigns and all manner of social influences. It is, however, by the methods and technique of psychiatry that the causation of alcoholism can best be elucidated and the best modes of treatment devised. It is essential, he declared, that alcoholism should be regarded as an illness or disease and not as a crime or misdemeanour, as is still done even to-day by some medical practitioners. Dr. Henderson then discussed alcoholism as a cause of homicide, assault, sex offences with adults or children and suicide, as well as the effect of parental alcoholism on the children and the relation of alcoholism to mental disease. In conclusion, he urged that the lunacy laws, which he said are archaic both in name and form, should be replaced by mental health laws applicable to all groups of nervous and mental disease.

Co-operation in Bibliography

THE movement for co-operation in bibliography has received an important impetus from the Bataafsche Petroleum Maatschappij. This company classifies, by means of the Decimal Classification, 150,000 references annually to literature in chemistry, physics, etc., and their applications. We learn from Dr. S. C. Bradford that, since March last, the firm has contributed copies of its non-secret references to the Science Library, for intercalation, with titles from other sources using the standard classification, in its Subject-Matter Index of 2½ million references to scientific papers. This valuable contribution exemplifies the new spirit of co-operation in bibliography, which is surely achieving the production of a complete index to the records of discovery and invention. It is interesting to note, also, that Dr. Maximilian Pflücke, the editor of the *Chemisches Zentralblatt*, is collaborating in the production of the German edition of the Decimal Classification.

The Liverpool Biological Society

THE fiftieth anniversary of the Liverpool Biological Society is an event of more than local importance in that the large amount of original work by its members has wide significance, particularly through the foundations laid by one of its most prominent leaders, the late Sir William Herdman. Founded in 1886, the Liverpool Biological Society has since worked in close association with the Department of Zoology of the University of Liverpool, the Lancashire Sea Fisheries Laboratory and the Liverpool Marine Biological Committee which was started as a section of it, but some years ago, on the origin of the Department and chair of oceanography at the University, was absorbed in that. The *Transactions* of the Society have been issued annually and contain a wealth of original papers. The Society has always had distinguished presidents, some prominent past names being Profs. W. Mitchell Banks, Sir William Herdman, R. J. Harvey Gibson, Robert Newstead, P. G. H. Boswell, W. Dakin and J. Johnstone; the present holder of the office is Dr. R. J. Daniel. It was Sir William Herdman, in pre-War days, who succeeded in interesting city businessmen in the Society's activities, thereby increasing its financial support and enabling it to build up a valuable library. In 1924, the Liverpool Heredity Society amalgamated with it, following which special attention was given to this side of biological study. Although the Society's membership was 130 ten years ago, it now musters only about sixty, chiefly connected with the University. With its annual meeting in October, it meets, usually, at the University, every month during winter, with occasional summer excursions.

American Cultural Origins

THE latest addition to the excellent series of "Leaflets" describing the collections of the Field Museum of Natural History, Chicago ("Archaeology of South America". By Eric J. Thompson. Leaflet 33. Field Museum of Natural History, Chicago. Pp. 160, 12 pls., 18 text-figures and 1 map), is an introduction to, and description of, the cases in the museum covering the archæology of South America. An account of the culture of the separate and distinct geographical and cultural areas of the sub-continent is preceded, by way of introduction, by a concise review of current theory of American origins. The indigenous civilization of South America, when the pre-Inca and Inca peoples are taken into account, ranges from the greatest achievements in social organization and material development of the New World before Columbus to what is perhaps the most backward of any culture known among surviving primitive peoples—the culture of the Yahgans of Tierra del Fuego, a people who in their native state have not advanced so far as polishing stone.

THE Yahgans are taken, with reservations, as representing the culture of the earliest immigrants into the continent. The physical characters of the earlier arrivals probably were those of the Lagoa Santa skull type. Such innovations as basketry, bow and arrow and the domestic dog may, it is thought, have been brought in by the third wave of immigration, broad-headed peoples, also coming from Asia. The turning point in cultural development is the introduction of agriculture. Mr. Thompson is inclined to the view, now current, that the origins of the advanced American civilization must be sought in South rather than Central America; and he is disposed to hold that the domestication of plants, which took place about five to eight thousand years ago, began in eastern South America with the cultivation of manioc, rather than, as is generally assumed, in Central America with the development of maize from the wild grass Teocentli (*Euchlaena mexicana*). While Mr. Thompson rejects so low an estimate as two thousand years as the period of man's existence on the continent, he does not consider that a higher antiquity than twenty thousand years is probable.

Artificial Lakes in Africa

A REMARKABLE proposal for the formation of several great lakes in the interior of Africa in order to create cultivable land and stores of hydro-electric power is outlined in a report issued by Science Service, of Washington, D.C. The project emanates from H. Soergel, of Munich. A great dam two and a half miles long about 500 miles from the mouth of the Congo would turn the basin into an inland sea with an area of about 350,000 sq. miles. An outlet by the lower Congo would provide abundant water power or, alternatively, an outlet could be arranged to the north to create a second inland sea centring around Lake Chad, which would drain through existing wadis to the west, north-east and east by a "second Nile" to the Gulf of Gabes in the Mediterranean. This new river would provide irrigation water for vast areas in the French and Italian Sahara. A further suggestion is for a dam on the Zambezi River above Victoria Falls in order to create an inland sea over much of the Kalahari desert. Herr Soergel does not discuss the effect of evaporation on the projected Chad and Victoria Seas, both of which would lie in almost rainless regions.

Bee Control in Czechoslovakia

WE learn from the *Bee World* that Czechoslovakia is taking drastic steps in dealing with Acarine disease. The new law insists on treatment with the recognized British or Frow remedy of all colonies within 10 km. of an infested hive. Stocks found to be weak in mid-August are to be destroyed. The use of methyl salicylate is ordered during the spring up to honey flow, in all stocks discovered to be infested after overwintering.

Indian Association for the Cultivation of Science

INDIAN physics, under the leadership of Sir C. V. Raman and Prof. M. N. Saha, has an established position; and it is interesting to read, in its report for 1935, a history of the Indian Association for the Cultivation of Science, an institution which has played a large, if not the dominant, part in bringing about this result. The Association was founded in 1870, and the laboratory, built in 1890, later became an active centre of research under the stimulating guidance of Raman, who was succeeded as Mahendralal Sircar professor by Dr. K. S. Krishnan. The financial and administrative arrangements have lately been re-organized and a material annual grant obtained from the Government of India, which accordingly has a voice in the management. The work of the past year covers a fairly wide range and includes studies of molecular structure, of magnetic effects and of optical phenomena. There is, therefore, every ground for anticipating the maintenance of full activity.

Anti-Rabic Treatment at Kasauli

IN the annual report of the Pasteur Institute of India, Kasauli, for 1934, the Director states that 1,471 Europeans and 15,380 Asiatics were treated at Kasauli and associated centres, a total increase of 913 compared with 1933. Of the treated cases, one death was reported among Europeans, and 90 among Asiatics, a mortality among the latter of 0·53 per cent, the lowest death-rate recorded during the last ten years. In addition, 671 courses of vaccine for the prophylactic treatment of animals were issued during the year. The vaccine employed is a carbolized 5 per cent Paris sheep vaccine.

Tuberculosis and Cattle

A FURTHER issue of the Register of Herds attested under the Tuberculosis (Attested Herds) Schemes, England and Wales and Scotland, has been published jointly by the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1, and the Department of Agriculture for Scotland, Queen Street, Edinburgh, 2. It contains particulars of 117 herds in England and Wales and 144 herds in Scotland which had been attested up to July 31, 1936. Since the previous issue of the Register on March 31, 1936, 36 herds have been added in England and Wales and 56 in Scotland.

Parliamentary Science Committee

LAST April the Parliamentary Science Committee received the adhesion of the Association of British Zoologists. Recently it has had the gratification of the accession of another body devoted to biology, the Association of Applied Biologists. The Committee is already strong in support from bodies devoted to applied and mechanical science, and the strengthening of the biological support was much desired. The aggregate membership of the Committee's constituent bodies is now upwards of 100,000.

International Association for Testing Materials

THE Congress of the International Association for Testing Materials is to be held in London in April next. The subjects to be discussed are divided into four groups, A (Metals), B (Inorganic Materials), C (Organic Materials), and D (Subjects of General Importance), each of which is presided over by a distinguished worker from overseas. The last Congress for Testing Materials was held in 1931, and every effort is being made to ensure that the knowledge in this most important field will be brought completely up to date. The papers will be presented in the form of summaries, so that a vast amount of information will be made available in easily accessible form. Particulars of the Congress can be obtained from the honorary secretary, Mr. K. Headlam-Morley, at the offices of the British Committee, International Association for Testing Materials, 28 Victoria Street, London, S.W.1.

Announcements

THE Right Hon. Lord Balfour of Burleigh, and Prof. John Mellanby, Waynflete professor of physiology in the University of Oxford, have been appointed members of the Medical Research Council, in succession to the Most Hon. the Marquess of

Linlithgow, and Prof. E. D. Adrian, who retired in rotation on September 30. The appointment of Prof. Mellanby was made after consultation with the Medical Research Council and with the president of the Royal Society. Lord Balfour has been appointed to succeed Lord Linlithgow as chairman of the Medical Research Council.

A DINNER will be held at the Hyde Park Hotel, Knightsbridge, London, S.W.1, on November 24, at 7.30 for 8.0 p.m., when the president of the British Science Guild, the Right Hon. Lord Melchett, will preside. At the dinner, a presentation from supporters of the Guild will be made to Sir Richard Gregory, chairman of the Council of Management, in recognition of his services to science generally and to the British Science Guild in particular.

AT a meeting of the Advisory Council of the Imperial Institute on Mineral Resources, Sir Robert Hadfield, who is a member of the Council and has been interested in the mineral work of the Institute for many years past, announced that he wished to make a contribution of £1,000 to promote the compilation of mineral brochures by the Institute. The Director accepted this generous offer with gratitude on behalf of the Board of Governors. In making this offer, Sir Robert emphasized the importance of iron and ferro-alloy metals to the Empire, and expressed a hope that this importance would be recognized in the brochure programme of the Institute.

DR. OTTO KNOPF, professor of astronomy at Jena since 1923 and director of the Jena Observatory since 1900, celebrated his eightieth birthday on September 24, and Prof. Wladimir Köppen of Graz, formerly head of the naval observatory at Hamburg, was ninety years of age on September 25.

PROF. R. ZAUNICK, of Dresden, has been awarded the Sudhoff Medal by the German Society of the History of Medicine, Natural Science and Technique for his lecture on Karl Gustav Carus and his Dresden circle.

DR. WILLIAM HALLOCK PARK has retired from the chair of bacteriology and preventive medicine at the University of New York after thirty-eight years service on the staff of the College of Medicine. Dr. Park is the founder of the New York City Public Health Laboratories, on which he has served for forty-two years as director.

A SPECIAL institute for experimental physiology and therapeutics has been organized at the Pirogoff military hospital, Moscow, where researches will be made in physiology, physiochemistry and biochemistry.

DURING the first five months of this year the number of deaths from motor accidents in New York City fell to 9·3 per 100,000, which is the lowest figure hitherto reached in the towns in the United States. In New York State the number has fallen by 14 per cent, 829 persons having been killed in comparison with 965 during the same period in 1935.

THE thirty-fifth Congress of the Italian Society for the Progress of Science will be held at Tripoli on November 1–7 at the same time as the meeting of the Royal Italian Geographical Society, and will constitute the first Italian Scientific Congress of the Fascist Colonial Empire. The programme will include papers on hygiene and colonial pathology, with special reference to the sanitary, prophylactic and eugenic organization of the Italian colonies. Further information can be obtained from the Segretaria generale, Società Italiana per il progresso delle scienze, Via del Collegio 26, Rome.

THE *Proceedings and Transactions of the South London Entomological and Natural History Society* for 1935–36 form a record of a successful year's activities which close with the Society in a satisfactory financial condition. This publication, which appears annually, contains papers of both general and more specialized interest to naturalists, together with records of field meetings and of various congresses. The most extensive article is by Mr. Kenneth J. Hayward, and is an account of a collecting expedition along the Alto Parana, Argentina, illustrated by interesting photographs.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

A chief technical instructor in the Government Trade School, Haifa—The Secretary (SIR/CA), Board of Education, Whitehall, S.W.1 (October 26).

Three technical officers, two assistants (Grade I), and one assistant (Grade II) in the Directorate of Technical Development, Air Ministry—The Secretary, Air Ministry (S.2.D./405), Adastral House, Kingsway, W.C.2 (October 30).

Assistants (Grades I and II) in the Royal Aircraft Establishment, South Farnborough, Hants—The Chief Superintendent (October 30).

A lecturer in pathology in the University and pathologist to the Queen's Hospital, Birmingham—The Secretary of the University (October 31).

A head of the Science Department, West Ham Municipal College—The Town Clerk (November 6).

A professor of applied chemistry in Andhra University—The High Commissioner for India (December 20).

A mechanical engineer, an architectural adviser and an assistant engineer to the Copper Development Association—The General Manager, Copper Development Association, Thames House, Millbank, London, S.W.1.

An assistant lecturer in education in University College, Exeter—The Registrar.

A professor of mathematics in University College, Southampton—The Registrar.

Civil engineering and architectural assistants in the drawing office of H.M. Dockyard, Portsmouth—The Civil Engineer-in-Chief, Admiralty, S.W.1.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 724.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

The Dentition of *Australopithecus* *

THE importance of *Australopithecus* as a possible near relative of man is such that it seems but right that the world should have the facts at the earliest moment after they are fully confirmed.

The Taungs ape is represented only by the skull of a six-year-old 'child'; and though some of its human-like characters are due in part to the infantile condition, there are a number of others that seem to show that it is more nearly related to man than to the chimpanzee. Of these, the most convincing is the structure of the milk molars, which agree closely with those of man and differ very greatly from those of the chimpanzee and gorilla. But owing to the superficial general resemblance of the skull to that of a young chimpanzee, many seem still to be inclined to regard the Taungs ape as a variety of chimpanzee.

The discovery at Sterkfontein of the adult skull of an allied species is thus of great importance. It will be some months naturally before a full account of the skull can be published as the bone is very friable, and development has to be done slowly, but as the upper dentition is now almost fully known, a preliminary account of it cannot fail to be of interest.

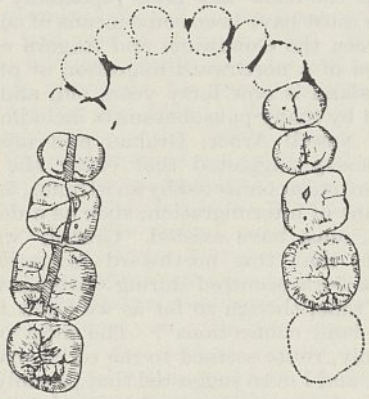

FIG. 1. The upper dental arch of *Australopithecus transvaalensis* Broom. As the maxillæ are detached, the exact relation of one to the other is uncertain. Three of the teeth of the right maxilla have been cracked and the fragments pushed apart during fossilization, but otherwise they are practically perfect. ⅔ natural size.

When I sent off the first notice of the discovery a few days after the find was made (see NATURE, Sept. 19, p. 486), only the upper part of the skull and the right maxilla were known. In the stone on the left side of the left orbit I later discovered the nearly perfect left maxilla, with both premolars and the 1st and 2nd molars in perfect condition and the sockets of the incisors and canine. The 3rd molar is probably also present but it cannot be displayed without destroying an important part of the skull.

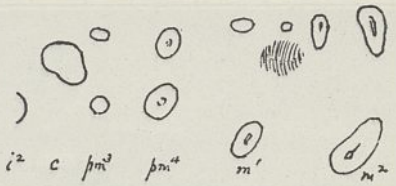

FIG. 2. Irregular section across the roots of some of the teeth of the right maxilla of *Australopithecus transvaalensis* Broom; the little shaded area between the roots of m^1 is part of the floor of the maxillary antrum. Note the remarkable degree to which the roots of the molars spread. Natural size.

The premolars and 1st molars are so remarkably human-like that there is scarcely a doubt that had they been found without the skull they would have been held by most to be human. They bear no close resemblance to the corresponding teeth in the chimpanzee. Each premolar has only two roots.

The canines are relatively small, and the incisors large. Perhaps the most striking character is the fact that the canine and the 2nd incisor are in contact as in man, and not with a gap between them as in living anthropoids.

It is unnecessary at present to discuss in detail the various features of the dentition, but Figs. 1 and 2 are sufficient to show that the Sterkfontein ape at least is not a chimpanzee, and that it approaches man in quite a number of characters.

R. BROOM.

Transvaal Museum,
Pretoria.
Sept. 29.

* Published by permission of the Trustees, Transvaal Museum, Pretoria.

A New Upper Triassic Fossil Insect Bed in Queensland

SOME four years ago, two members of the staff of the Queensland Geological Survey, Messrs. Owen Jones and Denmead, picked up at Mount Crosby, some thirty miles inland from Brisbane, two finely preserved cockroach tegmina on pieces of dark brown shale. These were sent to me for description, and proved to belong to two new species of the genus *Triassoblatta*, originally described from the Rhaetic of Ipswich, Queensland (a locality about seven miles from Mount Crosby).

On my visit to Queensland in June 1936, members of the University of Queensland and of the Geological Survey, including Mr. Denmead, accompanied me to this locality. The original bed of shale, from which the cockroach tegmina came, was found without much difficulty. It appears to represent the mud

deposit of the stream-bed of an ancient river which flowed sluggishly between high banks of older Brisbane Tuff. The age of the beds is definitely older than that of the Ipswich fossil insect beds, and may be placed with considerable certainty as Upper Triassic. The insect-bearing shales lie beneath a loose conglomerate, and are only about ten inches thick. Insect remains are abundant but mostly fragmentary, and are found in association with the following plants : *Schizoneura*, *Thinnfeldia*, *Baiera*, *Voltzia* and a Cycadophyte. The remains of the genus *Triassoblatta* include fore and hind wings, heads, pronota, thoracic and abdominal sclerites, all evidently having been separated by gentle maceration in the stream bed and fossilized separately. They total about half the whole number of fossil insects so far discovered.

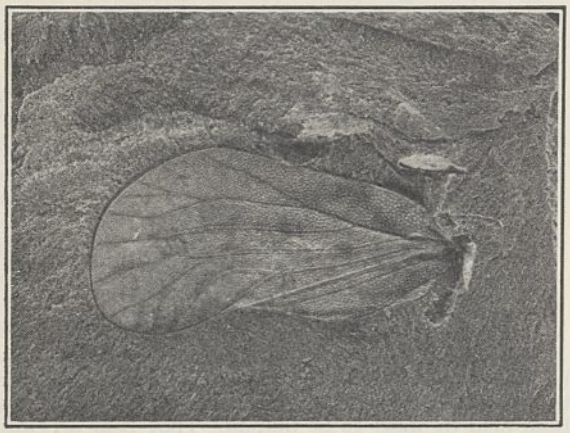

FIG. 1. Complete tegmen of a specialized Scytinopterid type (order Homoptera, division Auchinorrhyncha) in process of becoming a true Heteropterous type. Length 12 mm. ; Upper Triassic of Mount Crosby, Queensland. Photo by Walter James.

The dominant order in families, genera and species is the Homoptera, with the following groups : Prosbolidæ, Scytinopteridæ, Fulgoroidea, Jassoidea and Psylloidea. The photograph (Fig. 1) shows the most remarkable of a number of perfectly preserved homopterous tegmina, in the shape of one which appears to be turning from a Scytinopterid type into a true Heteropteron. This is the first clear indication from palæontology of the probable mode of origin of the Heteroptera from the older Homoptera.

Next in importance are the Coleoptera, represented by elytra, heads and bodies. They are all small types, the largest being about 8 mm. in length (elytron), and the smallest only about 1 mm. long and therefore the tiniest fossil insect so far discovered. The Ipswich genus *Ademosyne* is well represented, but the beetle fauna is nothing like so abundant as at Ipswich.

Next in point of interest come the Trichoptera, with three entirely new types, two being perfect forewings. These are easily the oldest known Trichoptera, and represent almost perfectly the archetypic wing already postulated in my previous papers.

The older order Paratrichoptera is only represented by a single tiny wing, which could be classed as a Dipteron were it not for the form of its anal area.

A magnificent wing, practically perfect, introduces the true order Diptera as a member of this fauna. It has the general form of a Tipulid, with three-branched radial sector, but the anal area is of Tanyderid form, with only a single anal vein. As usual, the action of the water on this wing has caused considerable longitudinal rucking.

Some fine mecopterous types are present, including the genus *Mesochorista*, originally described from Ipswich, and a fine type ancestral to *Archipanorpa* and apparently also closely related to the Orthophlebiidæ of the Lias in the northern hemisphere.

True Neuroptera are represented by three new types, one being a perfect wing allied to the Berothidæ. Other orders, unfortunately so far only represented by fragmentary wings, are the Odonata and Orthoptera.

A total of more than two hundred specimens has now been obtained as a result of breaking up less than a cubic yard of shale. No less than fourteen specimens were found by splitting one small piece about four inches long by three inches wide and about an inch thick. Unfortunately, the amount of suitable material available is strictly limited, but the discovery promises to be one of the most interesting of recent years, and helps to fill the gap between the Upper Permian and the Rhætic.

A monograph on the above insect fauna is now in course of preparation.

R. J. TILLYARD.

Canberra, F.C.T.,
Australia.

The Gondwana Affinities of the Angara Flora in the Light of Geological Evidence

THE late Palæozoic flora of northern Russia and Siberia has long been known to include a certain element remarkable for its suspected affinities with the *Glossopteris* flora[1]. Prof. Zalessky, to whom much of our recent knowledge of the Angara flora is due, has been the chief exponent of the Gondwana affinities of the northern flora[2]. Prof. Halle believes (probably with some justice) that these affinities have been somewhat over-emphasized. But no one, so far as I know, has denied that some striking resemblances exist, and the view has been repeatedly expressed that there must have been some means of communication between the Gondwana and Angara continents.

The idea of a northward migration of plants from Gondwanaland is now forty years old, and has been advocated by many palæobotanists including Seward, Zalessky, Newell Arber, Grabau and myself[3]. In 1918, Zalessky suggested that either the two continents were once connected by an isthmus, or else some other means of intermigration, such as a dense group of islands, must have existed. Grabau[4] wrote : "It is possible that this northward migration of the Gondwana flora occurred during Carboniferous (pre-Permian) time, though so far as we know there were no direct land connections". The most obvious, if not the only, route seemed to me to be that through Kashmir[5], and I even suggested that possibly Kashmir was only a southern outpost of Angaraland. But data from the critical region between Kashmir and the known southern limit of the Angara flora were lacking, and are still awaited.

D. N. Wadia's brilliant work on the syntaxis of the north-west Himalaya[6] seemed at first to suggest that the marine barrier of the Himalayan geosyncline was too complete to allow migration of land plants to the northern continent. Nevertheless, the resemblance between some of the northern and southern types seemed to me too striking to be due to chance. I therefore wrote in a recent paper[7] as follows : "In the face of these considerations, Zalessky's hypothesis of a connecting isthmus or a chain of islands across the Tethys does seem bold, but then the Gondwana resemblances of the Angara

flora, which, I believe, are undeniable though they may have been exaggerated, must be explained by an indirect route, still to be discovered."

Unfortunately for us palæobotanists, at a congress in Heerlen (September 11, 1935) when these matters were discussed in a geological atmosphere, we could not induce Mr. Wadia, who was present, to take part in the discussion. For had he done so, we would have learned, there and then, that he had already found this much-needed evidence of a means of communication with the north, during his recent field work in north-west Kashmir and Hazara[8]. According to Wadia, until as late as the end of the Middle Carboniferous, a continuous land bridge must have stretched from the Punjab as far as the Pamir plateau and possibly beyond. This is proved by the occurrence of a well-marked regional unconformity between the marine Dogra slates, which are probably of Cambrian age, and the overlying agglomeratic slate, regarded as not older than Upper Carboniferous. The long period of time from the Cambrian until at least the end of the Middle Carboniferous was therefore a land period* in this area. This land bridge, as stated, must have stretched at least as far as the Pamir plateau. What the conditions were farther north we shall only know from the work of our Russian colleagues: quite possibly the land bridge was unbroken as far as the northern continent.

Wadia further states that even during Upper Carboniferous and Permian times, the Kashmir portion of the Tethys must have been studded with an archipelago of volcanic islands, which may well have permitted some intercourse for land plants between India and the north. Proof of this is to be found in the presence of carbonaceous matter as well as recognizable impressions of Gondwana plants at six or seven localities in the Permo-Carboniferous tuffs so extensively developed in this region.

I confess that, not being a geologist, I had at first failed to appreciate the full implications of this work, although I had read it early in 1935. Mr. Wadia, in his turn, told me recently that he had not at first realized how important for palæobotanists was the evidence that he had found. Zalessky's idea of a possible archipelago in the Tethys, which may have served as stepping stones for terrestrial forms of life migrating north, thus emerges as a prophetic utterance.

It remains to add that it is at Mr. Wadia's suggestion that I am writing the present note, which has been read by him. If conditions permit, we hope to present the whole evidence, from our respective points of view, before the International Geological Congress to be held in Moscow next year. On that occasion I also hope to be able to bring with me typical specimens of Indian Lower Gondwana plants for a direct comparison, now more urgent than ever, with the Gondwanoid members of the northern flora.

B. SAHNI.

University, Lucknow.
Aug. 8.

* There is here a possibility of finding evidence of the Devonian flora, which has not so far been discovered in India.

[1] Amalitzky, *Trav. Soc. Imp. Nat. St. Pétersb.*, **28** (1897); *ibid., Compt. rend.*, **132**, 591 (1901); Zeiller, *Bull. Soc. Bot. France*, 392 (1898); Schmalhausen, *Mém. Acad. Imp. Sci. St. Pétersb.*, **27**, 4 (1879).
[2] Zalessky, *Mém. Com. Géol. N.S.*, Livr., 174, 5–6 (1918).
[3] Seward, "Plant Life through the Ages", pp. 161, 252 (1933).
[4] Grabau, "Stratigraphy of China", Pt. 1, Palæozoic and Older, p. 407 (1923–24).
[5] Sahni, *Proc. 13th Ind. Sci. Congr.*, Pres. Addr. (Geol. Sec.) Bombay, pp. 239–240 (Jan. 1926).
[6] Wadia, *Rec. Geol. Surv. Ind.*, 65 (ii), 189 (1931).
[7] Sahni, *Current Science*, **4**, 388 (1935).
[8] Wadia, *Rec. Geol. Surv. Ind.*, 68 (ii), 144 (1934).

Early Chinese Glass from Pre-Han to T'ang Times

IN a previous letter[1], Beck and Seligman described the analysis of a large ornamental glass "eye-bead" from the Han Chün graves near old Lo Yang, dating back to the second half of the third century B.C. or perhaps even earlier. This bead had the surprisingly high specific gravity of 3·57, and proved to be essentially a lead-barium silicate, with small amounts of soda, lime, alumina, etc. Prompted by this unexpected result, we have now extended our examination to a series of thirty-two specimens of Chinese glass, covering some twelve centuries, pre-Han and Han (*c.* 250 B.C., or earlier – A.D. 220) and T'ang (A.D. 618–907). Within these broad limits, there is little reasonable doubt as to the correct dating of the pre-Han and Han specimens. It is more difficult to be certain of the T'ang; perhaps all the specimens so attributed may be of this period, and some certainly are. As most of the specimens were of considerable value, only minute samples could be removed for analysis. The work was carried out spectrographically, and though accurately qualitative, no attempt was made to place it on more than an approximately quantitative basis.

While it is obviously not permissible to generalize too freely from such a limited number of specimens, a broad general fact emerges—namely, that in passing from pre-Han to T'ang times, Chinese glass tends to change from a lead-barium silicate type (so far unique) to a lead-soda-lime silicate type and to the more common soda-lime silicate type. The results may be grouped as follows:

(1) Twenty-three specimens of pre-Han and Han glass were examined, including eleven "eye-beads", more or less resembling the type originally described. Twenty belonged essentially to the system PbO : BaO : SiO_2, with small amounts of soda, lime, etc.; the lead was usually accompanied by tin and silver, and often by traces of bismuth and antimony. The specific gravity ranged from 3·25 to 5·25. The remaining three specimens contained no barium.

(2) Nine specimens of T'ang glass were examined. Seven were essentially soda-lime silicates, and two lead-soda-lime silicates. No barium was found, save a trace in three specimens.

An extended statement of the spectrographic analyses summarized in this preliminary note will be published by one of us (P. D. R.) in "Technical Studies in the Field of the Fine Arts", together with analyses of a number of intermediate specimens, which are less definitely dated but may be thought to range from the post-Han period to that of the Wei, say, third to sixth centuries A.D.

C. G. SELIGMAN.
P. D. RITCHIE.
H. C. BECK.

Scientific Department,
Courtauld Institute of Art,
University of London.

[1] NATURE, **133**, 982 (1934).

A Cosmic Ray Burst at a Depth equivalent to 800 m. of Water

WE have recently made measurements of cosmic ray intensities in the Simidu tunnel of the Government Railways of Japan. The measurements were carried out at different positions along its length of 9·7 km., in order to find the penetration of cosmic rays through various thicknesses of rocks, which consist mainly of diolite, the average density being probably 2·8. The measuring apparatus was the Neher electroscope[1] with which Dr. Millikan kindly

supplied us. The ionization chamber of diameter 15 cm. was covered with 11 cm. of lead and was left at each place for about 24 hours. The vertical thickness of rocks varied from 1,230 m. to 120 m., corresponding to about 3,400 m. and 340 m. of water-equivalent respectively.

The results of the measurements are given in the accompanying table. The minimum thickness of rocks overhead was calculated from the contour lines of a map and is naturally not exact. The ionization values were calculated according to the constant of the instrument determined and communicated to us by Dr. Neher. They should be taken as relative values rather than absolute, because the difference in the surrounding conditions might have caused a minute change in the constant of the instrument.

Vertical thickness of rocks (m.)	120	175	220	325*	650	1230
Its water-equivalent (m.)	340	490	620	910	1800	3400
Minimum thickness of rocks (m.)	120	175	175	290	540	880
Its water-equivalent (m.)	340	490	490	810	1500	2500
Ions/cm.³/sec./atm. (Cosmic rays + residual)	0·230 ± 0·001	0·223 ± 0·003	0·224 ± 0·003	0·222 ± 0·004	0·221 ± 0·002	0·220 ± 0·004

* A burst of about 10^7 ions was observed at this position.

Unfortunately, the residual ionization which Dr. Neher determined by going 70 m. underground is rather large (0·23 ions/cm.³/sec./atm.) and the instrument is not suited for the present purpose. From the decrease of ionization with depth shown in the table we see the indication of the penetration of cosmic rays through much thicker layers of matter than has hitherto been observed[2]. The fluctuation of the ionization, however, is larger than the difference of ionization between the succeeding depths, and no definite inference in this regard can be made at present.

One conclusion, however, which we can draw from our results, is that the cosmic rays can definitely pass through more than 800 m. of water, and probably go much deeper. We observed, for example, a burst of the size of about 10^7 ions at a vertical depth of 325 m. (min. depth 290 m.), corresponding to a much greater penetration than has hitherto been directly observed. Both Kolhörster and Corlin[3] made measurements with an ionization chamber down to 800 m. water-equivalent underground. The cosmic ray intensity at this point was tentatively assumed to be zero. From the above results, however, we see that there still remains a very small part even at this depth.

Our measurements were made possible by the courtesy of the Bureau of Maintenance of the Japanese Government Railways, and our thanks are especially due to Mr. H. Asonuma and Dr. T. Watanabe of the Department of Railways, as well as Prof. M. Ishimoto of the Imperial University, Tokyo, for their interest in this work, and to Mr. Minamide and others at Minakami Station who offered us much assistance.

Y. NISHINA.
C. ISHII.

Cosmic Ray Sub-Committee of the Foundation for the Promotion of Scientific and Industrial Research of Japan, Tokyo. Sept. 10.

[1] Cf. R. A. Millikan and H. V. Neher, *Phys. Rev.*, **50**, 15 (1936).
[2] W. Kolhörster, *Sitz. Pr. Ak. Wiss.*, 689 (1933); NATURE, **132**, 407 (1933). A. Corlin, NATURE, **133**, 63 (1934); *Ann. Observatory Lund*, No. 4, A, 95 (1934).
[3] loc. cit.

Radioactive Isotopes of Nickel and Copper

IT has been shown by Fermi and co-workers[1] and by Bjerge and Westcott[2] that the activity induced in zinc through neutron bombardment is due to an isotope of copper. Considering the well-known possibilities of the formation of active substances by a neutron bombardment, it is evident that the possibility of forming an active isotope of nickel is implied. Now, by means of an apparatus formerly described[3], the formation of active nickel from zinc irradiated with neutrons has been actually shown.

The experiments were carried out with metallic zinc powder. After activation, it was dissolved in nitric acid and a trace of cupric oxide and of nickel sulphate was added. The copper was precipitated from the acid solution by means of hydrogen sulphide. After filtration, ammonium chloride in excess was added to the filtrate, next dimethylglyoxime was added, and finally the acid solution was made alkaline by the addition of ammonium hydroxide. The red precipitate was ignited and placed in a counter in a manner formerly described[4]. The activity decayed with a period of nearly 100 minutes. McLennan and others[5] have found a period of 100 minutes produced by slow neutrons in metallic zinc. Perhaps this is the same activity as that mentioned here. Rotblat[6] and Naidu[7], however, found a period for nickel formed by means of neutron irradiation of nickel to be 3 hours. These results may indicate the possibility of the existence of two active isotopes of nickel—possibly $^{63}_{28}$Ni and $^{65}_{28}$Ni.

The period of the active copper has also been measured. The copper sulphide was dissolved in nitric acid and transformed to cupric oxide. The period of this product was measured and found to be 17 hours. This result is not in accord with the results of Fermi and of Bjerge and Westcott, who found 10 hours and 6 hours respectively. Special care was taken in the measurements during the first twenty hours to find, if possible, a shorter period, but the decay curves only gave the 17-hour period. Van Voorhis[8] has reported an activity produced in copper by deuteron bombardment, supposed to be due to an isotope $^{64}_{29}$Cu, with a period of 12·8 hours, emitting both positrons and electrons. It seems difficult at present to reconcile these observations, apparently giving four different decay periods for the same isotope. As the experimental method only allows detection of active products with fairly long periods, the 5-minute period of copper was not found.

The number of particles counted from the nickel is only one tenth of that from the same amount of copper.

Attempts to isolate active chlorine from irradiated potassium gave negative results. This may be due to the possibility that it is not $^{35}_{17}$Cl, but $^{38}_{17}$Cl which is the bearer of the chlorine activity already known.

C. B. MADSEN.

Physical Institute,
University,
Aarhus, Denmark.
Sept. 22.

[1] Fermi and others, *Proc. Roy. Soc.*, A, **149**, 522 (1935).
[2] Bjerge and Westcott, NATURE, **134**, 286 (1934).
[3] Madsen, *Z. Phys.*, **101**, 72 (1936).
[4] Buch Andersen, *Z. Phys.*, **98**, 597 (1936).
[5] McLennan and others, NATURE, **135**, 505 (1935).
[6] Rotblat, NATURE, **136**, 515 (1935).
[7] Naidu, NATURE, **137**, 578 (1936).
[8] Van Voorhis, *Phys. Rev.*, **49**, 876 (1936).

Evidence for the Expulsion of Two Neutrons from Copper and Zinc by One Fast Neutron

COPPER and zinc were bombarded with neutrons from different sources. The results are represented in the following table :

Source of neutrons	Periods	
	Copper	Zinc
$^2H + {}^2H$	6 m. (weak)	No activity
$^2H + {}^2H + P$ / $Be + {}^2H + P$	6 m.	60 m.
$Be + {}^2H$	6 m. (weak)	No activity
$Li + {}^2H$	10·5 ± 0·5 m.	6 m. 60 m.
$Li + {}^2H + Ag + Cd$	10·5 ± 0·5 m.	6 m. 60 m.

P means that paraffin was used to slow down the neutrons. Ag + Cd means that a sheet of 0·2 mm. silver and one of 0·2 mm. cadmium were placed between source and bombarded material in order to stop slow neutrons.

The 6-minute period of copper most probably corresponds to the 5-minute period reported by Fermi and his collaborators[1]. The 10·5-minute period appears with the fast neutrons from (Li + ^2H) only. An initial activity of 1,200 impulses per minute was measured. An activity of about 11 minutes observed in cobalt bombarded with slow neutrons and in nickel with fast neutrons (which may be the same as the 20-minute period reported by Rotblat[2]) might lead to the assumption that an active cobalt isotope is produced here. We found, however, that this assumption is not justified.

The 60-minute period of zinc induced by slow neutrons probably corresponds to the 100-minute period reported by McLennan, Grimmet and Read[3], the 6-minute period to that reported by Fermi and his collaborators[1].

The same 60-minute period appears, however, with the fast neutrons from the (Li + ^2H + Ag + Cd) source, and not with those from the ($^2H + {}^2H$) or (Be + ^2H) source, which excludes the possibility of ascribing this activity to the action of slow neutrons ; it indicates that neutrons of considerable energy are essential here.

A chemical separation of the radioactive substances was attempted by Mr. R. W. P. de Vries. As to copper (10·5-minute period) : cobalt and nickel precipitated in different ways were found to be inactive. Copper precipitated electrolytically was active. As to zinc (60-minute period obtained with fast neutrons) : precipitated nickel was inactive. Copper showed a 6-minute and a 10–12 hour period, as was to be expected. Zinc precipitated electrolytically from the solution showed the 60-minute period. Both activities must therefore be ascribed to isotopes of the irradiated elements.

An investigation of the particles emitted by copper (10·5-minute period) by means of magnetic deflection *in vacuo* and a Geiger-Müller counter proved these to be positrons. A period of about 10 minutes was found for these deflected positrons. The intensity of the 60-minute period of zinc was too small to observe the deflected particles with certainty.

From these data we may infer that the following reactions take place with fast neutrons :

$$^{63}Cu + {}^1n \rightarrow {}^{62}Cu + 2\,{}^1n \qquad {}^{62}Cu \rightarrow {}^{62}Ni + e^+$$
$$^{66}Zn + {}^1n \rightarrow {}^{65}Zn + 2\,{}^1n \qquad {}^{65}Zn \rightarrow {}^{65}Cu + e^+$$

We found the same zinc isotope to be formed by capture of a slow neutron :

$$^{64}Zn + {}^1n \rightarrow {}^{65}Zn.$$

The possibility of the type of reaction described was discussed by Fermi[4] but up to the present it had not been observed with certainty (cf. L. Meitner and O. Hann[5] and Johnson and Hamblin[6]).

Further details and a description of our apparatus will appear elsewhere.

F. A. HEYN.

X-Ray Research Laboratory,
N. V. Philips' Gloeilampenfabrieken,
Eindhoven, Holland.
Sept. 30.

[1] *Proc. Roy. Soc.*, A, **149**, 522 (1935).
[2] NATURE, **136**, 515 (1936).
[3] NATURE, **135**, 505 (1935).
[4] *Proc. Roy. Soc.*, A, **146**, 483 (1934).
[5] *Naturwiss.*, **24**, 158 (1936).
[6] NATURE, **138**, 504 (1936).

Thermal Properties of Helium, Hydrogen and Deuterium

IT has been shown by F. Simon[1] and F. London[2] that the abnormally large specific volume and compressibility of helium and hydrogen can be understood by considering the influence of the zero point motion. Clusius and Bartholomé[3] pointed out that this zero point motion is also responsible for the fact that the specific heat of hydrogen is nearly equal to that of deuterium. They remarked that it is no longer legitimate here to represent the potential energy as a quadratic function of the deviations of the particles from their equilibrium positions.

As at low temperatures only long heat waves, which are harmonic, contribute to the specific heat, and the frequencies of these waves are determined by the velocity of sound, the specific heat near the absolute zero can be calculated if the velocity of sound is known.

It is possible to derive a 'Schrödinger equation' for a crystal deformed by a long wave. The deformation energy, derived with the help of this equation, contains not only a change in the potential energy but also in the kinetic energy. An expression for θ is obtained in which the two effects are separated :

$$\theta^2 = \frac{1}{2\pi^{2/3}} \frac{h^2}{mk^2} \left[\frac{s}{2} + \frac{\pi^2 h^2}{2^8 m l^4}\right],$$

where m is the mass of the particle, s the second derivative of the molecular field at a lattice point and l is a length which is equal to or smaller than $a - \sigma$ (a is distance between nearest neighbours, σ is molecular diameter).

Taking $l = a - \sigma$, and omitting s (which means that the molecules are replaced by hard spheres) the following results are obtained :

	Mol. vol.	σ	l	θ calc.	θ exp. (0° K.)
He	19·88	2·35	1·24	29·2	34·0 [4]
	19·32	,,	1·21	30·8	36·0 [4]
	18·35	,,	1·15	33·9	39·5 [4]
H_2	23·31	2·80	0·98	93·7	91 [5]
D_2	20·48	,,	0·83	65·7	89 [3]

The rather large deviation shown by deuterium may be due to the fact that it is not permissible to omit s in this case, and the value of l is only an upper limit.

Some conclusions about the thermal expansion can also be deduced by this formula. According to Debye's

theory[6], the thermal expansion contains the factor $-\delta\theta/\delta V$. For increasing volume, s becomes negative and then becomes zero. At very small densities it may therefore give a positive contribution in $\delta\theta/\delta V$. So the thermal expansion might become negative for very small densities.

Although the formula only holds for crystals, this might still be an indication of how the negative expansion coefficient of 'liquid' helium II is to be explained.

A detailed account will be published in *Physica*. My thanks are due to Dr. A. Michels for stimulating discussions.

A. BIJL.

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[1] NATURE, **133**, 529 (1934); **138**, 244 (1936).
[2] *Proc. Roy. Soc.*, A, **153**, 576 (1936).
[3] *Z. phys. Chem.*, B, **30**, 237 (1935).
[4] W. H. Keesom and A. P. Keesom, *Physica*, **3**, 105 (1936).
[5] Simon und Lange, *Z. Phys.*, **15**. 307 (1923).
[6] "Vorträge über kin. Theorie der Materie."

Electrification of a Roof during a Thunderstorm

A LETTER from my daughter in Jamaica refers to her house being affected electrically in a curious manner. She was sitting on the verandah during a thunderstorm when she heard "a funny sound like the buzzing of a bumble-bee", and saw that the verandah gutter was emitting sparks and smoke. Running to the kitchen to get a bucket of water, she found the legs of the stove, where they rested on the stone floor, spluttering sparks. She threw a bucket of water on them, and in doing so "got quite a bad shock and the bucket was torn out of my hands". On returning to the verandah, the gutter was still emitting sparks.

The explanation of this affair appears—from my knowledge of the house—to be as follows. The roof—its ridge about 25 ft. above the ground—is of galvanized iron, and is insulated from 'earth' except via the kitchen stove funnel. The guttering is fastened to wooden verandah pillars and normally is not in contact with the roof. The single down-pipe of the guttering leads to a water tank and presumably is earthed.

I imagine that what occurred is this: somehow the partially insulated roof became charged as one plate of a condenser, and the charge, being insufficient to break through the resistance to earth in one discharge, leaked away gradually via the weak contact of the stove legs with the floor and also via the small gap between the roof and the gutter. The shock my daughter got was obviously due to the thrown water forming another channel for discharge via the bucket and herself.

W. F. TYLER.

Thatched House Club,
St. James' Street,
S.W.1.
Sept. 24.

Points from Foregoing Letters

DR. BROOM has now prepared a description, with diagrams, of teeth belonging to the fossil skull, *Australopithecus transvaalensis*, described by him in NATURE of September 19, p. 486. It will be recalled that the skull was found at Sterkfontein, Transvaal, and is of presumably Upper Pleistocene age. The teeth differ from those of the chimpanzee and resemble those of man in many respects.

A photograph of a fossil wing-cover of an insect from the Upper Triassic of Queensland, showing transition from characters of the order Homoptera to those of Heteroptera, is submitted by Dr. R. J. Tillyard. The bed from which it was obtained is rich in insects; some two hundred specimens belonging to various orders (Homoptera, Coleoptera, Trichoptera, etc.) have been found in less than a cubic yard of shale.

A continuous land-bridge must have stretched in Permian to Middle Carboniferous times from the Gondwanaland (the Palæozoic continent which spanned the South Atlantic and Indian Oceans) northwards through the Punjab as far as the Pamir Plateau and possibly beyond. Commenting on the evidence for this view, supplied by the investigations of D. N. Wadia in the Himalaya, Prof. B. Sahni points out its importance to the old hypothesis of a land connexion between Gondwanaland in the south and Angaraland (which included a great part of eastern Siberia) in the north across the Thetis Sea (of which the Mediterranean is a remnant).

Chemical analysis of early Chinese glass indicates that in the period from pre-Han (before A.D. 220) to T'ang times (A.D. 618) Chinese glass tends to change from lead-barium silicate type to the more common soda-lime silicate type. The investigation was carried out spectrographically on minute samples by Prof. C. G. Seligman, Dr. P. D. Ritchie and H. C. Beck.

Dr. Y. Nishina and C. Ishii have recently made measurements of cosmic ray intensities in a railway tunnel under a vertical thickness of rock (diolite) varying from 1,230 m. to 120 m., water-equivalent about 3,400 m. and 340 m. respectively. At a vertical thickness of 325 m. (minimum thickness 290 m.) a burst of 10^7 ions was observed, which proves the presence of cosmic rays after passing through rock the absorption of which is equivalent to that of more than 800 m. of water.

The chemical identification of radioactive nickel, of nearly 100 minutes period, prepared by irradiation of zinc with neutrons, is described by Dr. C. B. Madsen. Radioactive copper was also obtained, with a period of 17 hours. Bombarding copper and zinc with neutrons, according to F. A. Heyn, leads to expulsion of other neutrons and formation of radioactive isotopes of the elements irradiated.

An equation for calculating specific heats at very low temperatures (near the absolute zero), if the velocity of sound is known, is given by A. Bijl. In the case of helium and hydrogen, the calculated values agree with those experimentally observed, but in the case of heavy hydrogen there is a wide discrepancy. This, the author considers, may be due to the fact that the simplifying assumption—that molecules behave like hard spheres—is not permissible in the case of heavy hydrogen.

Research Items

Physical Characters of the Cook Islanders

To a series of monographs on the physical characters of the native populations of Polynesia, Dr. H. L. Shapiro and Dr. P. H. Buck (Te Rangi Hiroa) have added a study of the Cook Islanders, based on material collected by Dr. Buck in 1926 and 1929 (*Mem. Bernice P. Bishop Museum*, 12, No. 1). The process of disintegration has not gone so far in Cook Islands as in other parts of Polynesia, and it is still possible to find there a representative example of true Polynesians. Although strictly speaking the Cook Islands are limited to six, three others, Manihiki, Rakahanga and Tongareva are included. Of the 913 individuals examined, a number were rejected as unsuitable, and the records here studied are derived from 804 individuals, of whom 551 are males and 253 females. Ten measurements and twenty observations were taken. The characteristic features show that the Cook Islanders are akin to other Polynesian groups. Tall, robust, and well developed, they show a typical tendency to brachycephaly, with a massive face and characteristic combination of broad bizygomatic diameters with high narrow foreheads. The nose is large and fleshy and the lips full. In complexion they are moderately brown-skinned with dark, straight, or wavy hair, which, though luxuriant on the head, is only sparsely developed on the body and face. The eyes are full and dark-brown, and the epicanthus is usually absent. The archipelagic uniformity which is characteristic of other parts of Polynesia, with one exception, is completely lacking here. The exception is the resemblance between Manihiki and Rakahanga. Certain characters, however, bind the islanders into a homogeneous group, while in others, such as nose height, face height, head length and span, the islanders are differentiated one from another. Two distinct types, however, can be established with several intergrades, the differences to be allotted to Central, Western and Maori strains.

Proficiency and Psychological Tests

REPORT No. 74 of the Industrial Health Research Board, by E. Farmer and E. G. Chambers, is a study of the prognostic value of some psychological tests. In all, 2,731 men from fourteen occupational groups were tested with a number of psychological tests, and the data were examined to see to what degree proficiency at the tests was related to proficiency at the different occupations. Statistical treatment of the results showed that the psychological tests given to adolescents did have prognostic value in the skilled groups, but that they were of no diagnostic value for proficiency in the unskilled groups. There was also no evidence to show that psychological tests can afford a measure of the factors involved in the proficiency of those already proficient. The report is extremely valuable, not only for its positive conclusions but also because it shows the very great complexity both of the processes involved in proficiency and in the interrelation of the various psychological functions. Vocational selection is an infinitely more difficult problem than some enthusiasts for testing realize.

Birds of Bay Islands, Spanish Honduras

"LAS ISLAS DE LA BAHIA" form a chain of islands in the Caribbean Sea, off the north coast of Honduras. They are little known, and have a very limited fauna, land shells being particularly scarce. James Bond has described the resident birds of the islands, 43 species or subspecies, five of the latter being new to science (*Proc. Acad. Nat. Sci. Philadelphia*, 88, 353; 1936). The resident bird fauna is fundamentally of Central American type, and the island chain must be looked upon as the tops of a submerged mountain range, which through isolation from the mainland have retained a number of Central American species. These relict forms have entirely or almost disappeared from Central America proper, but they appear, again as relicts, on islands off the coast of Yucatan.

Reproduction in the Chimpanzee

THERE are about twenty published records of the birth of chimpanzees in captivity, but in none of these cases has the whole process been described in the full detail which is given in a recent paper by J. H. Elder and R. M. Yerkes (*Proc. Roy. Soc.*, B, 120, 409; 1936). This paper reports fifteen births (one of them twins) which have occurred during the last six years in the Yale Laboratories of Primate Biology. Fertilization, pregnancy, parturition and the puerperium are fully described. Impregnation occurs about, or slightly after, the midpoint of the 35-day sexual cycle. The average duration of pregnancy was 236 days—about 30 days shorter than in man. Menstrual bleeding does not commonly recur after conception. Almost without exception, the chimpanzee female during pregnancy and nursing is much more gentle, friendly, dependable and easily handled than at other times.

Genetical Constitution of *Drosophila pseudo-obscura*

LIGHT is thrown on the relationships of species by a comparison of their mutations. Mr. H. P. Donald (*J. Genetics*, 33, No. 1) has investigated the forty-five known mutations of *Drosophila pseudo-obscura* in comparison with those of *D. melanogaster*, and gives revised linkage maps for its five pairs of chromosomes. A number of the mutants are similar to those of *D. melanogaster*; for example, the autosomal types bithorax, glass, stubble, pink, cross-veinless and jaunty, and the sex-linked mutations known as pointed (= beaded), yellow, scutellar, white, singed, vermilion and miniature. Linkage maps of the two species, connecting genes which are supposed to be homologous, indicate that various rearrangements of the genetic material have taken place, and that these have been intrachromosomal more frequently than interchromosomal. Considerable homology is indicated between corresponding chromosomes or whole arms of chromosomes in the two species. Despite a number of translocations involving changes in the positions of one or more genes, the loci involved appear to have retained largely the same phenotypic effects, variability and mutability as before.

Radioactive Elements in Plants

THE continued interest in the relation of radioactivity to plant growth focuses attention on the paucity of information available as to the presence of radioactive elements in plants. K. Kunasheva and B. Brunowsky, of the Biogeochemical Laboratory of the Academy of Sciences at Moscow, who have already published work dealing with the presence of elements of the thorium series in duckweed, have reported in a letter to the Editor the results of quantitative determinations of uranium in the same species. They find the uranium content to be $9{\cdot}5 \times 10^{-5}$ per cent. By the same method the radium content was found to be $2{\cdot}38 \times 10^{-11}$ per cent. On the basis of these figures, the ratio Ra : U for duckweed is calculated as $2{\cdot}7 \times 10^{-7}$, that is, within the limits of error in measurements, uranium is in equilibrium with radium. Details of the method and results of the measurements are to be published in a forthcoming issue of the *Proceedings of the Biogeochemical Laboratory of the Academy of Sciences*.

A New Genus of Mesembryanthemum

The late Dr. N. E. Brown left a manuscript note of six species of shrubby South African mesembryanthemums. He included these in a new genus, *Mestoklema* (Gr. *Mestos*, full, *klema*, a small branch), and full descriptions of the species appear in the *Gardeners' Chronicle* of August 29. *Mestoklema* is allied to the older genus *Delosperma*, but differs in its peculiar branched habit, the very small flowers, the persistent, hardened, subspinose cymes, and the closed cells of the capsule, which are provided with cell wings.

The South Sandwich Trench

To the north and east of the South Sandwich Islands in the South Atlantic on the edge of the Weddell Sea, the *Meteor*, and later *Discovery II*, took some unexpectedly deep soundings exceeding seven thousand metres. This area was further sounded in the most recent cruise of *Discovery II* and is provisionally mapped in a paper by Dr. N. A. Mackintosh on "The Third Commission of the R.S.S. Discovery II" in the *Geographical Journal* of October. The trench seems to extend in an arc about a hundred miles to the east of the line of volcanic peaks which constitute the group of South Sandwich Islands. On the north it ends in about lat. 55° S., and in its northern part it is widest and deepest, falling to below eight thousand metres. To the south it narrows to a cleft of more than seven thousand metres, less than ten miles wide in its deepest parts. This remarkable cleft has not yet been traced south of about lat. 61° S., where it seems to curve towards the west, south of the ridge joining the South Sandwich and South Orkney Islands.

'Polaroid'

DEMONSTRATIONS of some technical uses of the new polarizing material 'Polaroid' are being given by appointment with Messrs. Polaroid Products, Ltd., 39 Lombard Street, E.C.3 (Telephone, Mansion House 2997). This firm is the representative agent in Great Britain of the American manufacturers of the polarizing film described by Prof. A. F. C. Pollard in NATURE of August 22 (p. 311) and now named the International Polaroid Corporation, New Jersey, U.S.A., with its laboratories in Boston. The film, which formerly consisted of nitrocellulose, but now consists of the less inflammable cellulose acetate, contains sub-microscopic crystals of herapathite with their optic axes oriented in one direction parallel to one another, and is made in the two grades designated Types I and II. Type I is intended for use in optical systems and instruments, whereas Type II is intended for use over light sources when plane polarized illumination is required. Type I may be obtained clear or dyed in various colours. Type II is not optically clear, but polarizes light just as efficiently as Type I and is cemented to one side of glass sheet. Messrs. Polaroid Products, Ltd., supply Type I film, cemented between glass plates of optical quality sufficiently good for most purposes and mounted in bakelite rims with an aperture of 4 cm. Disks, ½–4 in. diameter, and squares of the same dimensions, with the film cemented to one side of the glass only can also be supplied immediately. The American concern is now manufacturing film 2–2½ ft. wide, and, we are informed, will supply 'Polaroid' in production quantities in the near future. Amongst the technical applications of 'Polaroid' to be seen at the demonstration there is the elimination of glare by motor-car headlights, a very striking and beautiful stereoscopic cinema projection in natural colours, a large apertured stereoscope which can be viewed by several people at the same time, a strain viewer and some effects with colourless 'Cellophane' cut out to form pictures which in polarized light appear in a variety of interference colours. In addition, a lamp is arranged to give strong polarized illumination so that the texture of the skin may be examined by the aid of a 'Polaroid' screen.

A Fairthorne–Salt Mathematical Film

A CINEMA film to show the qualitative properties of the differential equation $\ddot{x} + x = 0$ has been produced by R. A. Fairthorne and B. G. D. Salt and can be obtained from the former at Kirk Michael, Hillfield Road, Farnborough, Hants. It shows two disks of variable radius, revolving at constant speed. The radius of one represents the acceleration $\ddot{x}$, so the length of a string unrolled from it represents the velocity $\dot{x}$. The radius of the second disk is equal to the length of this string, and so represents this velocity, and the length of a string unrolled from it represents the distance x. By arranging that the length of this second string, taken in a certain direction, is numerically equal to the radius of the first disk, we get the differential equation. This arrangement may be regarded as embodying the fundamental ideas of the differential analysers used by Dr. Bush at Massachusetts Institute of Technology or Prof. D. R. Hartree at the University of Manchester. The film can be obtained on 35 mm., 16 mm. or 9·5 mm. stock. The methods used can be extended to other differential equations, as was explained in a paper by Mr. Fairthorne read before the International Congress of Mathematics at Oslo last July.

ERRATUM.—In the summary prepared for NATURE of Dr. I. V. Newman's paper before the Linnean Society of New South Wales on the angiospermic carpel (NATURE, August 1, p. 209), the third conclusion, that "the legume is not a foliar structure", is incorrect. It should read "the evidence is compatible with the legume being a foliar structure".

The Second International Cancer Congress

THE Second International Cancer Congress, held at Brussels under the auspices of L'Union Internationale contre le Cancer, terminated on September 28. Between three and four hundred surgeons, physicians, radiologists and research workers, drawn from forty-seven different countries, were in attendance, and were welcomed by M. Lerat, president of the Congress; by M. Justin Godart, president of L'Union Internationale contre le Cancer; and by M. Vandervelde, (Belgian) Minister of Health, in the presence of H.M. The King of the Belgians.

Great Britain was officially represented by Dr. W. Cramer, Col. A. B. Smallman, Mr. Sampson Handley, Mr. J. J. Shaw, and Mr. Cecil Rowntree. There was also a large group of workers from the great research centres, which included Dr. W. E. Gye, Prof. E. L. Kennaway, Prof. J. W. Cook, Dr. R. D. Passey, Prof. Mathew Stewart, Dr. Dorothy Russell, Dr. P. D. Peacock, Dr. Donaldson, and Mr. Stanford Cade.

The Belgian Committee, to whom the organization of the Congress had been entrusted by the Union Internationale, by a wealth of private and public hospitality did much to establish a degree of intimacy between the nationals of so many diverse countries, and added greatly to the success of the Congress.

Among the more notable official occasions was a reception by the Prime Minister and Mme. van Zeeland held at the beautiful Musée Cinquantenaire; and a banquet at which speeches were made by representatives of Germany, France, Great Britain, Italy, Spain, Greece and Sweden expressing their appreciation of the great scientific and social success of the Congress. During the latter, one delegate felt that song was the only suitable medium with which to express his feelings, and brought down the house with his delightful rendering of "Qui ne sait boire, ne sait rien".

But perhaps the most interesting event—in any event so far as the delegates from the British Empire were concerned—was the reception on the last evening at the Fondation Universitaire, when the opportunity was taken to present to Profs. Kennaway and Cook the prize award of the Union Internationale. The allocation of this prize to the two English research workers was unanimously voted at a meeting of the Council of the Union. It consists of a sum of money and a quantity of radium, generously placed at the disposal of the Union Internationale by the Union Minière [see NATURE, Oct. 3, p. 579].

In addition to a large number of independent papers, thirty-five official reports were presented. All the different aspects of the cancer problem came under consideration, and the subjects ranged from the demonstration of micro-puncture of cells by ultra-violet rays, to the provision of hospital accommodation for incurable cancer patients.

For the presentation of the communications, six different sections had been created, and by skilful organization it had been arranged that papers relating to allied subjects were read in one section, and so far as possible at the same meeting. One of the most interesting meetings was a discussion on carcinogenesis, in which Profs. Kennaway and Cook spoke on chemical compounds as carcinogenic agents, and Dr. Gye on tumours transmissible with viruses. At a subsequent meeting, Prof. F. Pentimalli (Florence) submitted a report on the nature of the agent present in two filtrable fowl tumours. The hereditary factors in cancer were discussed by Dr. Clara Lynch (New York), Prof. Maud Slye (Chicago), Dr. L. Kreyberg (Oslo), Prof. Nadine Dobrovolskaia-Zavadskaia (Paris), Prof. R. Korteweg (Amsterdam), Dr. Wilhelmina Dunning (New York), and Prof. A. Hintze (Berlin).

Communications on the experimental investigation of cancer were submitted by Dr. P. R. Peacock (Glasgow), Prof. R. D. Passey (Leeds), Prof. J. McIntosh (London), Dr. O. Schürch (Winterthur), Prof. Oberndorfer (Istanboul), Dr. I. Berenblum (Leeds), and others. The interesting new subject of transplantable fibro-adenomata of rats and their transformation into sarcomata was discussed by Dr. Ch. Oberling (Paris), and Dr. J. Heiman (New York). Mr. Sampson Handley (London) presented his thesis on the etological importance of lymph stasis.

On the subject of the diagnosis of cancer, Dr. J. Ewing (New York) read a report on problems in histological diagnosis, whilst Prof. L. Hirszfeld (Warsaw), Prof. P. Rondoni (Milan) and Prof. P. Del Rio Hortega (who had specially travelled from Madrid to attend the Congress), discussed the serological and sero-cytological diagnosis of cancer. Dr. Dorothy Russell showed her instructive film demonstrating the tissue culture of gliomata.

The papers read in the section of radiotherapy by Prof. F. Carter Wood (New York), Prof. H. R. Schniz (Zurich), and Dr. L. Mallet (Paris) gave an indication of the progress made in this important branch of cancer therapy as a result of a better understanding of the mode of action of X-rays and radium. By a modification of the previous technique, Schinz has succeeded in obtaining in tumours of the mesopharynx, in which previously radiotherapy had been a failure, a remarkably high percentage of five-year cures. Schinz also emphasized the importance of radiotherapy as a palliative measure in cancer. This aspect was dealt with in greater detail in the communication of Dr. Mallet. He has applied systematically tele-X-ray therapy to patients in advanced stages of cancer, by exposing large parts of the body at long distances. He showed by numerous illustrations that his method enables him to check the progress of the disease in advanced stages of cancer of the uterus and of the œsophagus, and also in metastases in bones and lungs. Mr. Stanford Cade gave an account of the results obtained by the Curie therapy in pharyngeal cancer.

In the Social Section, the importance of statistics as a scientific method for the investigation of the etiological factors of cancer in man was emphasized in reports by Dr. L. I. Dublin (New York), Dr. W. Cramer (London), and Dr. S. Peller (Jerusalem). Some of the American and German delegates, believing that a morbidity statistic would advance our knowledge, submitted a resolution that the compulsory notification of cancer is advisable from this point of view, and that the Union Internationale should appoint a committee to consider this question.

The incidence of cancer in different races was discussed by Prof. C. Bonne (Batavia), and M. J. A. des Ligneris (South Africa).

The thorny problem of the medical treatment of cancer was discussed in numerous communications. One of these methods which, described as a polyvalent hormonetherapy, had received a good deal of notice in the Continental press, was submitted to a devastating criticism; while the more serious attempts by Prof. E. Freund and Dr. Kaminer of Vienna, which were frankly admitted to be mainly of a palliative nature, were listened to with respectful scepticism.

The general feeling among the delegates was that definite progress has been made both in our understanding of the disease and in the methods of treatment; and that a continuation of this progress is assured. This feeling found expression in the conclusion submitted at the final meeting, in which it was stated, for the first time officially, that cancer is a disease which is not only curable, but also, within limits, preventable.

National Smoke Abatement Exhibition

DURING October, an exhibition and conference is being held under the auspices of the National Smoke Abatement Society in the Science Museum, South Kensington. The interesting Handbook (Pp. 78. Price 6*d*.) published by the Society, the offices of which are at 36 King Street, Manchester, contains twelve articles on various aspects, which are reinforced by another dozen addresses at the Conference held at the Science Museum on October 14–17. Dr. des Voeux, reviewing the smoke abatement movement, mentioned that an exhibition of appliances was held in 1885. Actually one was held still earlier, in November 1881, under most influential auspices and also in South Kensington (NATURE, **25**, 219; 1882). The writer has been informed that the organizers were prosecuted for causing a smoke nuisance. Many would be interested to learn that a grate designed by Sir W. Siemens for burning coke and fitted with a gas burner for ignition was a prominent exhibit (NATURE, **23**, 25; 1881). The promoters of the 1881 exhibition would have been surprised to learn that a problem which they understood would still await solution after half a century.

Technically, of course, a solution is possible, but the obstacle is a lack of will. Generally speaking, enthusiasts for smoke abatement lack power and influence commensurate with their knowledge and vision. They control neither politics nor finance. As a result it is rare, even now, to find in local government any party making atmospheric cleanliness a primary object of policy. Alteration may, however, come soon. It may be realized by property owners that upper floors of buildings in central urban areas might serve as attractive residential quarters if the air were freed from smoke. That realization might create an interest in smoke abatement in people now indifferent though suffering from the depreciation in value of urban property due to a flight to the suburbs. In one of the papers read, Mr. Noel Carrington blamed the decay of civic spirit in large cities for the lukewarm interest in the smoke nuisance. Those who do not live near their work are prone to be indifferent about the conditions there.

The present activity in rebuilding cities offers an unprecedented chance of replacing smoky by clean fuel appliances, but generally speaking the opportunity is neglected. The opportunity is recognized by public health officials—as shown in Dr. A. S. M. Macgregor's paper on the work of his department in Glasgow; but public opinion rarely gives adequate backing.

The development of flying has brought support to the movement from a new quarter. Flight-Lieut. H. M. Schofield's paper described with terse emphasis how aviation is hindered in Great Britain by atmospheric conditions.

There is no doubt that improvement has taken place in the matter of industrial smoke, but the advance is uneven. In many light industries, the spread in the use of gas and electricity has removed the need for boiler plants, and new factories are often smokeless. However, as H. G. Clinch described, there is often great difficulty in enforcing a high standard, and this is increased by the reluctance of employers to encourage and reward technical training among working stokers.

The heavy industries offer another problem, for generally they are protected by law from prosecution for unavoidable smoke. This exemption has generally deprived them of a strong incentive to seek to avoid smoke. As Mr. H. C. Armstrong said in his paper, Sheffield opinion held that their "steels could not be made without smoke". This was due to the recognized need for maintaining a reducing atmosphere in furnaces. That this could only be done by keeping smoking coal fires seemed so axiomatic as to need no investigation. Recent studies have largely destroyed the basis for this opinion, and new practices are developing in Sheffield and Rotherham, assisted by the development of the 'grid' conveying gas from the coke ovens to the steel works. Mr. Armstrong shows clearly that large technical and financial difficulties retard the rapid abolition of coal-fired furnaces, and that much depends on the availability of cheap gas. A definite amelioration can be looked for.

The same point follows from the examination of the problem of smoke in the clay industries by E. Rowden and A. T. Green. It must have puzzled many to understand why the makers of artistic ceramic ware should be content to live in the atmosphere of the Potteries. The firing of clayware is, however, beset with peculiar technical problems which often demand the use of intermittent kilns. When these are fired by coal, smoke production is inevitable, but efforts are being made to diminish this. Headway is being made with the use of town gas-fired kilns when possible, but cost of fuel is a limiting factor.

These industrial examples show the need for making gaseous fuel cheap if industrial smoke is to be reduced. At the moment, the case of the South Metropolitan Gas Co. has brought forward prominently

the question of gas charges, and those interested in smoke abatement will welcome tariffs framed to encourage the displacement of raw coal, not only in the home, but also in industry.

Dr. M. Fishenden reviewed the problem of domestic fuel problems in an illuminating manner, and concluded that although any rapid cure is impossible, present trends to the use of gas, coke, electricity, anthracite should in time be effective.

Three papers dealt with the medical aspects of smoke abatement, two of them with tuberculosis. To-day when the improvement of physique is increasingly regarded as of national concern, it is time to expect that the State will act as though the reduction of atmospheric pollution were something of national importance. A paper by Sir Arthur Hill and Dr. C. R. Metcalfe, on the effect of such pollution upon plants at the Royal Botanic Gardens, Kew, illustrated the direct interest of a public department in the subject.

Only a few of the papers have been mentioned, but all merit study, and together form a very comprehensive survey of the problem as it stands to-day.

H. J. HODSMAN.

Pedology (Soil Science) at the British Association

THE assignment of pedology (or soil science as it is still, unfortunately, termed) to Section M (Agriculture) of the British Association is the natural outcome of its historical development from a branch of agricultural chemistry. But although, in its applied aspect, it has the closest and most vital connexion with agriculture, it is to be feared that it is not entirely at home in the agricultural section. Indeed, if the geologists could be persuaded to adopt it, pedology might more fittingly find a home in Section C. It is probably the exception rather than the rule for papers or discussions to be interesting, or even intelligible, to all attending members, even in the senior sections of the British Association. Section M, however, is expected to be more popular in its appeal, and it might be better in future years to introduce pedology in the form of joint meetings with other sections. Problems of applied pedology might still be assigned to Section M.

One session in Section M on September 14 at Blackpool was devoted to pedology. The president, Prof. J. Hendrick, devoted his address to a review of the development of soil studies in the twentieth century. He directed attention to the great change which has taken place in our outlook on soil science since the beginning of the century. At that time there were no British text-books on the subject, little was known of work in other countries, and the soil was regarded simply as a medium for the growth of crops. Since that time, our outlook has been widened both by the recognition of the soil as an object of study in itself and also by the extension of our interest to include not only British soils but also those of other lands. The study of soils is essentially international, and Prof. Hendrick traced the development of that active organization, the International Society of Soil Science, which held its third Congress in England last year. In the remainder of the address, the newer conceptions in pedology were briefly adumbrated. In conclusion, Prof. Hendrick dwelt on the applied aspect of the subject and its impact on society. Increased knowledge means the possibility of increased production and even over-production, problems for the economist and the social reformer. Yet, whilst malnutrition and under-nutrition exist, even in a prosperous country like Great Britain, the fear of over-production is not likely to restrain the soil investigator from pursuing that fundamental knowledge from which progress in practice ensues.

The remainder of the session was devoted to three different aspects of pedology. Prof. G. W. Robinson dealt with the problems and difficulties of soil classification. Pedology as an independent branch of inquiry being still comparatively youthful, the principles of soil classification have not yet been so clearly defined as in the older disciplines. Whilst there is general agreement in regarding the soil profile as the unit of study, it is not always easy to define its lower limit. Further, actual profiles are not always developed to climax. Apart from complications due to immaturity of development, human interference introduces a group of soil-forming factors which must be accorded their place in a scheme of classification. The importance of giving relevant and precise information about soil profiles was stressed. Much of the published descriptive material is almost valueless through irrelevance and lack of precision. Whilst the final elaboration of a world system of classification must await the accumulation of more information, it seems possible to distinguish three main groups, depending on the character of the leaching processes, namely, (1) completely leached soils; (2) incompletely leached soils; and (3) soils with impeded leaching.

The effect of human interference as a pedogenic factor was raised in the discussion, and it was agreed that the study of soil history is of great importance for the comprehension of contemporary soils.

Dr. R. K. Schofield dealt with the behaviour of soil moisture in the field. Given the importance of soil moisture for the growth of plants, and remembering that the interstitial space of soils is the reservoir not only of water but also of air, the importance of studying the moisture conditions of the soil in profile is evident. Ideally, it would be desirable to follow the moisture changes and movements in each horizon throughout the year. By frequent sampling, a certain amount of information may be obtained, and Dr. Schofield gave the results of observations on the classical Broadbalk field at Rothamsted, on a soil in Utah, and on a soil in the Sudan—the last two under the influence of irrigation.

One of the most striking advances in our knowledge of soil moisture has been the virtual abandonment of the 'capillary-tube hypothesis' and the recognition of the limited role of capillary action in determining water movements in soils. This was

stressed in the ensuing discussion by Dr. B. A. Keen, who gave a striking instance of the way in which erroneous ideas of the influence of a deep water-table on surface moisture conditions can still enter into questions of compensation in public schemes for water supply.

Dr. A. B. Stewart dealt with a group of problems in applied pedology by describing the methods used in the advisory service at the Macaulay Institute, Aberdeen. The problems are attacked by three methods, namely, (*a*) field experiments, (*b*) pot experiments, and (*c*) laboratory examination. Since the last method is the cheapest and most convenient, a considerable amount of work has been devoted to correlating laboratory results with field and pot trials. The work is concerned chiefly with the investigation of deficiencies in lime, phosphate and potash. Field and pot experiments are generally in good agreement in the case of potash. In the case of phosphate, agreement is less satisfactory, and the necessity for taking the subsoil conditions into account is suggested. Laboratory methods are, to a large extent, arbitrary and empirical, but, with adequate interpretation, can serve as useful guides to the application of manures and fertilizers.

Soil problems were also dealt with in the session of the Forestry Sub-Section on September 10, where, arising out of an interesting series of papers on afforestation, an animated discussion took place on the possible disadvantages of purely coniferous planting. There was also a discussion on the position of British soils in a world system at a meeting of the British section of the International Society of Soil Science, held in connexion with the Blackpool meeting. G. W. R.

Work of the Government Laboratory

PRESENTING his first report as Government Chemist, Dr. J. J. Fox* refers to the considerable increase in volume and complexity of the work carried out in the Government Laboratory under the direction of his predecessor, Sir Robert Robertson, who held office from March 1921 until April 1936. During this period, the number of samples examined annually rose from about 300,000 to nearly 550,000, whilst the literature of chemistry has been enriched by many accounts of investigations arising out of fiscal and technical developments.

The subject matter of the report follows familiar lines, and provides ample material for satisfaction that the hand of the Government Chemist is on the pulse of so many activities affecting the health and revenues of the nation. Thus one paragraph commences with the words, "In order to ensure that no tea but that which is fit for human food shall pass into the country for human consumption . . .", and records the fact that of the 22,741 samples of imported tea examined during the year ended March 31, 1936, 100 samples, representing 311 packages, were found to contain foreign substances or to be unfit for human consumption. The increase in the number of samples was due principally to the necessity for re-examining nearly 10,000 samples after outbreaks of fire in the warehouses. It is of interest to note that damaged or condemned tea may be used, free of duty, for the manufacture of caffeine, after being suitably denatured with nauseous materials.

Tobacco smokers are informed that in order to maintain the moisture in tobacco and to improve its quality, glycerol or diethylene glycol is added by foreign manufacturers, but such additions are illegal in Great Britain, and the prohibition automatically extends to imported manufactured tobacco. Offal tobacco is used for manufacturing nicotine; now, however, an alkaloid, anabasine, from *Anabasis aphylla*, a weed growing in eastern Europe and northern Africa, is produced for use as a substitute for nicotine in insecticidal preparations. This fact has necessitated researches into methods for the detection of anabasine, and for distinguishing it from nicotine.

Beer is of interest in the Government Laboratory principally in its relation to the revenue, but we are informed in the report that of the 2,115 samples of beer and brewing materials examined, 23 were found to contain arsenic in slight excess of the limit recommended by the Royal Commission on Arsenical Poisoning, namely, the equivalent of one hundredth of a grain of arsenious oxide per pound in solid materials or per gallon in liquids.

Services are rendered to numerous Government departments and offices. Thus the Prison Commission for Scotland desired an opinion on soap; the Post Office on gum, gold thread and ink, among other things; the Mines Department on bath water; the Ministry of Labour on refuse dumps; the Home Office on seized drugs and on matters affecting the health of factory workers; the Ministry of Pensions on Stores supplied to hospitals; and the Board of Inland Revenue on stamps and documents.

Once again we reproduce comments on the composition of cheese and cream. In the paragraph on cheese we read: "The water ranged from 27·0 to 66·8 per cent; the proportion of fat varied from 7·9 to 40·4 per cent of the cheese. . . . As, however, there are no regulations relating to the marking of skimmed or partially skimmed cheese, no exception could be taken to any of the importations". Of tinned cream it is said: "The percentage of fat varied greatly. Two samples contained 50–52 per cent of fat, and the remainder [88] contained from 19–30 per cent. Since there is no standard for cream in this country, exception could not be taken to the samples in respect of low proportion of fat, even when the tins were labelled 'thick cream'". We remind ourselves, with Little Buttercup, that things are seldom what they seem, but we do not find the thought entirely satisfactory.

* Report of the Government Chemist upon the Work of the Government Laboratory for the Year ending 31st March, 1936; with Appendices. Pp. 46. (London: H.M. Stationery Office, 1936.) 9*d*. net.

Progress of the Post Office

IN an address delivered to the meeting of the Portsmouth Brotherhood at Portsmouth on October 18, Mr. J. H. Brebner, the controller of press information for the General Post Office, gave a brief account of the history of the Post Office. He laid stress on the fact that in the early days, about 1800, the Post Office was considered more as an instrument for taxation than as an undertaking to be run for the benefit of the public.

In 1801 the Post Office was called on to make a contribution of £150,000 to the Exchequer. The Secretary of that date thought that this was an excellent opportunity to remedy what he considered a grave defect in its system of charging, namely, that the postage was the same whatever distance the letter was delivered, while obviously the charge should vary with the distance. He therefore fixed new rates proportional to the distance the letter travelled. In 1812, for example, the postage from London to Portsmouth was 8*d*. and from London to Thurso 5*s*. A consequence of these high rates was that the illegal conveyance of letters became general. To stop this, prosecutions were undertaken whenever evidence became available. Sometimes hundreds of prosecutions were proceeding simultaneously, and in one case in Scotland there were twelve hundred.

It is instructive to learn that owing to the increased long-distance telephone traffic, an extensive programme of underground cables costing £4,500,000 will be carried out this year. The traffic has increased so rapidly that to enable additional circuits to be provided in advance of the completion of the new cables, schemes are in hand for doubling the capacity of many of the existing four-wire trunk circuits by dividing them into two-wire circuits. Telephone lines more than 100 miles in length will be provided by means of a twelve-channel carrier system, from which twelve telephone circuits will be obtained. This compares with one circuit by normal methods. In this new system, at repeater stations, at every twenty miles, the power of the speech currents can be amplified 100,000 times. The first twelve-channel system will be brought into use between Bristol and Plymouth about the end of this year.

Those who think that radio communication has displaced submarine cables will be surprised to learn that arrangements have been made for the laying of two submarine cables of a new type between Great Britain and Holland, and for one new cable to Ireland. The two Anglo-Dutch cables will provide eleven circuits and the Anglo-Irish cable will provide eight circuits. It is anticipated that further circuits to meet the ever-increasing traffic will be obtained by the installation of additional terminal equipment at a later date.

In conclusion, Mr. Brebner said that the Post Office, by pursuing a policy of reducing the charges for its various services, has grown to be the largest employer of labour in the country. Its ever-increasing profits approximate thirteen millions annually; telephone calls last year were 1,800 million, showing an increase of 140 million over the preceding year. The remarkable progress of recent years is due to the recognition of the fact that the Post Office should work for the common weal. The results which have been achieved fully justify this policy.

Educational Topics and Events

CAMBRIDGE.—D. H. Valentine, of St. John's College, has been appointed curator of the Botanical Museum and Herbarium.

The degree of M.A. has been conferred on Dr. D. J. Bell, University lecturer in biochemistry.

At Trinity College, the following have been elected into fellowships: Dr. N. Feather, on appointment as assistant lecturer in natural sciences, M. H. L. Pryce, for research in mathematics, A. L. Hodgkin, for research in physiology, and T. T. Paterson, for research in geology.

GLASGOW.—Dr. J. W. McNee, University College, London, has been appointed regius professor of the practice of medicine.

The Rector, Sir Ian Colquhoun, is delivering his rectorial address in St. Andrew's Hall, Glasgow, on October 23, at 11 a.m., and a luncheon in his honour is being held in the Bute Hall of the University.

Prof. J. Graham Kerr, M.P., has presented to the Zoological Department of the University a very valuable collection comprising all his zoological manuscripts and the material on which the work was based, including a unique series of *Lepidosiren* and *Spirula*, Budgett's collections of *Protopterus*, and Minchin's slides and material illustrating his study of sponges. Many other collections of great historical interest are included, and will form a basis for many future investigations. In addition, the gift comprises a collection of more than seven thousand books and pamphlets together with various scientific apparatus, and a unique series of demonstration slides which had been accumulated during his long tenure of the chair at Glasgow. In accordance with Prof. Graham Kerr's wishes, the further study of the research material included in this gift is to be restricted to fully qualified investigators, and their work must be carried out in the Department of Zoology at the University.

Prof. F. O. Bower has presented a valuable Zeiss microscope, together with a very complete series of objectives, for the use of research students in the Department of Botany.

Mr. Lewis H. Littlejohn, of the Botany Department, has been awarded a Colonial agricultural research scholarship, and is spending one year at Cambridge and the second year in Trinidad.

NURSERY education problems were dealt with in two papers read before Section L of the British Association on September 11: one by Miss I. Jones on "Nursery Education in Lancashire" and one by Mrs. M. Wintringham on "Emergency Open-air Nurseries in the Distressed Areas". Both papers comment on the favourable influence nursery schools are capable of exerting not only on the children in them but also on the homes from which they come. Miss Jones described two successfully working examples of nursery education: one in "The Tannery School" comprising a full range of classes with children of ages 3–14 years, where older girls are serviceable in the nursery class, finding thus an outlet for mothering instincts, older boys cultivate and keep in order a school garden, and part of the playing field is available for use by toddlers; the other in "The Titan Works School", having only children up to the age of eleven; here conditions point to development into a 'home school' in which parents intimately co-operate

with teachers in meeting the needs of the few nursery children. Mrs. Wintringham said of children who have been cared for in the open-air nurseries in distressed areas that "in all cases the teachers of the infant schools, where the children go afterwards, notice how much more alert they are, more independent and adventurous—willing to try" than the other infants. On the question of the effect on family life of "taking the children away from their mothers", she says there are many instances of little reforms and improvements in the personal habits and domestic life of the parents due to the nursery school training.

MR. E. I. LEWIS has issued a pamphlet, "Preparation for Business Careers" (W. Heffer and Sons, Cambridge. 1*s*. net), advocating a course of teaching during the last year of school life which should be a bridge between school and business. Mr. Lewis's ideas were originally presented in an address to a conference of public school masters. He appears to have in mind mainly boys receiving education of a public school or similar type. He does not attempt to deal, "for our present purposes with students in technical schools, colleges or universities. . . ." Mr. Lewis's suggested course aims at avoiding sectional-mindedness and at producing a view of business as a whole, its several parts working to one end. He realizes the present hampering quality of examinations, and sees that only by a new educational treatment can over-specialization be avoided. He makes points which are not new but are in constant need of emphasis. Classical masters, for example, extol the artistic conception of ancient peoples, but neglect their workmanship and their organizing genius. "Whoever would appraise Egyptian, Greek or Roman engineers might with profit consult their living successors". The treatment of subjects, chemistry for example, in vast detail at too early a stage imposes uneven development and imperils chances of promotion to administrative posts where scientific training is needed. No chemist should be content with an education based solely upon the branches of knowledge which directly meet his professional needs ; he should enjoy a liberal education, from which flows broad interests, corrective of the narrowness that threatens men who follow professions shut off from the everyday affairs of their kind. With all of which no one who desires to see the scientific worker accorded his proper sphere in the administration of a scientific and industrial world will disagree. Mr. Lewis gives an outline of the subjects of the proposed "Bridge Course", which is the more stimulating since they will by no means find universal agreement.

Science News a Century Ago

Population of England and Wales

The Times of October 26, 1836, contained an article by T. R. Edmonds, author of "Life Tables", on the "Density of the English Population". "The rapid increase of the English population", he said, "during the last 30 or 40 years is one of the most decisive manifestations of our national prosperity. Whilst other European nations are increasing their food and population at the rate of 8 per cent. every ten years, the population of England is increasing at the rate of 16 per cent. every 10 years. The density of the English population is now much greater than that of any other European nation, with the exception of the Netherlands, which being the commercial depot of Germany, is not a fair comparison. In the different counties of England the variations in the density of the population are very considerable ; in the manufacturing counties the density is nearly twice as great as in the agricultural counties. . . . In the year 1821, the mean density of the population of England and Wales was represented by 207 inhabitants to each square mile ; in 1831 there were 240 to each square mile ; and in 1841 there will be 278 inhabitants to each square mile. . . . The comparative densities of the population in the different counties of England is a subject of some importance to the nation and to capitalists. A given extent of territory may, with few exceptions, be presumed to be wealthy or productive in proportion to the density of the population." The article was accompanied by a table of the counties showing the area and the number of inhabitants per square mile ; the latter ranging from 4,817 in Middlesex to 72 in Westmoreland.

Death of William Lax, F.R.S.

ON October 29, 1836, the death took place of the Rev. William Lax, the third Lowndean professor of astronomy at Cambridge. Born in 1761, Lax graduated in 1785 from Trinity College, Cambridge, as senior wrangler ; he was a Smith's prizeman, and was afterwards elected a fellow of his college. In 1795, at the age of thirty-four years, he was chosen to succeed Dr. John Smith in the Lowndean chair of astronomy and geometry, and after several years spent in tuition was presented to the livings of Marsworth, Buckinghamshire, and St. Ippolyts in Hertfordshire. At the latter place he erected a small observatory, and it was there he died at the age of seventy-five years. Lax was elected a fellow of the Royal Society in 1796, and in 1799 and 1808 respectively he contributed memoirs to the Society on "A Method of Finding the Latitude of a place by means of the Altitude of the Sun", and "On a Method of examining the Divisions of Astronomical Instruments". His "Tables to be used with the Nautical Almanac" was published by the Board of Longitude in 1821. In Lax's time, the University of Cambridge possessed no observatory, and it was due to his successor, George Peacock (1791–1858), Dean of Ely, that one was erected.

The Brussels and Antwerp Railway

THE first railways to be planned in Belgium were those between Ostend and Liège and Antwerp and Valenciennes, and portions of these were opened in 1836. Referring to the railway line between Antwerp and Brussels, the *Athenæum* of October 29, 1836, said : "We learn from *Le Voleur* that this undertaking, which has been in operation only a few months, has already met with great success. The following is an account of the number of passengers who availed themselves of it in the first four months. In May 101,000 ; in June 98,000 ; in July 112,000 ; in August 117,000 ; total 428,000. . . . This result is extraordinary. The number exceeds that of the travellers by the Manchester and Liverpool Railway, which is upon the average only 80 per train whilst upon the above it is 200. The average price is 1 fr. per person, and the receipts for the four months in question are more than 430,000 frs., which gives an interest of 5 per cent. on the capital."

Societies and Academies

Paris

Academy of Sciences, September 28 (*C.R.*, **203**, 573–592).

EDOUARD CHATTON and MLLE. BERTHE BIECHELER: New evidence relating to the Coccidinia (parasitic Dinoflagellates). The sexuality of *Coccidinium Mesnili*.

ALBERTO GONSÀLEZ DOMÌNGUEZ: A theorem of M. Glivenko.

PAUL MONTEL: Univalence or local multivalence.

MARCEL SERVIGNE: The luminescence of solid substances produced by direct excitation in a Geissler tube. Under the experimental conditions described, the light phenomena observed could not have been caused by the action of gaseous ions; they were due to ultra-violet rays.

RENÉ DUBRISAY and ALBERT SAINT-MAXEN: Researches on the basic lead acetates.

LOUIS ANDRÉ GERMANN: Contribution to the study of the mechanism of the condensation between acetone and formaldehyde.

HENRI LABBÉ and FRÉDÉRIC HEIM DE BALSAC: The presence of vitamin E in the embryo of cacao.

Cracow

Polish Academy of Science and Letters, July 6.

M. CENTNERSZWER and J. SZPER: The electrolysis of some salts in anhydrous glycerol. With copper electrodes, the chlorides of copper, zinc and magnesium, electrolysed in glycerol, give cuprous chloride at the anode and glycerates of the metals at the cathode.

J. SUSZKO and F. SZELAG: The steric inversion of the alkaloids, compounds of the type of the optically active carbinols. The total transformation of quinidine into epiquinidine.

K. DZIEWONSKI and W. DYMEK: A method of synthesis of compounds, diaryl derivatives of 2,4-diaminoquinoline.

ST. KREUTZ: Studies on the luminescence of some minerals. Description of the phenomena observed when fluorite, willemite and calcite are illuminated with a quartz lamp under varying temperature conditions.

W. VORBRODT: An attempt to use concentrated hydrogen peroxide for the determination of the mineral contents of plant and animal materials. A list of materials is given for which the oxidation is sufficiently complete. The method is specially useful for the determination of phosphorus.

B. SKARZYNSKI: The metabolism of the sterols in the egg of the fowl during its development.

J. S. MIKULSKI: (1) The influence of constant and alternating temperatures on the survival of some stages of development of *Tribolium confusum*. (2) The influence of constant and alternating temperatures on the variations of the rapidity of development in some stages of the embryogeny of *Tribolium confusum*.

H. SZARSKI: The anatomy and physiology of the digestive tube of worms of the Naïdin family.

MME. Z. OPOCZYNSKA-SEMBRATOWA: The anatomy and innervation of the heart of *Carausius morosus*.

Moscow

Academy of Sciences (*C.R.*, **3**, No. 1; 1936).

A. BERMANT: A theorem of P. Montel.

I. KANTOROVIČ: Some classes of linear operations.

E. A. ŠILOV and S. M. SOLODUŠENKOV: The velocity of hydrolysation of chlorine.

V. RASUMOVSKIJ: Correlations between the energetic saturation and the polarity of molecules.

I. A. SMORODINCEV and P. I. PAVLOVA: The chemical composition of eggs of *Taeinarhynchus saginatus* and of *Diphyllobothrium latum*.

L. V. KRIŠTOFOVIČ: Brachiopoda from the Tertiary sediments of the western coast of Kamchatka.

L. G. ARUTJUNOVA: An investigation of chromosome morphology in the genus *Gossypium*.

K. I. PANIN: Distribution of *Sardinops melanosticta*, Temm. and Schl., in the waters of eastern Kamchatka.

(*C.R.*, **3**, No. 2; 1936).

W. SIERPINSKI: Functions of class 1.

A. TICHONOV: Topological universal space.

N. MOISEJEV: A quantitative character of the qualitative theory of contiguity.

V. S. LUKJANOVA: The physical characteristics of mimicry in fish.

B. I. SVEŠNIKOV: Influence of the solvent on the kinetics of bimolecular reactions in solutions.

T. T. DEMIDENKO and V. P. POPOV: Colloido-chemical characteristics of sugar beet as dependent on its conditions of growth.

L. N. BEREZNEGOVSKAJA: Some peculiarities in the development of resistant forms of sunflower when attacked by *Orobanche cumana* Wallr., race *B*.

K. I. PANGALO: (1) The diversity of sex expression in plants as illustrated by the *Cucurbitaceae*. (2) Genes determining different sex types in plants as illustrated by the *Cucurbitaceae*.

K. S. USENKO: The distribution of Lower Sarmatian deposits on the north-western outskirts of the Donetz Basin.

A. I. SCHMIDTOV: Survival of the spermatozoids of *Acipenser* spp. under different external conditions.

Rome

Royal National Academy of the Lincei (*Atti*, **3**, 277–380; 1936).

G. ARMELLINI: Erroneous objection against the cosmogonic hypothesis of Laplace.

G. ANDREOLI: Composition functions of the second kind, infinite functions of matrices.

R. CACCIOPPOLI: Conformable representation of surfaces.

B. MANIÀ: Navigation problem of Zermelo.

G. SANSONE: Limitation of the integral $\int_{-1}^{+1} |P_n(x)|^m dx$.

B. SEGRE: Varieties of Veronese with two indices (1).

L. TOSCANO: Permutable operators of the second order.

F. TRICOMI: 'Density' of the continuum of points or of straight lines and 'density' of a correspondence.

C. AGOSTINELLI: Motion generated by a plane liquid source imposed on a rigid rectilinear profile with formation of vortices.

B. CALDONAZZO: A hydrodynamic problem relative to the arc of a circumference.

E. VOLTERRA: Questions of linked elasticity (4). Geometrical significance of the linking.

G. CONTI: Relations between the winter and summer temperatures at Rome.

M. MAGGINI: Rapid variations of colour of some stars.

J. R. DUNNING, G. B. PEGRAM, G. A. MITCHELL, G. FINK and E. SEGRÈ: Velocity of slow neutrons. Group C neutrons have a velocity of about $2{\cdot}2 \times 10^5$ cm. per sec., which is of the order of magnitude of the velocity due to thermal agitation at the ordinary temperature.

F. RASETTI, E. SEGRÈ, G. FINK, J. R. DUNNING and G. B. PEGRAM: Law of absorption of slow neutrons.

G. USIGLIO: A recent experiment considered as a confirmation of a new interpretation of refraction in conditions of total reflection.

G. C. WICK: Annihilation of positive electrons.

G. PICCARDI: Spectrum of praseodymium oxide in the vapour state.

M. BENAZZI: Physiological races of *Euplanaria gonocephala* differentiated by means of their different behaviour to scissiparity.

S. RANZI: The hypophysis and gestation in selachians.

E. BIOCCA: Crystallization of the carboxy-hæmoglobin of dried blood from various animal species, and a particular rule of medico-legal application.

E. TRIA: Enzymatic activity and surface tension. Action of some surface active substances on pancreatic lipase.

Forthcoming Events

[*Meetings marked with an asterisk are open to the public.*]

Tuesday, October 27

ROYAL HORTICULTURAL SOCIETY, at 3.30.—Redcliffe N. Salaman: "The Potato in its Early Home and its Introduction into Europe" (Masters Memorial Lectures. Succeeding lecture on November 10).

ROYAL ANTHROPOLOGICAL INSTITUTE, at 9 p.m.—(in the Lecture Room, Royal Society, Burlington House, W.1).—Prof. E. Westermarck: "Methods in Social Anthropology" (Huxley Memorial Lecture).

Thursday, October 29

CHEMICAL SOCIETY, at 8.—Prof. A. P. Laurie: "Mediæval Pigments and Mediums used in Painting".

UNIVERSITY OF OXFORD—(in the Milner Hall, Rhodes House).—Dr. E. Hubble: "The Observational Approach to Cosmology" (Rhodes Memorial Lectures. Succeeding lectures on November 12 and 26).

Friday, October 30

ROYAL ASTRONOMICAL SOCIETY, at 4.30.—Geophysical Discussion on: "The Gaseous Content of the Atmosphere at Various Altitudes" to be opened by Dr. F. A. Paneth.

SCHOOL NATURE STUDY UNION, at 6.—Autumn Meeting to be held in the Conference Hall, County Hall, London, S.E.1.

Prof. David Katz: "Some Problems of Animal Psychology".

INSTITUTION OF CHEMICAL ENGINEERS, at 6.30—(at the Institution of Civil Engineers, Great George Street, Westminster, S.W.1).—Prof. F. A. Lindemann, F.R.S.: "Research at the Lowest Temperatures and its Importance to Industry".*

Official Publications Received

Great Britain and Ireland

The Demand for Colonial Territories and Equality of Economic Opportunity. Pp. 32. (London: The Labour Party.) 4*d*. [289

The Rubber Growers' Association. Rubber and Agriculture Series, Bulletin No. 4: The Care and Cleaning of Milking Machines. By Alexander Hay. Pp. ii+16. (London: Rubber Growers' Association.) [299

The Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), No. 40: A Comparison of some Dutch and Irish Potato Mosaic Viruses. By Paul A. Murphy and J. B. Loughnane. Pp. 419–430+plate 9. 1*s*. 6*d*. Vol. 21 (N.S.), No. 41: A Study of the Aurora or Yellow Mosaics of the Potato. By Phyllis E. M. Clinch, J. B. Loughnane and Paul A. Murphy. Pp. 431–448+plates 10–12. 2*s*. 6*d*. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) [309

Rothamsted Experimental Station, Harpenden: Lawes Agricultural Trust. Report for 1935. Pp. 279. (Harpenden: Rothamsted Experimental Station.) 2*s*. 6*d*. [110

The Royal Botanic Gardens, Kew. Twelve coloured Views. Pp. 14. (London: H.M. Stationery Office.) 1*s*. 6*d*. net. [210

Iron and Steel Institute. Special Report No. 13: Fourth Report of the Corrosion Committee: being a Report by a Joint Committee of the Iron and Steel Institute and the British Iron and Steel Federation to the Iron and Steel Industrial Research Council. Pp. xv+240+11 plates. (London: Iron and Steel Institute.) [710

Other Countries

Trinidad and Tobago. Progress Report on Exotics. Prepared for the British Empire Forestry Conference, South Africa, 1935, by R. L. Brooks. Pp. 4. Timber Supply, Consumption and Marketing in Trinidad and Tobago. Prepared for the British Empire Forestry Conference, South Africa, 1935, by R. L. Brooks. Pp. 8. Forests and Forestry in Trinidad and Tobago. A statement prepared for the British Empire Forestry Conference, South Africa, 1935, by R. L. Brooks. Pp. 26. (Trinidad: Government Printing Office.) [110

U.S. Department of Agriculture. Circular No. 237: Control of the Japanese Beetle on Fruit and Shade Trees. By W. E. Fleming and F. W. Metzger. Revised edition. Pp. 12. 5 cents. Farmers' Bulletin No. 1758: Cover Crops for Soil Conservation. By Walter V. Kell and Roland McKee. Pp. ii+14. 5 cents. Technical Bulletin No. 524: Silting of Reservoirs. By Henry M. Eakin. Pp. 142+16 plates. 40 cents. (Washington, D.C.: Government Printing Office.) [110

U.S. Department of Commerce: Coast and Geodetic Survey. Special Publication No. 201: Earthquake Investigations in California, 1934–1935. Pp. ix+231. (Washington, D.C.: Government Printing Office.) 35 cents. [110

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